WC/WDM GUIDELINE

Water Conservation and Water Demand Management Guideline for the Mining Sector in South Africa

DIRECTORATE: WATER USE EFFICIENCY

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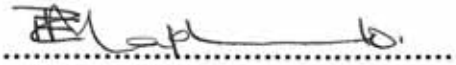

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PREFACE

The Department of Water Affairs (DWA) has been implementing the legislative framework that has been updated and refined since 1994. During the implementation phase, emphasis has been placed on Integrated Water Resources Management (IWRM) to ensure environmental sustainability, socio-economic equity and efficiency in water use. The Directorate: Water Use Efficiency (D: WUE), was established as a result of the new approach to the management of South Africa's water resources. As one of its major objectives, the D: WUE must develop appropriate policies and regulations that will give effect to Water Conservation and Water Demand Management (WC/WDM).

The D: WUE has an ongoing role to promote, guide and assist WC/WDM practices and measures within South Africa. As part of this responsibility, the Directorate initiated the development of a "Generic Water Conservation and Water Demand Management (WC/WDM) Guideline for the South African Mining sector" in 2005. This Guideline was based on the details and objectives set out in the National Water Conservation/ Water Demand Management Strategy (NWC/WDMS), together with the Industry, Power and Mining Sector strategy. The WC/WDM Guideline focuses on water conservation and water demand management within the South African Mining Sector. The publication of the series of Best Practice Guidelines for Water Resource Protection in the South African Mining Industry (BPGs) by the DWA resulted in a situation where the WC/WDM Guideline required updating and alignment.

The purpose of the Guideline is to highlight the linkage between the implementation of WC/WDM measures and best practice measures and to unpack the overall process of WC/WDM. This entails a process of assessment, planning and management in order to achieve water use efficiency through a process of continual improvement within the mining sector. This guideline will therefore assist the mining industry with the implementation of WC/WDM. It is important to note that there are many aspects related to WC/WDM, which does not only entail effluent treatment. The process described in this guideline results in the compilation of a Water Conservation Plan. There is a requirement to report on the implementation of the Water Conservation Plan. This Guideline provides guidance on the content of such a plan, which can either be produced as a standalone document or be included in an Integrated Water and Waste Management Plan (IWWMP).

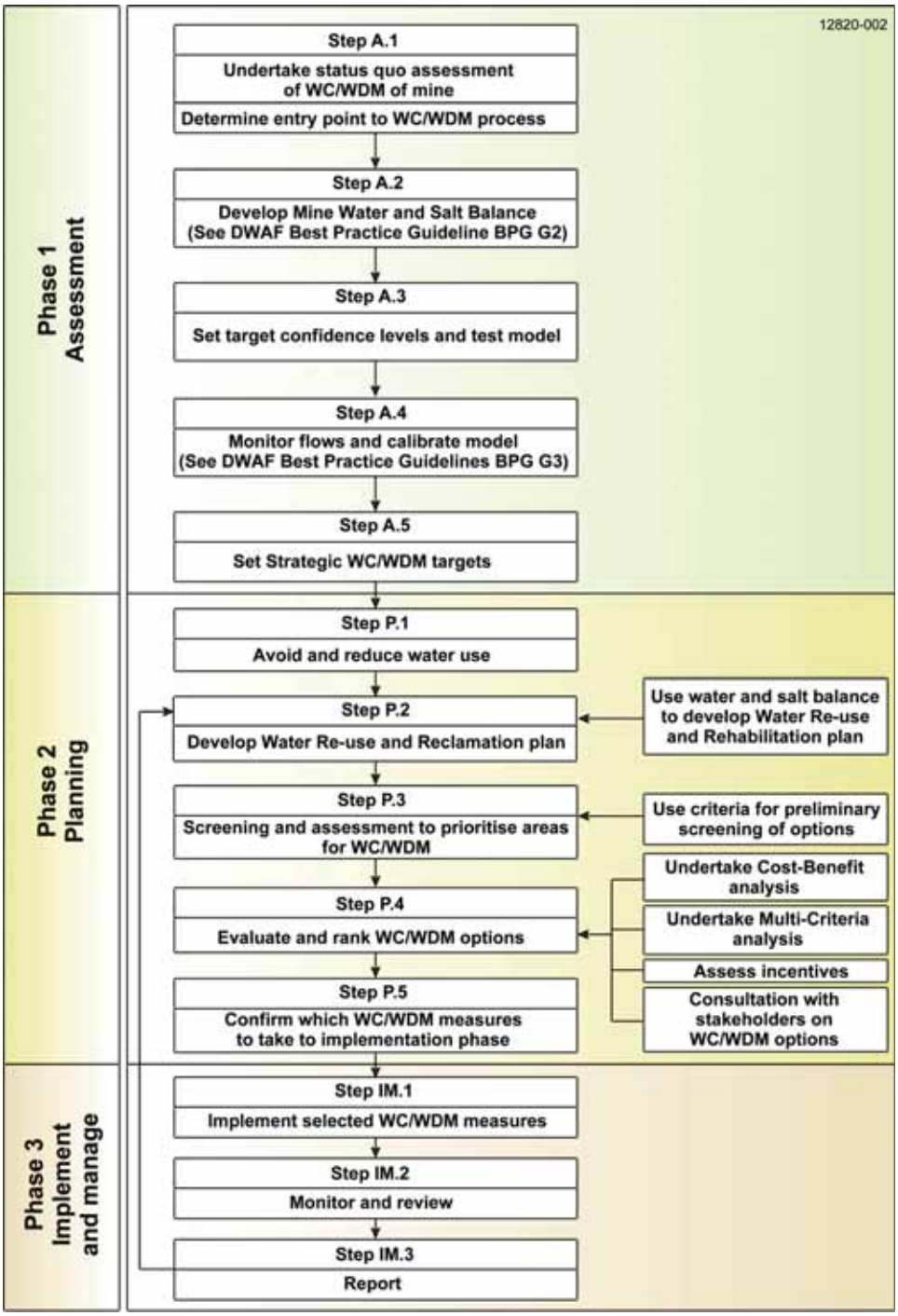
All mines have the responsibility to implement WC/WDM, irrespective of whether it is using water in terms of a water use authorisation or not. It should also be applied to the entire mining area and address each water system on the mine. The key steps in the implementation of WC/WDM are based on the Resource Protection and Waste Management Hierarchy, with specific focus on water quantity in order to:

Prevent pollution and avoid water use through the implementation of waterless options and/or processes;
Reduce water use through measures such as efficient water use and improved technology;
Reuse and recycle water as far as possible, in accordance with applicable rules and regulations;
Disposal of water or treated wastewater that is not recycled or reused, in such a manner that it does not cause degradation to the receiving environment; and
Feedback and adaptive management to achieve more efficient use of water, thus reducing overall water consumption by an industrial/commercial/mining facility through the process of continual improvement.

Figure 1 provides details on the recommended steps to follow in the assessment, planning, implementation and management of WC/WDM on a mine.

The implementation of the WC/WDM process at a mine will lead to the generation of a Water Conservation Plan, which will inform both mine management and DWA of the status and improvements in terms of water use efficiency. The proposed Water Conservation Plan is aligned with the reporting requirements contained in the proposed WC/WDM Regulations.

Figure 1: Details of the WC/WDM Process



GLOSSARY AND ABBREVIATION

ABBREVIATIONS

BPG	Best Practice Guideline
BCR	Benefit/cost ratio
CBA	Cost Benefit Analysis
CMA	Catchment Management Agency
CMS	Catchment Management Strategy
DWA	Department of Water Affairs
D:WUE	Directorate: Water Use Efficiency
GIS	Geographic Information System
GMP	Good Management Practice
GRI	Global Reporting Initiative
IMP	Industry, Mining and Power Generation
ISP	Internal Strategic Perspective
IWMP	Integrated Water Management Plan
IWRM	Integrated Water Resources Management
IWWMP	Integrated Water and Waste Management Plan
MPRDA	Minerals and Petroleum Resources Development Act
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NPV	Net Present Value
NWA	National Water Act (Act No. 36 of 1998
NWCSF	National Water Conservation Strategy Framework
NWRS	National Water Resource Strategy
NWC/WDMS	National Water Conservation/Water Demand Management Strategy
PPI	Producer Price Index
PV	Present Value
SABS	South African Bureau of Standards
TDS	Total Dissolved Solids
WACC	Weighted Average Cost of Capital
WC/WDM	Water Conservation/Water Demand Management
WMA	Water Management Area
WSA	Water Services Act (Act No. 108 of 1997)
WSA	Water Services Authority
WSDP	Water Services Development Plan
WSP	Water Service Provider

GLOSSARY

Clean water

Water that complies with a negotiated standard for a particular water use.

Consumptive use

"*Consumptive use*" of water refers to the water used by businesses in closed processes that do not generate wastewater and that effectively remove that water from the water cycle. A bottling plant is an example of a business that has closed processes in which large volumes of consumptive use occurs.

Demand-side management

Any measure or initiative that will result in the reduction of the expected water use or water demand.

Dirty water

Water that is not clean water.

Distribution management

Any function relating to the management, maintenance and operation of any system of structures, pipes, valves, pumps, meters or other associated equipment, including all mains, connection pipes and water installations that are used or intended to be used in connection with the supply of water.

Efficient use of water

Water used for a specific purpose that is part of accepted and available best practices and benchmarks or water used for a purpose where benefit is derived from it.

Inefficient use of water

Water used for a specific purpose over and above the accepted and available best practices and benchmarks or water used for a purpose where very little benefit is derived from it.

Integrated Water Resource Management

This process determines the optimal way of managing water within a catchment by analysing the change in water demand and evaluating a variety of supply-side and demand-side management measures. Integrated Water Resource Management forms the basis for the Integrated Water and Waste Management Plan for a mine.

Mining area

In relation to a mining right or a mining permit, *"mining area"* means the area for which that right or permit is granted. In relation to any environmental, health, social and labour matter and any latent or other impact thereto, includes:

any adjacent or non-adjacent surface of land on which the extraction of any mineral and petroleum has not been authorised in terms of this Act but upon which related or incidental operations are being undertaken and including any area connected to such an area by means of any road, railway line, power line, pipeline, cable way or conveyor belt, and any surface of land on which such road, railway line, power line, pipeline or cable way is located; and

all buildings, structures, machinery, mine dumps or objects situated on or in that area which are used for the purpose of mining on the land in question.

	(Minerals and Petroleum Resources Development Act, Act No. 28 of 2002).
Mining operation	Any operation relating to the act of mining and activities directly incidental thereto.
Non-consumptive use	A term used to describe the water that is used by businesses in open processes, generating wastewater that can be recycled or discharged back into the water cycle for use by other users. It should be noted that many open processes are not efficient and that they often contain an element of consumptive use. Cooling is an example of an open process that can consume significant quantities of water, but which also discharges water.
Potable water	Clean water that is suitable for human consumption and may be used within a mine process.
Primary water use	Water that is used in the process of beneficiation or washing of a mineral, from sources such as potable water, recycled/non-potable water, surface water, groundwater and fissure water. Primary water use includes potable water and water used for gardening purposes within the plant, mining and smelter areas.
Secondary water use	Water used in areas that support the primary mining function (e.g. mine village, mine offices, golf course), from sources such as potable water, recycled/non-potable water, surface water, groundwater and fissure water. Secondary water use includes water used for dust suppression on service roads, watering gardens and grass at mine offices, soccer fields and water used in hostel areas.
Supply-side management	Any measure or initiative that will increase the capacity of a water resource or water supply system to supply water.
Total recycling and reuse of water	The amount of water reused by the organisation over a period of time for a process that would otherwise be supplied by fresh water (GRI, 2003).
Total water use	Total water use is represented by four components, namely the amount of water withdrawn from water sources, stored on site, consumed and discharged by the reporting organisation (GRI, 2003).
Water Intensity	Water use per unit of economic activity. In the case of the mining sector, this is expressed as the amount of water used per unit of ore mined or mineral produced.
Water conservation	The minimisation of water loss or waste, the care and protection of water resources and the efficient and effective use of water.
Water demand	The expected water usage for a mine.
Water demand Management	The adaptation and implementation of a strategy or a programme by a water institution or water consumer (such as a mine) to influence the water demand and use of water in order to meet any of

	the following objectives: economic efficiency, social development, social equity, environmental protection, sustainability of water supply and services and political acceptability.
Water institution	Water institutions include both Water Management Institutions (WMI) and Water Services Institutions (WSI), as defined in the National Water Act and Water Services Act respectively.
Water recycling	Involves only one use or user and the effluent resulting from the use is collected, treated if necessary and redirected back to its original use or related application. Water recycling sometimes involves the inclusion of additional treatment or a regeneration step to remove the contaminants, which build up in the system.
Water reuse	The use of effluent without additional treatment for other beneficial purposes. Wastewater from one operation can be used in another operation on the mine, provided the level of contamination from the previous process does not interfere with the subsequent process.
Water supply services	The abstraction, conveyance, treatment and distribution of potable water, water intended to be converted to potable water or water for commercial use but not water for industrial use.
Water utilisation	Used to describe both the consumptive and the non-consumptive uses of water by businesses, whether it is raw or potable water.
Water wastage	Water lost through leaks or water use that does not result in any direct benefit to a consumer or user.
WC/WDM toolkit	A collation of various water conservation/water demand management (WC/WDM) measures that can be implemented by the consumer or water management institution to improve the productivity and efficiency of the use of water in order to optimise benefits derived from the use of water. These measures include, amongst others: type of water management system employed by the consumer; monitoring of water use and impacts to the resource; utilising water use management practices that are based on reuse and recycling water to minimise and reclaim water used in the system; and, providing key performance indicators for performance evaluation and monitoring.

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1. INTRODUCTION AND BACKGROUND

1.1 BACKGROUND AND CONTEXT

The Department: Water Affairs (DWA) has been implementing the legislative framework that has been updated and refined since 1994. During the implementation phase, emphasis has been placed on Integrated Water Resources Management (IWRM) to ensure environmental sustainability, socio-economic equity and efficiency in water use. The Directorate: Water Use Efficiency (D: WUE) was created as a result of the new approach to the management of South Africa's water resources. As one of its major objectives, the D: WUE must develop appropriate policies and regulations that will give effect to Water Conservation and Water Demand Management (WC/WDM).

Since its inception in 1998, the D: WUE has promoted the efficient and sustainable use of water resources through, amongst others, the following activities:

- Taking a pioneering role in the integration of water conservation and water demand management in the behavioural processes and business culture of all sectors and spheres of South African society;
- Finalising the National Water Conservation and Water Demand Management Strategy (NWC/WDMS) in August 2004 to promote water as a primary, but scarce, resource that should be intrinsically valued;
- Initiating the National Water Conservation Strategy Framework (NWCSF) process in May 1999, which provided a solid foundation for the development of the four sectoral strategies, as well as defining eight strategic objectives upon which the sectoral strategies were based;
- Finalising sectoral Water Conservation and Water Demand Management Strategies in August 2004 for a) the Agriculture sector, b) the Industry, Power and Mining sector and c) the Water Services sector; and
- Assisting the development of an Integrated Water and Waste Management Plan (IWWMP) for the mining industry.

The D:WUE has an ongoing role to promote, guide and assist WC/WDM practices and measures within South Africa. As part of this role, the Directorate initiated the development in 2005 of a "*Generic Water Conservation and Water Demand Management (WC/WDM Guideline for the South African Mining sector".* The Guideline is based on and will be underpinned by:

- The details and objectives as set out in the NWC/WDMS, together with the Industry, Power and Mining Sector Strategy; and
- A Situation Assessment of water use practices in the Mining Sector in South Africa, in particular the potential to apply a closed loop water system in the overall use of water in the sector.

Since 1994 South Africa moved from a water supply side management approach to also include a demand side management approach in order to holistically manage South Africa's scarce water resources. Therefore all water user sectors have to implement WC/WDM for water to be shared equitably and to ensure sustainability.

This WC/WDM Guideline will further focus water conservation and water demand management within the South African Mining Sector, as there has been a shift from water provision to demand management.

All mines generally require a source of water supply, either in the mining process, as a feed into the mineral beneficiation process or for potable use. Given the growing demand for water and the scarcity of this

natural resource, it is important for any mining operation to prove that water utilisation is optimized by suitable reuse and reclamation of contaminated water. Therefore, all mines have to consider water conservation and water demand management, irrespective of whether it is utilising surface and/or groundwater in its processes or whether or not it is impacting on downstream surface or groundwater users. Other aspects which have to be considered as part of defining the need for water conservation and water demand management is the regional context of the particular mine, its impact on downstream users and benchmarking for the specific sector in the mining industry.

The total water that is expected to be used by a mine is termed the water demand. This water demand may be satisfied by water sources of varying qualities, depending on the anticipated water use. Water conservation and water demand management seek to minimise this water use, through the implementation on a mine of appropriate water management and water loss strategies and programmes. This should also include the implementation of good management practices. The implementation of a well managed water management system will also result in the water being seen as an asset by mining companies.

1.2. THE PURPOSE OF THE WC/WDM GUIDELINE

The overall purpose of the Guideline is to provide assistance to both Departmental and Mining Sector personnel in the assessment, planning and management of WC/WDM. The Guideline should be used as a tool to guide improvements in water use efficiency within the sector and to evaluate and report on the effectiveness of these improvements. The purpose of this Guideline can be summarised as follows:

To create awareness within the mining sector that every mine has the responsibility to implement WC/WDM in order to improve its water use efficiency;
To provide a process for the assessment, planning and management of WC/WDM on mines, thereby identifying the areas for continual improvement in water use efficiency;
To demonstrate the applicability of best practices in WC/WDM within the mining sector;
To align the WC/WDM process with the implementation of best practice at a mine and with the Integrated Water and Waste Management Plans (IWWMPs) compiled for a mining operation; and
To define the relevant information that is required when reporting on the implementation of WC/WDM at a mine.

1.3. FLEXIBILITY OF THE WC/WDM GUIDELINE

The WC/WDM Guideline is structured as a pragmatic guide to demonstrate the opportunities for the implementation of best practice in support of water use efficiency in the mining industry. It describes the process to be followed by a mine to become efficient in water use. The DWA will, however, use the Guideline to assist the assessment process of WC/WDM measures in the South African Mining Sector.

In developing the Guideline, it is recognised that there are site-specific conditions that affect the achievement of holistic compliance with the requirements of the Guideline. In such instances, any deviations from these requirements should be supported by an IWWMP which is geared towards achieving similar objectives of continual improvement in water use efficiency.

1.4. INTEGRATION AND STRUCTURE OF THE WC/WDM GUIDELINE

1.4.1. Integration

The WC/WDM Guideline should be read in conjunction with the NWC/WDMS document and the NWC/WDMS for the Industry, Mining and Power Generation Sectors. In particular, these documents provide relevant detail on:

The background, context and legislative development;
The need for the WC/WDM strategy;
The applicable definitions and principles;
An overview of the constraints and opportunities within the Industry, Mining and Power Generation Sectors; and
Detailed outputs, activities and role-players within the sectors.

Relevant sections from these documents are contained in the WC/WDM Guideline.The Guideline should also be read in conjunction with the Best Practice Guidelines (BPGs) developed by DWA especially BPG H1: Integrated Mine Water Management with specific focus on WC/WDM. Other relevant BPGs are briefly discussed in section 3 of this report.

1.4.2. Structure

The WC/WDM Guideline is structured as follows:

An overview of relevant legislative aspects and institutional roles (Section 2);
A summary of the relevant Best Practice Guidelines for Water Resource Protection in the South African Mining Industry(Section 3);
Overview and Guidelines for the assessment, planning and management of WC/WDM within the Mining Sector (Section 4); and

Guidelines on the reporting structure for WC/WDM on a mine (Section 5).

2. OVERVIEW OF LEGISLATIVE, STRATEGY AND INSTITUTIONAL ASPECTS

2.1. LEGISLATION AND STRATEGY

The environmental rights of the people of South Africa are specified in Section 24 of the Constitution. This guarantees everyone the right to an environment that is not harmful to her/his health or well-being, and for the environment to be protected for the benefit of present and future generations. This is to be achieved through reasonable legislation and other measures that promote, amongst others, conservation. This guideline therefore significantly relates to water conservation, which emphasises the need for WC/WDM to play a central role in the manner in which water resources are used and managed.

The National Water Act (NWA) (Act 36 of 1998) emphasises the effective management of South Africa's water resources through the basic principles of IWRM. Both the NWA and IWRM seek to achieve social equity, economic efficiency and ecosystem sustainability, which are undertaken within a framework that includes institutional roles, an enabling environment (legislative, regulation and policy) and management instruments. Efficiency in water distribution and use is the fundamental premise of WC/WDM.

The National Environmental Management Act (NEMA) (Act No. 107 of 1998) provides the guiding legislation and framework for environmental management in South Africa. Chapter 2 of the NEMA describes a set of fundamental guiding principles governing the actions of those organs of state that may significantly affect the environment. These principles need to be considered in all dimensions of water management, including those related to WC/WDM. The DWA and the mining sector are thus guided by these principles in the development and implementation of WC/WDM policies and strategies.

The Minerals and Petroleum Resources Development Act (MPRDA) (Act No. 28 of 2002) regulates the prospecting for, and optimal exploration, processing and utilisation of minerals; provides for safety and health in the mining industry; and controls the rehabilitation of land disturbed by exploration and mining. The Act indirectly supports the principle of water conservation by promoting the goal of sustainable development in the development of mineral and petroleum resources. The Act specifically states that "any prospecting or mining operation must be conducted in accordance with generally acceptable principles of sustainable development by integrating social, economic and environmental factors in the planning and implementation of prospecting and mining projects, in order to ensure that exploration of mineral resources serves present and future generations."

The National Water Resource Strategy (NWRS) seeks to ensure a balance in the use of water between the benefits to society, the state of the environment and the needs of the economy. The NWRS describes policies, strategies, plans and procedures which express the responsibility of the DWA to ensure that South Africa's water resources are used wisely, both now and in the future.
The NWC/WDMS, published by the DWA in August 2004, together with the related sectoral strategies, are a fundamental step in promoting water use efficiency. They are consistent with the effective management of water resources. The NWC/WDMS is complementary to other strategies within the NWRS, including water quality management and catchment management strategies. It also provides an approach to optimise existing opportunities within each sector.

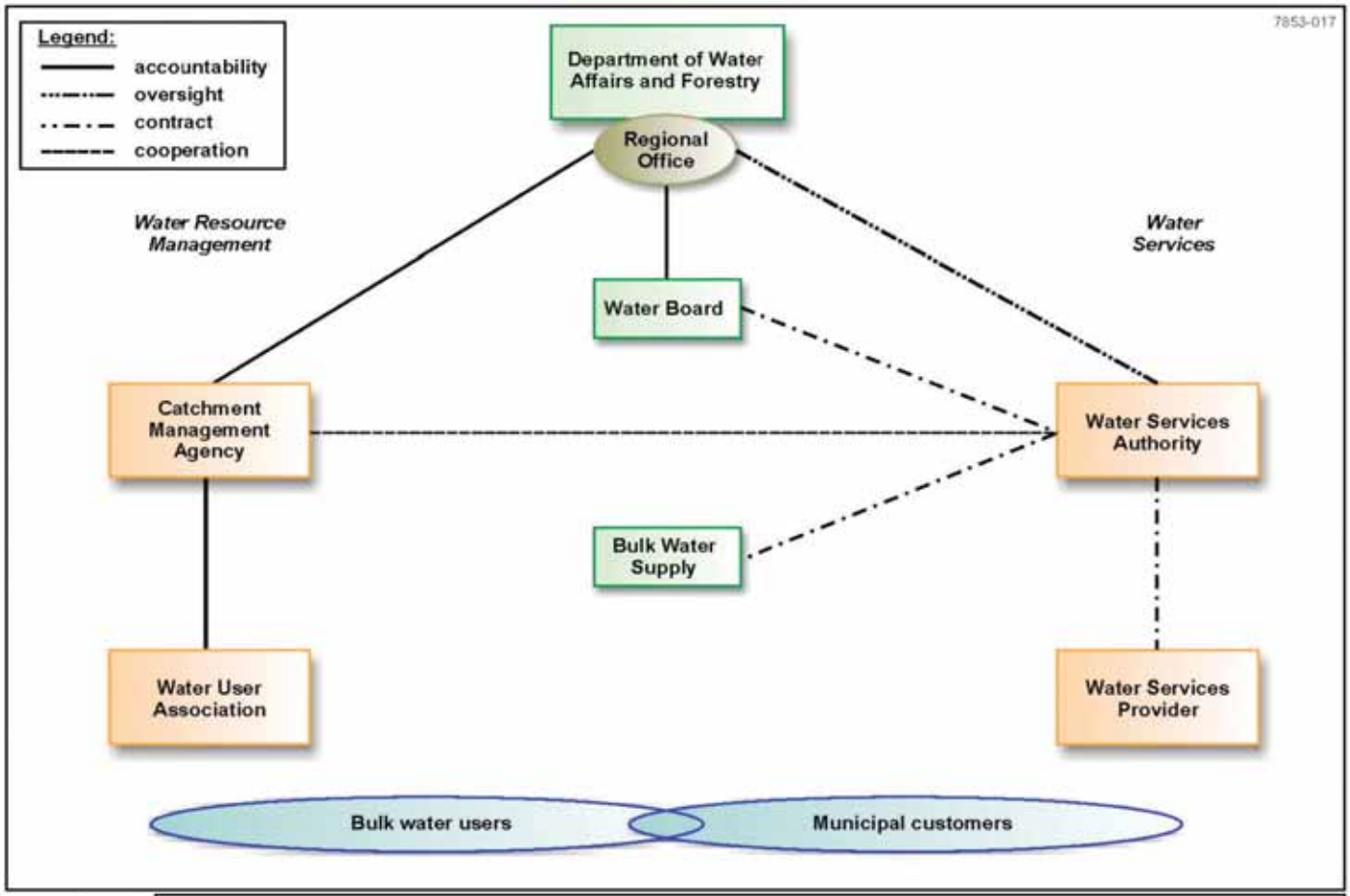
The Catchment Management Strategies (CMS) and Water Services Development Plans (WSDP), developed by the Catchment Management Agencies (CMA) and the Water Services Authorities (WSA) respectively, together with processes such as compulsory licensing and registration, are intended to facilitate the effective attainment of sustainability, efficiency and equity. WC/WDM is at the core of each of these provisions and it calls for strategies that optimise opportunity.

2.2. INSTITUTIONAL ROLES

Mining falls within the Industry, Mining and Power Generation (IMP) Sector. This sector uses almost 16 percent of the total water demand of South Africa, with the Mining and Large Industry sub-sector using about 8 percent (DWAF, 2004). The sector's water users are grouped into two broad categories:

Those who obtain water directly from sources under the jurisdiction of the DWA; and
Those who are serviced by Water Service Providers (WSP).

The relationships of the various water sector institutions in respect to WC/WDM are reflected in **Figure 2.** The responsibilities of the various role-players are described in the NWC/WDMS.



Roles of water sector institutions for WC/WDM

3. BEST PRACTICES IN THE MINING SECTOR RELEVANT TO WATER CONSERVATION AND WATER DEMAND MANAGEMENT

3.1. BACKGROUND

The IWRM approach described in Section 2 provides for both resource directed and source directed measures. Resource directed measures aim to protect and manage the receiving environment, while source directed measures aim to control the impacts at source through the identification and implementation of the efficient use of water, pollution prevention, water reuse and water treatment mechanisms. WC/WDM is an example of such a mechanism.

The integration of resource and source directed measures forms the basis of the hierarchy of decision-taking aimed at protecting the resource. 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
Avoid water use

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

Step 3: Discharge or disposal of waste and/or waste water

The Resource Protection and Waste Management Hierarchy, as outlined above, is based upon a site specific risk based approach and the polluter pays principle.

The DWA has developed a series of Best Practice Guidelines (BPGs) for Water Resource Protection in the South African Mining Industry 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 DWA'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; and
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; and
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; and
A6. Water Management for Underground Mines.

The BPGs is utilised by the mining sector as input for compiling water use licence applications, and as a guideline as to what is considered as best practice in resource protection and waste management. These best practice guidelines fully support the implementation of WC/WDM asan integral part of integrated mine water management.

3.2. GENERAL PRINCIPLES OF INTEGRATED MINE WATER MANAGEMENT

In order to successfully implement integrated mine water management in a manner that complies with the source and resource directed measures required by the relevant legislation, certain essential principles must be adhered to. The BPG H1: Integrated Mine Water Management identifies the following general principles of integrated mine water management:

Compliance with the water management decision-taking hierarchy;
Life-cycle approach;
Plan for closure;
Cradle to grave principle;
Precautionary principle;
Water conservation and water demand management (WC/WDM);
Consideration of temporal variability of water quality and quantity;
Risk-based approach;
Continual improvement;
Cumulative impacts;
Regional impacts;
Public participation;
Use suitably qualified persons; and
Management commitment.

Water conservation and water demand management (WC/WDM), listed as one of the principles of integrated mine water management, must give effect to the three fundamental objectives for managing South Africa's water resources, namely:

- To achieve equitable access to water, to the use of water resources, and to the benefits from the use of water resources;
- To achieve sustainable use of water by making progressive adjustments to water use with the objective of striking a balance between water availability and legitimate water requirements, and by implementing measures to protect water resources and
- To achieve efficient and effective water use for optimum social and economic benefit.

The key steps in the implementation of WC/WDM are based on the Resource Protection and Waste Management Hierarchy, and entail the following:

- Prevent pollution and avoid water use through the implementation of waterless options and/or processes;
- Reduce water use through measures such as efficient water use and improved technology;
- Reuse and recycle water as far as possible, in accordance with applicable rules and regulations;
- Disposal of water or treated wastewater that is not recycled or reused, in such a manner that it does not cause degradation to the receiving environment; and
- Feedback and adaptive management to achieve greater efficiency in the use of water, thus reducing overall water consumption by an industrial/commercial/mining facility through the process of continual improvement.

The key steps in the implementation of WC/WDM, as listed above, forms part of the best practices addressed in the Best Practice Guidelines (BPGs) for Water Resource Protection in the South African Mining Industry. This should also be documented as part of the integrated water and waste management on a mine in either a Water Conservation Plan or as part of an Integrated Water and Waste Management Plan (IWWMP). The relevant BPGs which support WC/WDM the best are summarised in Table 1 and briefly described in section 3.3.

Table 1: BPGs applicable to the overall WC/WDM process

WC/WDM Phase	Applicable BPG
Phase 1: Assessment	• BPG H2: Pollution Prevention and Minimisation of Impacts • BPG G2: Water and Salt Balance • BPG G3: Water Monitoring Systems
Phase 2: Planning	• BPG H3: Water Reuse and Reclamation • BPG H4: Water Treatment
Phase 3: Implement and manage	• BPG G3: Water Monitoring Systems • BPG H1: Integrated mine water management

3.3. SUMMARY OF BEST PRACTICE GUIDELINES RELEVANT TO WC/WDM PROCESS

The different BPGs that have been produced all have particular application to different aspects of the mining process and to different components of the water management system at the mines. The BPGs which are most applicable to the process of assessment, planning, implementation and management of WC/WDM measures at a mining operation are briefly summarised in this section of the Guideline.

The remainder of the BPGs are not described in detail in this Guideline, however the implementation of the principles and procedures also impact on the effective implementation of WC/WDM measures at a mine. An example of such a principle would be the separation of clean and dirty water on mines, which is also one of the most fundamental pollution prevention principles within the mine water management hierarchy. Although the principle is a very simple one, it is nevertheless often misapplied. Best Practice Guideline G1: Storm Water Management provides clear guidelines on how to achieve it by defining a practical procedure to develop a storm water management plan.

It is believed that the application of the principles and procedures documented in the remainder of the BPGs will have major benefits in reducing pollution and reducing water demand on South African mines and thereby supporting WC/WDM.

3.3.1. BPG H2: Pollution Prevention And Minimisation Of Impacts

Pollution Prevention and Minimization of Impacts is a key step in the implementation of WC/WDM at any mining operation.

The Best Practice Guideline H2: Pollution Prevention and Minimization of Impacts is applicable to all mining operations, regardless of whether they are in the exploration, planning, operational or closure phase. It emphasises the planning and design process as the primary point where pollution prevention strategies can be identified and formulated for implementation in any phase of any mining activity, and which results in an optimum physical outcome, which may vary considerably depending on individual circumstances.

The BPG defines the fundamental principle of pollution prevention as to application of a planning and design process to prevent, inhibit, retard or stop the hydrological, chemical, microbiological, radioactive or thermodynamic processes, which result in the contamination of the water environment, at or as close to the point where the deterioration in water quality originates (i.e. source reduction), or to implement physical measures to prevent or retard the transport of the generated contaminants to the water resource (i.e. recycling, treatment and/or secure disposal).

The BPG also defines a number of secondary pollution prevention principles, and further highlights the issue that pollution prevention opportunities must be sought and maximized at each step in the process chain, from the mining face through to eventual disposal of mine residues. These also need to be optimized at different phases of the mine life. The BPG contains a range of examples of potential sources of pollution and pollution prevention opportunities. The BPG also contains a logical and practical procedure for the identification of most appropriate pollution prevention and impact minimization measures.

The prevention of pollution will lead to reduced water use, improved water use efficiency as part of WC/WDM on a mine.

3.3.2. BPG H3: Water Reuse And Reclamation

Due to the fact that significant amounts of water are consumed by the mining industry and the scarcity of this natural resource, it is important for any mining operation to prove that water utilisation is optimized

by reuse and reclamation of contaminated water.
The reuse and reclamation of water is another key step in the implementation of WC/WDM at any mining operation. All new and existing mines are, therefore, required to optimise Water Reuse and Reclamation by means of the establishment of a Water Reuse and Reclamation Plan. This plan should form part of the any mine's IWWMP, and constitutes a fundamental component of the planning and implementation of WC/WDM measures at a mine.

Close inspection and evaluation of a mine's Water and Salt Balance will indicate where opportunities for reuse and reclamation exist. These opportunities are described in BPG H3 and include instances wherever large volumes of water are used and/or disposed of, wherever good quality water is imported into the water circuits while poorer quality water is lost, etc.

It is recognised that there might be mine specific conditions where these opportunities do not exist, resulting in a situation where it is unlikely that there will be scope to improve water reuse and reclamation.

BPG H3 emphasizes the fact that a mine's Water Reuse and Reclamation Plan must take account of the changing water and salt balance over the life cycle of the mine. The plan must therefore be sustainable, flexible and regularly updated to reflect the relevant changes of the mining activity. The BPG assists with the development and review of a Water Reuse and Reclamation Plan by documenting the process that should be followed to develop such a plan.

3.3.3. BPG H4: Water Treatment

The planning, implementation and management of WC/WDM at a mine may, in many instances require the incorporation of a certain degree of water treatment. Water treatment may be required to improve the quality of the water to such an extent that it can be reused by the mine or other users as documented in the Water Reuse and Reclamation Plan. While water treatment may also be required as a final step to render water suitable for discharge, the focus of WC/WDM is on reuse and recycling.

Best Practice Guideline H4: Water Treatment provides an overview of possible water treatment options and does not aim to discuss in detail all the various available water treatment alternatives. New treatment technologies are continuously being developed and existing technologies are improved. The BPG is therefore not fully comprehensive and can therefore not replace the function of a water treatment specialist familiar with the latest technologies available on the market.

BPG H4 describes the technical methodology that should be applied by a mine to identify the constituents of concern that may require mine water to be treated to enable sustainable reuse or alternatively discharge as a last resort. It further also describes a methodology that, when applied, will enable the identification of suitable types of water teatment technology for the removal of constituents of concern, safe disposal of residues and the overall reduction in water consumed through the re-use of treated water.

3.3.4. BPG G2: Water And Salt Balance

The water and salt balance is considered the most fundamental building block of a mine water management system, which includes its WC/WDM measures. Without an effective and accurate water and salt balance, it is not possible to conduct the assessment, planning, implementation and management of WC/WDM at a mine.

In terms of WC/WDM measures, water and salt balances can be used as a tool to:

Audit water usage from various sources;
Identify points of high water consumption or wastage;

Identify and quantify imbalances;
Locate and quantify sources of seepage and leakage;
Identify and quantify pollution sources;
Simulate and evaluate various water management strategies before implementation; and
Assist in decision making.

Water and salt balances should be used as an ongoing water management tool and should be updated on a regular basis, both in terms of adding new data and ensuring that the reticulation system reflects all changes that have been made.

The BPG G2 details the general principles that should be taken into consideration when water and salt balances are developed including the procedural principles that one should be aware of when developing water and salt balances, as well as the technical principles which should be understood.
The recommended steps to construct a water balance network are presented as practical flow diagrams and procedures in BPG G2. A practical worked example that illustrates how each of these steps can be applied at a hypothetical mine is also documented in the BPG G2.

3.3.5 BPG G3: Water Monitoring Systems

The development, implementation, and management of a well-designed and effective monitoring programme is an essential component of the WC/WDM measures at any mine.

Best Practice Guideline G3: Water Monitoring deals with the following aspects of a monitoring strategy:

Definition of the objectives of a monitoring strategy;
Design of a monitoring strategy (including both discrete and continuous monitoring);
Implementation of a monitoring programme according to the detailed design and specified sampling procedures;
Development and implementation of an operating and maintenance programme;
Data management system; and
Audit and quality assurance of monitoring programme.

BPG G3 has been developed to provide clear guidelines on how to design an effective monitoring programme to meet the information needs to implement a monitoring programme such that the acquired data is reliable and supportive of the defined management needs and to interpret, manage and report on the data obtained from the implemented monitoring programmes. One such example includes monitoring to determine the efficiency with which water is used.

BPG G3 documents a defined, structured procedure to be followed in order to develop and implement an appropriate, accurate and reliable monitoring programme. The process follows a logical sequence from designing the monitoring programme, through implementation and managing the programme to auditing the programme. The process is, however, a continuous process where recommendations from the auditing need to be incorporated through a iterative process.

BPG G3 also describes the different measurement and monitoring techniques and different data storage, interpretation and presentation techniques and also contains a practical worked example to illustrate the practical development of a monitoring programme.

4. PROCESS AND PROCEDURE TO IMPLEMENT WC/WDM MEASURES ON A MINE

4.1. OVERALL PROCESS

Figure 3 provides details of the recommended overall WC/WDM process. There are three main phases, namely:

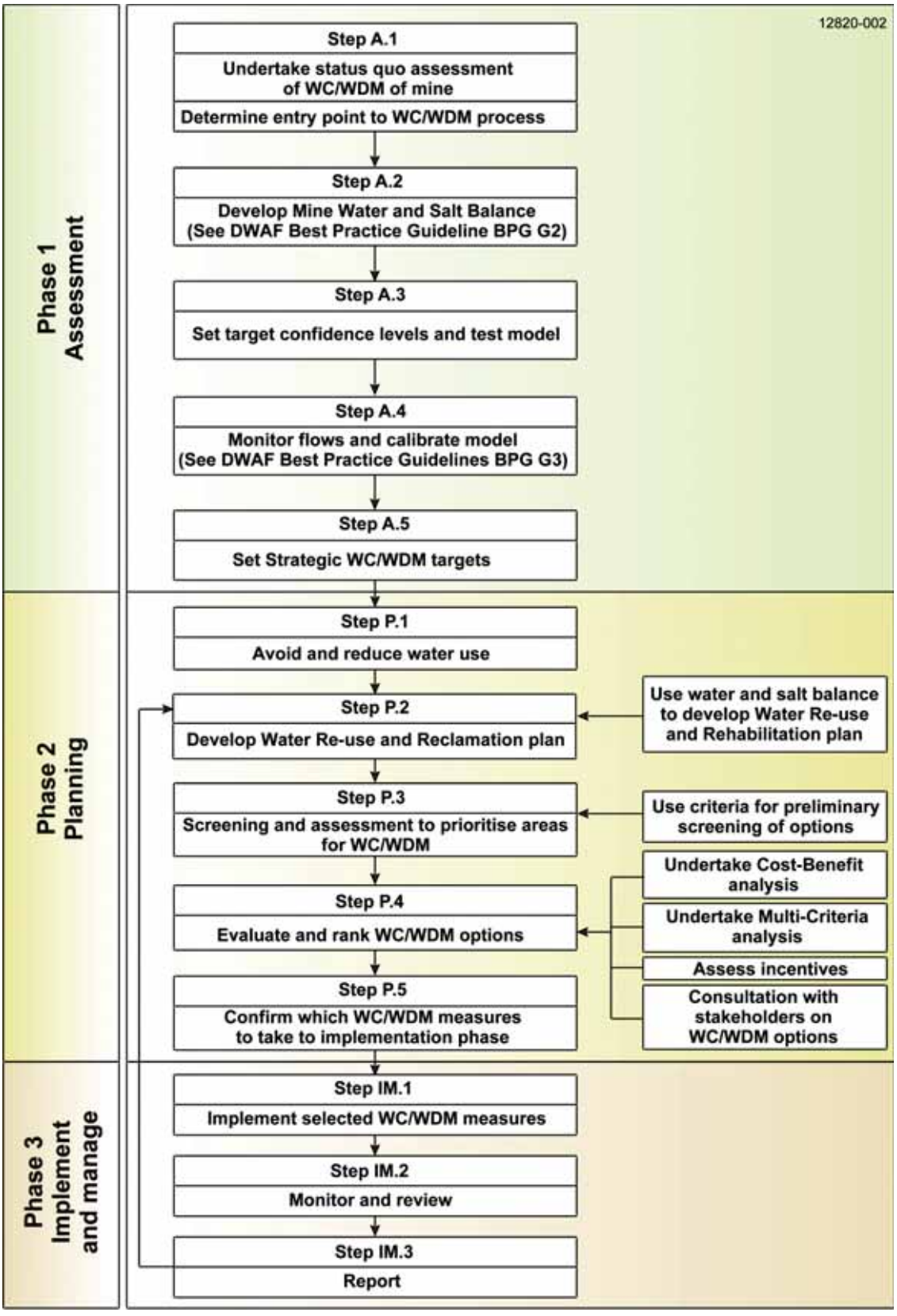
Assessment of the current water management, including the water use efficiency status of a mine;
Planning of WC/WDM measures and opportunities, including assessment of these measures; and
Implementation and Management of the selected WC/WDM measures and the mine water system. This will include ongoing monitoring, review and audit of the mine water system.

ASSESSMENT OF CURRENT WC/WDM STATUS

PLANNING FOR WC/WDM MEASURES & OPPORTUNITIES

IMPLEMENT & MANAGE WC/WDM MEASURES & MINE WATER SYSTEM

Figure 4. overleaf provides additional detail of the various steps recommended for the three phases of the overall WC/WDM process. These are described in more detail in the following sections of the Guideline. For the purpose of the Guideline, it is assumed that the mine management will allocate the responsibility for the described tasks to a suitably qualified person at the mine and that the mine will allocate the necessary resources for the execution of the WC/WDM measures.



4.2. PHASE 1: ASSESSMENT

4.2.1. Step A1: Undertake Status Quo Assessment Of WC/WDM At A Mine

It is recognised that not all mines in South Africa have implemented WC/WDM measures to the same extent. Therefore the required WC/WDM measures would be mine specific. The progress made by a mine in the assessment, planning, implementation and management of WC/WDM measures may be tracked and measured using a questionnaire attached in Appendix A. The completion of this questionnaire will inform both the DWA and the mine management of the mine's point of entry in the WC/WDM process detailed in Figure 4. The status quo assessment of WC/WDM at a mine would be undertaken in two steps, namely:

Step 1: Completion of the questionnaire with a list of key questions attached in Appendix A to identify the point of entry into the WC/WDM process; and
Step 2: Assessment of the extent of implementation of the Best Practice Guidelines supporting WC/WDM.

The determination of the extent of implementation of WC/WDM measures at a mine will inform the mine of the next step to be taken in terms of the recommended WC/WDM process.

The status quo assessment to determine the extent of implementation of WC/WDM measures at a mine should be undertaken within the context of:

The national legislative framework and regional/catchment strategies and objectives;
The true value of water in the region;
The local and catchment wide water demand, water use objectives and needs;
Any available information on benchmarking of water use for the specific sector; and
Information regarding available technology, management systems and other good practice measures which could reduce water use.

Table 2 overleaf, provides recommendations for the inputs, methodology and outputs for the determination of the extent of implementation of WC/WDM measures at a mine.

Table 2: Assessment of level of implementation of WC/WCM at mine

Stage	Activity
Input	WMA Internal Strategic Perspective (ISP) National Water Resource Strategy and Catchment Management Strategy
	Integrated Water and Waste Management Plan (IWWMP) for the mine
	Water Services Development Plans (WSDP) developed by District or Local Municipalities
	Any applicable regulations and water use authorisations issued by the DWA
	Best Practice Guidelines, good management practices, measures, benchmarks for the mining sector, etc., available in published literature
	Information regarding available cleaner technology
Methodology	Assessment of the extent of implementation of WC/WDM at mine includes a review of: • The level of Implementation of relevant Best Practice Guidelines supporting WC/WDM at the mine (Best Practice Assessment); • The extent of implementation of technology to reduce water demand; • Mine water and salt balance; • The comparison of mine's current water use and demand with other similar water uses via the process of benchmarking of water use; • The availability of water supply in the mine's catchment, Water Reuse and Reclamation Plan; and • Water monitoring system.

Output	• Report on the extent of implementation of WC/WDM at the mine supported by the following:
	  ○ Statement related to the water demand management needs (supply and demand) in catchment context;
	  ○ Completed questionnaire; and
	  ○ Findings from BPG implementation assessment.

4.2.2. Step A2: Develop Mine Water And Salt Balance

A clear understanding of the water systems around the mine and the mine water and salt balance is an essential prerequisite for identifying, assessing and implementing WC/WDM measures. An accurate water balance is considered to be the most important water management tool available to a mine.

Should a water and salt balance for the mine not currently exist; the mine will need to develop one.

Reference should be made to the Best Practice Guideline G2: Water and Salt Balances, which documents the general principles that should be taken into consideration when water and salt balances are developed. The procedural principles that one should be aware of when developing water and salt balances are:

Clear objectives should be defined for the water and salt balances, catering for the current situation and the probable or desired future situation;
Large, complex mines should preferably be divided into smaller management units. Thus an overall integrated balance and separate balances for smaller units may be developed;
To achieve a balance with an adequate resolution or degree of detail it is believed that for each type of circuit, the flows should be considered down to an accuracy level of 1% – 5% of the total flow;
For the purpose of water management and taking account of measurement errors, an accuracy of 5 – 10% over a unit process and 10 – 15% for the overall mine is considered adequate;
Common and uniform formats and procedures should be developed to ensure that the different management units could effectively exchange information;
Regular updating of the balances, both in terms of adding new data and ensuring that the reticulation system reflects significant changes which have been made. This should be done as an iterative process to continuously obtain more accurate balances; and
It is important that the water and salt balance system which is used, must be flexible enough to accommodate changes which are made to the mine water reticulation system with ease.

The following technical principles should be understood when water and salt balances are developed:

The basic principle of mass conservation forms the foundation of mass balances and the concept should be illustrated in a simplified manner in the water balance;
Conservative salts e.g. sodium are used to construct the complete water and salt balance, as it will not undergo any significant changes within the unit process over which the mass balance is being constructed;
The principle of "simultaneous solution of equations" enables one to calculate unknown flows; and
The hydrological years and their division into wet and dry seasons will need to be considered to account for seasonal changes within a water and salt balance.

Various methodologies may be used to develop a mine water and salt balance. The BPG: G2 Water and Salt Balance provides practical steps and consideration to construct a water balance network. While a mine may use the BPG:G2 guideline to develop its water and salt balance, it may have its own internal and/or corporate level guidelines and procedures.

Figure 5 details the flow diagram of the process to develop water and salt balances as documented in BPG G2.

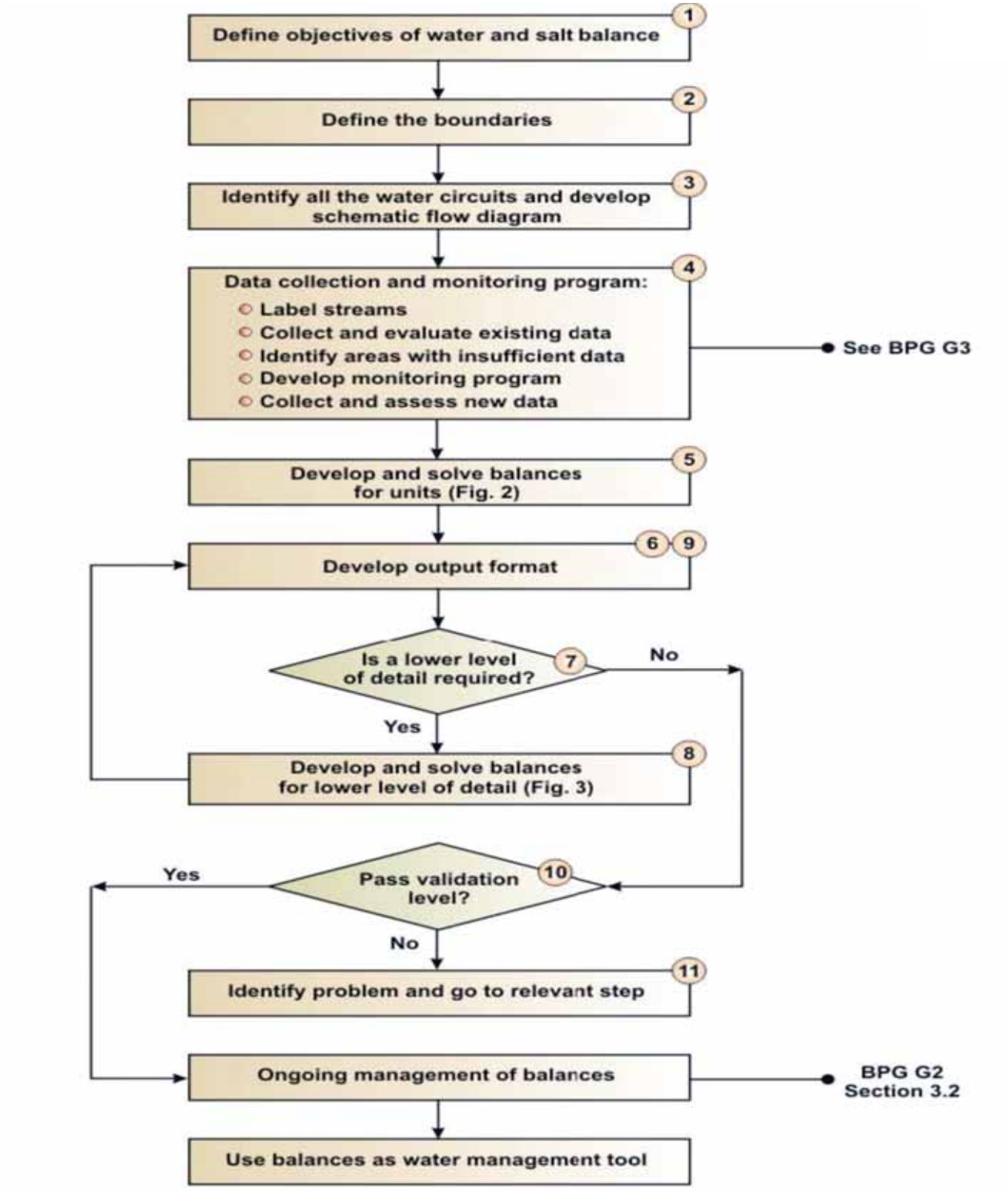


Table 3: Mine water and salt balance: Inputs, methodology and outputs

Stage	Activity	Details
Input	Define and describe the objectives of the water balance	Typical objectives can include: • Assist in identifying and assessing WC/WDM potential and measures to be implemented; • Assist in identifying opportunities for improving water use efficiency; • Develop a management and audit tool; and • Assist in the management of water and waste in a responsible and sustainable manner.
	Identify required level of accuracy	Required level of accuracy will be dependent on the objectives of the water balance. A high level of accuracy is required for WC/WDM to be effective.
	Define the boundaries	Divide mine area into Management and Sub-Management Units. Management units typically consist of: • Natural areas (catchments); and • Man-made processes. Main categories: • Mining areas (underground or surface mining); • Plant area; • Residue deposits; • Receiving environment; and • Domestic water systems.
	Mine plans	Details of mining areas, plant and waste deposits and water systems
	Topographical plans	Typically 1:50 000; 1: 20 000 and 1:10 000 topographical plans and aerial photographs
Methodology	Identify water circuits and develop schematic flow diagram	Identify water flow paths on the mine site and understand the layout of the water systems, including: • Surface and groundwater flow; • Mining circuits (underground and opencast); • Coarse and fine discard circuits; • Metallurgical plant and/or washing plant circuits; and • Domestic water circuits. Show layout of water systems schematically as a flow diagram

Stage	Activity	Details
Methodology	**Undertake data collection and monitoring**	Collect water flow quantity and quality data for the model inputs, including: • Flow rates for all water circuits; • Water quality within water circuits; and • Dam capacities and volumes.
	Develop and solve balances for Management and Sub-Management Units	For each Management and Sub-Management Unit: • Develop relevant water and salt balance equation; • Develop preliminary balance; • Assess the accuracy of balance; and • Identify and address causes of imbalance. This may require further monitoring and data collection.
	Develop and solve overall water and salt balance	For the overall mine: • Establish and validate the linkages between Management and Sub-Management Units; • Identify and address inconsistencies; • Develop preliminary balance for integrated units; • Identify and address causes for imbalance; • Calculate new balance; • Develop output format; and • Assess level of detail required.
	Develop output formats	Results of the water and salt balance should be presented in a user-friendly format. Schematic and graphical formats are preferred to lists and tables.
Output	**Mine water and salt balance**	Mine water and salt balance developed to the required level of accuracy

4.2.3. Step A3: Set Target Confidence Levels And Test Model

Confidence levels need to be established to calibrate the mine water and salt balance and to ensure the applicability and suitability of the model as a water management tool. Confidence levels are required for the overall balance and for each Management and Sub-Management Unit. Target confidence levels may be set either at corporate level or by mine management.

Table 4 provides details of the inputs, methodology and outputs for the calibration of the mine water and salt balance.

Table 4: Calibration of the Mine Water and Salt Balance: Inputs, methodology and outputs

Stage	Activity	Details
Input	Objectives for the mine water and salt balance	The development of the objectives and the mine water and salt balance are included in Step A2
	Mine water and salt balance	
	Target confidence levels for the overall mine water and salt balance and each management and sub-management unit	Set by the suitably qualified person
Methodology	Assign a confidence level to each input and output point in the mine water and salt balance	Confidence levels will depend on the level of accuracy of the data/ information for that point. Typical confidence levels within a Management Unit may be: • Measured flow/quality: 98%; • Calculated flow/quality: 85%; and • Estimated flow/quality: 50%.
	Assign a weighting to each input and output point	Weightings are generally based on flow volume, but may also take the level of importance of the flow into account
	Calculate confidence level for the Mine Water and Salt Balance	The confidence level is calculated as a flow-weighted average for all management units and for the overall mine water and salt balance
	Compare calculated confidence level to target confidence level	Is the actual confidence level for the mine water and salt balance above the target value? • If No, then proceed to Step A4; and • If Yes, then proceed to Step A5.
Output	Mine water and salt balance that has been tested against the target confidence levels	

4.2.4. Step A4: Monitor Flows And Calibrate Model

The monitoring of mine water systems is generally undertaken on an ongoing basis to provide continuous information for the mine management. Such monitoring is particularly required to improve the confidence levels of the mine water and salt balance where these are not being met.

Various methodologies may be adopted for developing a mine water monitoring system. The DWA has prepared BPG G3: Water Monitoring Systems that provides guidance on setting up and managing a mine's water monitoring system. While a mine may use the guideline to develop its water monitoring system, it may have its own internal and/or corporate level guidelines and procedures. Key features of the BPG G3 are included in section 3.3.5 of the document to assist any mine in developing its own water monitoring systems.

Mine water monitoring systems should be developed and managed within well-defined principles and procedures which may typically include:

- Undertake detail design the monitoring programme;
- Implement the monitoring programme;
- Collect and capture data;
- Report information and data; and
- Audit the monitoring programme and make recommendations for improvement.

Table 5 provides details on the inputs, methodology and outputs for developing a mine water monitoring system.

Table 5: Developing a mine water monitoring system: Inputs, methodology and outputs

Stage	Activity	Details
Input	Mine water and salt balance	From Step A2
	Define the objectives of the water monitoring system	Objectives should be specific, measurable and adhere to the principles of water monitoring systems
	Mine plans	Details of mining areas, plant and waste deposits and water systems
	Topographical plans	Typically 1:50 000; 1: 20 000 and 1:10 000 topographical plans and aerial photographs
Methodology	Define location of monitoring points	Identify the "where" to monitor, in relation to the objectives of the water monitoring system. Use suitably qualified personnel to locate monitoring points, particularly for groundwater monitoring. Indicate monitoring points on a map and/or process flow diagram.
	Define measurement parameters	This addresses the "what" to monitor Identify key indicators to meet the objectives of monitoring and parameters required to meet these requirements A phased approach is often useful, where: • A wide variety of tests are undertaken in the initial phase; and • Only parameters of specific interest are monitored in follow-up phases.

Table 5: Developing a mine water monitoring system: Inputs, methodology and outputs

Stage	Activity	Details
Methodology	Define frequency of measurement	This addresses the "when" to monitor. The frequency of measurement is dependent on such factors as: • The importance of the monitoring point; • The future duration over which data is required; • The expected variability of flow and quality at the monitoring point; • The location of the monitoring point; and • The available monitoring budget.
	Define data and information reporting requirements	Define the database storage and reporting formats Ensure that the database can meet anticipated future requirements and future additions/refinements to the monitoring programme
	Develop detailed data sampling and collection procedures, including quality assurance programme	A detailed set of data/sample collection procedures is required to ensure that: • The approach and methodology are uniform; • The programme is correctly implemented; • There is continuity (allowing for staff resignations, retrenchments and reassignments); • Quality control and assurance measures are included; and • Correct equipment is used and safety measures are applied.
	Develop data and information management systems	See Table 6 for details on available information management tools
	Implement and operate the water monitoring system	Implementation and operation include: • Collect and capture water quantity and quality data; • Report information in a user-friendly format and complies to water use licence conditions; • Provide recommendations for future water monitoring, based on the information provided; and • Audit the monitoring programme and provide recommendations.
Output	Mine water monitoring system that adheres to the water monitoring principles and is effectively implemented	

Data and information management systems take many forms and can vary significantly in terms of level of detail and complexity.

Table 6 summarises information management tools, giving individual detail of their advantages and disadvantages.

Table 6: Summary of available information management tools

Tool	Advantages	Disadvantages
Manual systems	• Minimum capital cost is involved to implement the system; • No specialised computer training is required to implement and manage the system; and • No specialised equipment is required.	• Manual manipulation of data requires specialised skills; • Labour-intensive and time-consuming to update the data; • Physical storage space required; and • Reporting of information is time-consuming and laborious.
Computer database and spreadsheet systems	• Information updated easily and quickly; • Information can be presented in a user-friendly format; and • Vast amounts of data can be stored, processed quickly and retrieved selectively.	• Software programmes and computer equipment are required; • Training is required; • Changes in software can result in non-compatibility; and • Spreadsheets can become customised and difficult to manage.
Geographic Information Systems (GIS)	• Information updated easily and quickly; • Information can be presented in a user-friendly format; • Different types of data (e.g. maps, monitoring points) can be integrated; and • GIS can be used as a modelling programme.	• Relatively expensive software is required; and • Specialised training is required.

4.2.5. Step A5: Set Strategic WC/WDM Targets

As South Africa is a water scarce country the mine has the responsibility to demonstrate efficient use of water and continual improvement thereof. Therefore the mine has to set WC/WDM goals and targets, and it must form part of a bigger process of formulation of the goals and objectives during the development and compilation of a Water Conservation Plan or IWWMP. The targets should reflect continuous improvement in water use efficiency on the mine, and should be set for the short, medium- and long-term.

The WC/WDM targets should relate to the catchment targets and objectives (if available from DWA), best practice and/or applicable benchmarks for the mine's water use. Some generic benchmarks for the mining sector are available in published literature. DWA currently utilises a voluntary mechanism of target setting for WC/WDM as well as continuous improvement in water use efficiency. However, DWA requires any greenfields operation to be water use efficient right from the start. Thus, water use efficiency should be considered up front during the planning phase of such an operation.

The assessment to determine the extent of implementation of WC/WDM measures at a mine may also provide details of typical water use benchmarks for various sub-sectors of the mining industry. Water use benchmarks specifically applicable to the mining industry can also vary with a number of criteria, including:

The type of mineral mined; and
The location of the mine; its impacts on the availability of water, the quality of water and the sensitivity of the receiving environment.

Figure 6 gives a diagrammatic indication of target setting for WC/WDM as related to primary water use efficiency on a mine. The diagram also applies to mining and beneficiation processes within the mine. In the diagram:

The benchmark range for the total water use is generally determined by a mine for its particular operation. The total water use benchmark will vary (and probably reduce) over time as new WC/WDM technologies and management practices are introduced;
The "limit of water use efficiency" represents the lowest limit of improvement in water use efficiency. The relevant mine process will be negatively affected by water use below this limit;
The goal of continual improvement in water use efficiency over time is indicated; and
Continual improvement in water use efficiency can be achieved through the implementation of a combination of Best Practices and WC/WDM measures.

Figure 6: Diagrammatic representation of WC/WDM target-setting on a mine

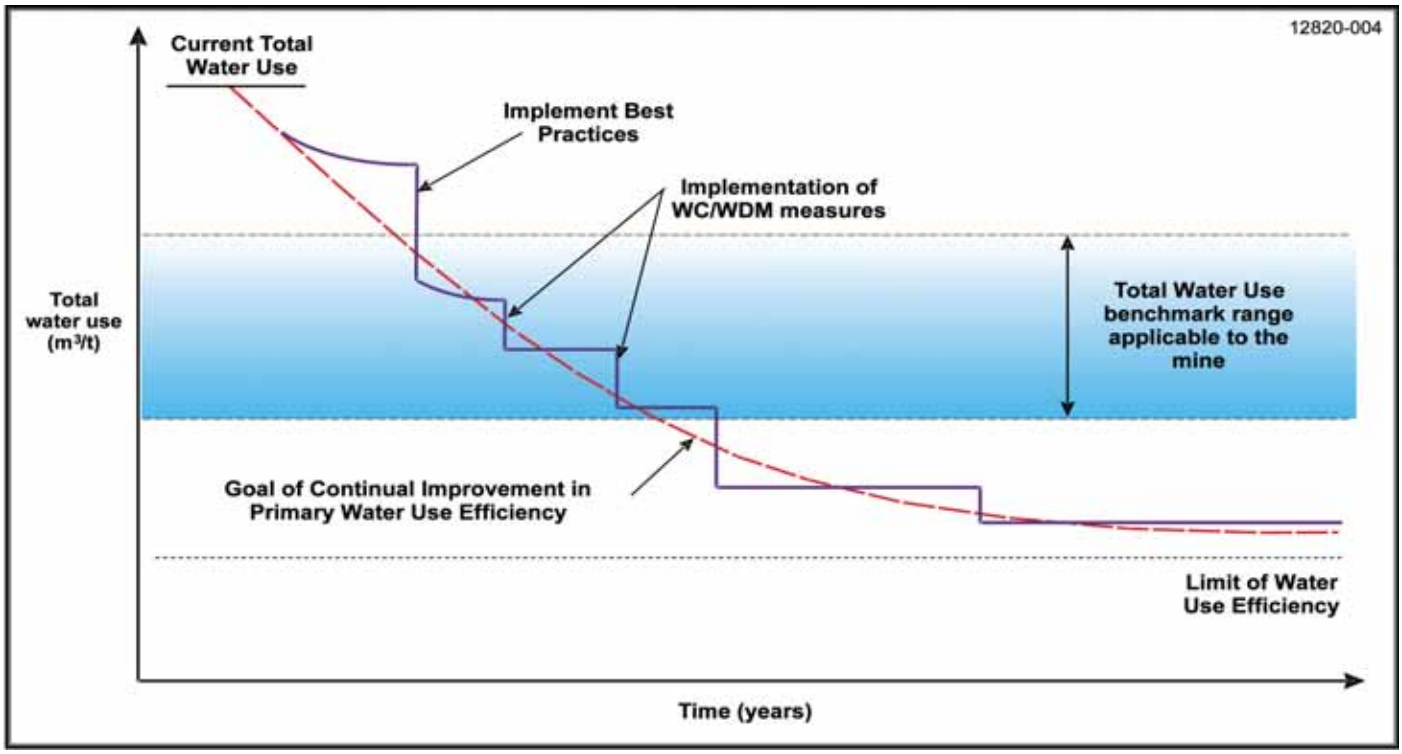


Table 7 provides details on the inputs, methodology and outputs for setting WC/WDM targets on a mine.

Table 7: Setting WC/WDM targets: Inputs, methodology and outputs

Stage	Activity	Details
Input	Benchmarks for the mining sector	Available from published literature or based on mine experience
	Corporate level targets	Set in corporate annual reports
	Mine water and salt balance	From Step A2
Methodology	Set mine-specific water use benchmarks	Adapt generic water use benchmarks to reflect mine-specific conditions
	Compare actual water use with mine-specific benchmarks	Use mine water and salt balance to determine actual water use. Compare overall water use and water use per management unit against available benchmarks.
	Define WC/WDM targets	Describe WC/WDM targets for immediate, medium-term and long-term time-frames. Relate targets to water use opportunities within the Mine water and salt balance.
Output	Defined WC/WDM water use targets for various time-frames	

4.3. PHASE 2: PLANNING

The planning phase of the WC/WDM process involves the identification, screening assessment and detailed evaluation of a mine's WC/WDM measures. Planning is an important step in achieving the goal of continual improvement in primary water use efficiency, both for the mine overall and for each of the management and sub-management units.

The following sections describe the planning steps in greater detail.

4.3.1. Step P1: Avoid And Reduce Water Use

Limiting the use of fresh water and potential pollution of water resources are major challenges facing the South African mining industry. The avoidance of water use is a key step in the implementation of WC/WDM on a mine and should be the first aim of the planning component of the WC/WDM process, irrespective of the mining phase or whether it is an existing or new mining operation. The entire mining operation, such as the process water, storm water circuits, etc. must be evaluated.

Mines should reduce the amount of clean water abstracted from natural resources. This can be achieved by looking at WC/WDM measures in all processes and throughout the life of a mine, and it can include implementation of opportunities provided by improved technology, as well as better management of water. The treatment of dirty water within the mining operation and its reuse can further contribute

towards reducing clean water abstraction and use from natural resources. In order to improve the efficient use of all types of water within a mining operation, the reduction in water use will be followed by the reuse and recycling of water and is addressed in the next step of the planning process.

Table 8: Identify opportunities to avoid and reduce water use: Inputs, methodology and output

Stage	Activity	Details
Input	Mine water and salt balance	Water consumption information obtained from Step A2
	Integrated Water and Waste Management Plan	Site characterisation, identification of matters requiring attention, objectives measures and action plan incorporated in the IWWMP
	Cleaner production and cleaner technologies information	Internationally available process related technologies
Methodology	Review intake of raw water and materials	Utilise water balance to review resource intake and identify water users on mine; Develop and maintain an accurate water balance for all water circuits, such as process water, potable water, storm water circuits, etc.; Elimination of leaks and process water outages; Identify measures related to the input to the operation, which could contribute to the reduction of water use; and Avoid extraneous water streams being introduced to the dirty water areas, for example storm water ingress.
	Identify "good" housekeeping and operating practices to reduce water use	Obtain a good understanding of mine layout, its associated water circuits and extent to which "good" housekeeping is implemented on site; and Identify "good" housekeeping and operating practices which can reduce the water use.
	Optimise reduction at source and pollution prevention	Identify measures which can be implemented on the mine which will contribute to reduction of water use at source and prevent pollution. These measures may include the following: ○ Bund and contain certain high risk areas; ○ Roof areas to prevent water infiltration and maximise runoff which could contribute to recycling and reuse; ○ Pave areas to prevent seepage into underlying groundwater and to maximise runoff, which could be recycled and reused; and ○ Divert storm water around major pollution sources.
	Optimise water management systems	• Design and operate water circuits to ensure a separation between process water circuits, storm water system, etc. and prevent cross contamination; • Keep clean water clean by constructing diversion berms and channels to carry clean water away from possible pollution sources; and • Collect and contain dirty water in dedicated containment facilities or bunded areas for reuse and/or reclamation.
	Investigate process or technology modifications	Identify potential process or technology modifications which could result in reduced water consumption. These could include the following: • Modification of mine process technologies to eliminate unnecessary production steps and to minimise water usage; • Implementation of more efficient process and equipment design; and • Consideration of innovative unit operations and innovative process integration.
Output	List of improved technologies, "good" housekeeping and operating practices, and other on-site measures which will enable the mine to avoid and reduce water consumption.	

4.3.2. Step P2: Develop Water Reuse And Reclamation Plan

The completion of the first step in the planning process for WC/WDM on a mine, which entails the identification of opportunities related to the avoidance of water use and reduction in the amount of clean water abstracted from natural resources is followed by the reuse and recycling of water. This would be undertaken by establishing a Water Reuse and Reclamation Plan. This plan should form part of the IWWMP or Water Conservation Plan for the mining operation, but may also be developed as a stand-alone operational plan.

The development of a Water Reuse and Reclamation Plan entails the optimisation of water reuse and reclamation of contaminated water at a mine. The entire mine area must be considered during this step of the planning process. The mine must ensure that all the various water circuits on the mine, such as the storm water, process water and effluent streams, are considered in the development of the Water Reuse and Reclamation Plan. The mine will use the mine water and salt balance, mine-specific benchmarks and targets developed in the assessment phase (Phase 1) to develop the mine's Water Reuse and Reclamation Plan.

The DWA has published BPG H3: Water Reuse and Reclamation which provides the details on the objectives, key considerations and the process for the development of a Water Reuse and Reclamation plan. This plan should form part of the IWWMP for a mine. Key points from the BPG H3 are included in Table 8 to assist the mine in identifying potential WC/WDM measures.

Table 9 overleaf provides details on the inputs, methodology and outputs for developing a mine Water Reuse and Reclamation Plan.

Table 9: Develop a mine Water Reuse and Reclamation Plan: Inputs, methodology

Stage	Activity	Details
Input	Mine water and salt balance	From Step A2
	Integrated Water and Waste Management Plan	Site characterisation, identification of matters requiring attention, objectives measures and action plan incorporated in the IWWMP
	Mine-specific benchmarks and targets	From Step A5
	Topographical plans	Typically 1:50 000; 1: 20 000 and 1:10 000 topographical plans and aerial photographs
Methodology	Pollution prevention	Investigate, evaluate, develop and implement appropriate pollution prevention strategies wherever possible
	Identify water sources using the mine water and salt balance	• Locate where processes are fed with clean water (from dams, boreholes, natural water bodies, service providers, etc); • Locate all water-using processes, including utility services and all points where (waste) water or effluent is generated; • Locate all water or dirty water storage and collection areas; and • Consider water quality, supply and volume (use data for past 5 years if possible).
	Define the water quality and flow status	Using a monitoring system, characterise the water streams/sources with respect to flow rate, quality and variability of data. Base the characterisation on information over the past 5 years, if possible
	Identify and define current/ existing water reticulation systems	• Identify opportunities for re-using effluent water from one process as influent water to another process; • Establish where water reticulation networks may need to be installed or extended/ modified once re-use pathways are validated; and • Assess adequacy of water storage facilities within the reticulation system and establish necessity of additional requirements.

Stage	Activity	Details
Methodology	Identify all mine water uses (i.e. areas and processes on the mine that require water)	• Conduct a water use inventory. Compile a list of existing and potential mine-related water use needs; and • Identify both direct and indirect water uses. Water use on a mine can range from potable use to use for mineral processing, cleaning, dust suppression, transport, irrigation etc.
	Define water quality and quantity requirements of all mine water uses	• Consider water quality parameters that affect/impact on product quality/yield and/or process performance/ optimisation; • Establish fit-for-purpose quality and quantity criteria; • Consider the water quality needs of the mine-related use and not only the water quality currently supplied (e.g. supply of potable water for a use that actually requires water of a lower quality); • Distinguish between direct and indirect water use and different requirements for these; • Determine potential acceptance of water quality and quantity at proposed standards (without treatment). If unacceptable, determine additional treatment required to render water quality and quantity of an acceptable standard; • Group uses with similar water quality requirements together to provide a number of different water quality groups/categories, which will meet all use requirements. These will be linked to key contaminants, specific applications or water uses; and • Aim to use water with the minimum amount of treatment.
	Develop geographically referenced plans	• Select an appropriate tool to use for data and information management; • Validate reliability of data before entering into the information management system; and • Develop plans showing water sources, water uses and existing reticulation system(s).
	Align and allocate water sources to water uses	• Align and allocate recycled water quality and quantity to various applications or water uses; • Achieve the minimum use of clean water or optimal flow configuration in the particular system of operations; and • Optimise the water reticulation system as far as possible.
	Determine whether all water sources have been allocated for reuse	• Assess whether all mine-related water uses are receiving the worst allowable quality water.
	Define the unused water sources	• Categorise the unused water in terms of the reason for not being allocated to a specific water use for reuse.
	Determine acceptable water quality	• Determine whether the unused water is of acceptable quality to allow alternative use or discharge/disposal.
	Identify and investigate relevant water treatment alternatives	• Identify and investigate water treatment options; • Determine process reliability; • Evaluate all side streams from the treatment process to ensure that all costs and impacts are known (handling and disposal of sludge etc); • Establish whether it would be more appropriate to treat effluent streams simultaneously or separately; and • Evaluate type and optimal placement of treatment process to achieve the desired trade-off between performance, reliability, capital expenditure, operating costs, environmental impact and waste generated.
	Determine reuse capacity after treatment	• Determine whether the treated water could be re-used within the mine water system; and • Investigate alternative use or discharge options.
	Develop the Water Reuse and Reclamation Plan	• Complete the Water Reuse and Reclamation Plan, including all identified WC/WDM measures.
Output	Water Reuse and Reclamation Plan	

4.3.3. Step P3: Screening Level Assessment To Prioritize Potential Areas For WC/WDM

The screening level assessment phase is designed to identify the measures that will be the most effective and which can be implemented in the short and medium term.

During this step, the mine screens the best management practices, all the alternative options to avoid or reduce water use, and water reuse and reclamation options that have been identified in Step P1 and Step P2. The outcome of this step in the WC/WDM process provides a preliminary prioritisation of the WC/WDM measures.

Table 10 provides details on the inputs, methodology and outputs for the Screening level assessment to prioritise potential areas for WC/WDM.

Table 10: Screening level assessment to prioritise potential areas for WC/WDM: Inputs, methodology and outputs

Stage	Activity	Details
Input	Mine water and salt balance	From Step A2
	List of improved technologies, "good" housekeeping and operating practices, and other on site measures which will enable the mine to avoid and reduce its water use	From Step P1
	Water Reuse and Reclamation Plan	From Step P2
	Good management practices	Alternative options and management practices documented in the Best Practice Guidelines
	Technology	List of available technology which could enable the implementation of WC/WDM measures
	Mine-specific benchmarks and targets	From Step A5
	Integrated Water and Waste Management Plan	Site characterisation, identification of matters requiring attention, objectives, measures and action plan incorporated in the IWWMP
Methodology	Prepare conceptual level costs	Provide a first order indication of the likely cost to implement the WC/WDM measure
	Undertake screening level assessment	The factors to consider in the screening level assessment include: • WC/WDM measures are compulsory in terms of section 22(2) of the NWA; • The likely costs of implementing the WC/WDM measure; • A qualitative assessment of the potential beneficial impact of the WC/WDM measure; • The need for, and availability of, technology advances to enable the WC/WDM measure; and • The timing of the flow reduction and improved water use efficiency resulting from the WC/WDM measure.
	Preliminary assessment and ranking	• Use the above criteria to assess the WC/WDM measures and provide a preliminary ranking (see Table 10).
	Generate short-, medium- and long-term plans	• Divide the WC/WDM measures into short-, medium- and long-term activities.
Output	List of identified WC/WDM measures for implementation in the short, medium and long term.	

Table 11 overleaf, provides details of a possible methodology for the preliminary assessment and ranking of the identified WC/WDM measures.

All potential WC/WDM measures	Is the measure a legal requirement?		Scoring for cost			Scoring for benefits			Specialised technology required?		Timing of benefits			Score	Preliminary ranking
	Yes	No	Low	Medium	High	High	Medium	Low	No	Yes	Short-term	Medium-term	Long-term		
			3	2	1	3	2	1	3	0	3	2	1		
Management Unit X															
1															
2															
3															
Management Unit Y															
1															
2															

Table 11: Guideline for screening level assessment of WC/WDM measures

4.3.4. Step P4: Evaluate And Rank The WC/WDM Measures

The mine will evaluate and rank the list of WC/WDM measures that have been identified during Step P3. The screening level assessment (Step P3) is an important step to confirm that the implementation of each of the listed WC/WDM options is appropriate from a water use efficiency perspective. The listed WC/WDM options are ranked so that implementation of the WC/WDM measures can be planned according to water use needs and benefits. The evaluation and ranking of WC/WDM measures can be further supported by the risk assessment process which forms part of the compilation of an IWWMP.

Table 12 provides details of the inputs, methodology and outputs for the detailed evaluation and ranking of the WC/WDM measures.

Table 12: Detailed evaluation and ranking: Inputs, methodology and outputs

Stage	Activity	Details
Input	List of identified WC/WDM measures for short, medium and long term	From Step P3
	Stakeholder list	List of stakeholders to be consulted, both within the mine hierarchy and external
Methodology	Undertake detailed evaluation and ranking of listed WC/WDM measures	The evaluation methodology for ranking of the WC/WDM measures are likely to be: • A cost-benefit analysis; and/or • NPV calculation assessment against environmental, social, technical and regulatory criteria.
	Consult with relevant parties	• Identify relevant stakeholders, both within management units and external, who may be impacted by the proposed WC/WDM measure; • Hold discussion meetings and presentations with relevant stakeholders; and • Consider contributions from stakeholders in the evaluation process.
	Prepare ranked list of WC/WDM measures	• Rank the WC/WDM measures, based on the above; and • Update the IWWMP or Water Conservation Plan documenting the preferred WC/WDM measures for implementation.
Output	Ranked list of WC/WDM measures to be implement in the short-, medium- and long term	

4.3.5. Step P5: Develop WC/WDM Implementation Plan

Based on the assessments and ranking from Step P4, the mine will confirm the planning and implementation programme for the WC/WDM measures.

Table 13 provides details on the inputs, methodology and outputs to confirm the WC/WDM measures.

Table 13: Confirm WC/WDM measures: Inputs, methodology and outputs

Stage	Activity	Details
Input	Ranked list of WC/ WDM measures to be implemented in the short-, medium- and long term	From Step P4
Methodology	Present and discuss the ranked list of WC/WDM measures	• Present the ranked list of WC/WDM measures to mine management and at corporate level; and • Gain input and feedback of the assessment methodology, results and recommendations.
	Obtain agreement and buy-in	• Discuss the recommendations for implementation of WC/WDM measures and obtain agreement and sign of from mine management.
	Develop detailed implementation plans	The implementation plan will include details on: • The design of the WC/WDM measures; • Detailed drawings and costs; • Tender documents, if the required work will be undertaken externally; • Time-frames for completion; • Resources required for implementation, both internally and externally; and • Budget for implementation.
Output	Approved implementation plans for the selected WC/WDM measures that will be implemented in the short-, medium- and long term	

4.4. PHASE 3: IMPLEMENTATION AND MANAGEMENT

The implementation of WC/WDM measures should be monitored and reviewed to ensure continual improvement in water use efficiency. The proposed reporting on the WC/WDM will enable a mine to demonstrate continual improvement in water use efficiency to its shareholders and the authorities.

All mines have the responsibility to implement WC/WDM in terms of this guideline or any additional requirements stipulated in legislation, e.g. regulations or water use licence conditions. If a mine has a water use licence and an IWWMP it is important to ensure that the implementation and management of the WC/WDM measures at the mine are aligned with water use license conditions, regulations and the action plan contained in the IWWMP. The approach presented in this guideline could be adopted in order for a mine to comply with legislation, regulations and specific license conditions.

4.4.1. Step IM1: Implement selected measures

The mine will supervise and manage the implementation of the selected WC/WDM measures for the current year, and plan the funding and implementation of the selected WC/WDM measures for the short-, medium- and long term.

Table 14 provides details of the inputs, methodology and outputs for the implementation of the selected WC/WDM measures.

Table 14: Implement WC/WDM measures: Inputs, methodology and outputs

Stage	Activity	Details
Input	Implementation Plan	From Step P5
	Construction details	Contract for construction, if applicable, including construction drawings, agreed contract value and programme
Methodology	Construct selected WC/WDM measures	Supervise construction of the WC/WDM measure, including adherence to: • The required technical quality of construction and the details contained in the construction drawings; • The contract price; and • The contract programme.
	Sign-off on construction	Sign-off that the construction of the WC/WDM measure was undertaken in accordance with the relevant construction requirements
	Prepare and update mine plans	• Prepare "as-built" drawings for the WC/WDM measure; • Update the mine water and salt balance to include the WC/WDM measure; and • Update other relevant mine plans.
Output	As-built drawings	

4.4.2. Step IM2: Monitor and review

The mine will monitor mine water flows and use the mine water and salt balance to review the performance of the WC/WDM measures that have been implemented. Similar to Step A4 of this guideline, the DWA's BPG G3: Water Monitoring Systems, provides guidance on monitoring mine water flows.

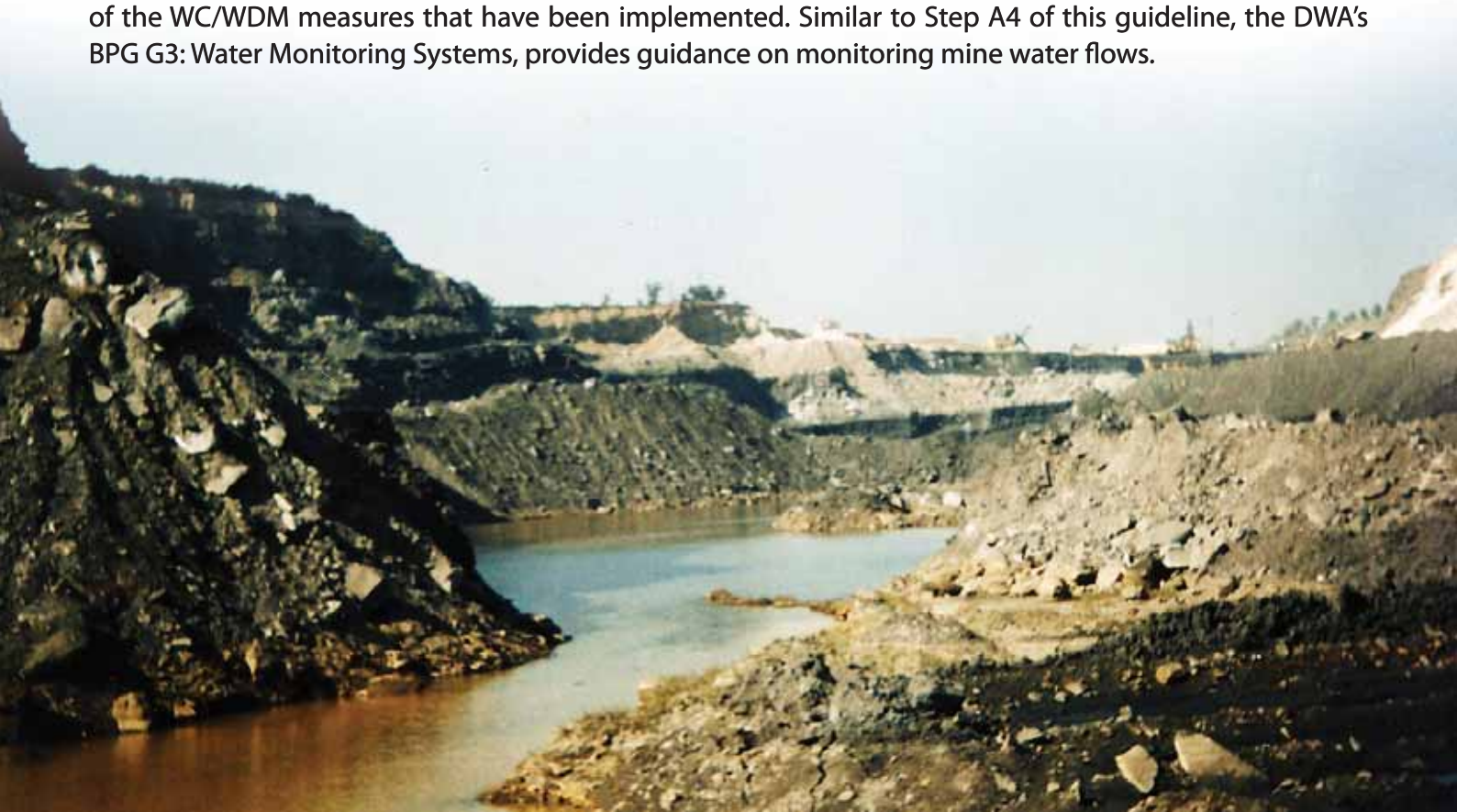


Table 15 overleaf provides details of the inputs, methodology and outputs for the monitoring and review of mine water flows.

Table 15: Monitor and review: Inputs, methodology and outputs

Stage	Activity	Details
Input	Mine Water and Salt Balance	From Step A2, including details of WC/WDM measures that have been implemented
	Mine Water Reuse and Reclamation Plan	From Step P2
	Mine water monitoring system	From Step A4
Methodology	Review mine water monitoring system	Review the mine water monitoring system to assess whether: • New or revised monitoring points should be established; and • Additional water quality parameters should be included in the assessment.
	Collect monitoring data	• Define the required collection period and scope of data collection; and • Using the mine water monitoring system, collect the required water quantity and quality data.
	Determine the impact of the WC/WDM measures that have been implemented	• Update the mine water and salt balance with updated monitoring data to reflect the WC/WDM measure; • The impact can be demonstrated by using one or more of the following: ○ Actual reduction in quantity of water used, both for the process under consideration and the overall mine water balance; ○ Percentage improvement in primary water use efficiency; and ○ Water quality improvements (e.g. use of poorer quality water in a particular process or improvements in overall mine water quality).
	Prepare summary report	• Summarise the implementation and impact of the selected WC/WDM measures.
	Plan future WC/WDM implementation plans	• Prepare implementation plans for future WC/WDM initiatives.
Output	Summary report on impact of WC/WDM measures. Implementation plans for future WC/WDM initiatives.	

4.4.3. Step IM3: Report

In order to demonstrate improved water use efficiency on a mine an annual report, named a Water Conservation Plan, must be compiled. The Water Conservation Plan provides a report for mine management, shareholders and authorities on the performance and success of the WC/WDM measures that have been implemented, plans for future implementation of WC/WDM initiatives and the overall performance of the mine in terms of water use efficiency.

This Guideline provides guidance to compile a Water Conservation Plan on the implementation of WC/WDM at a mine. It is recognised that a water use authorisation also stipulates specific requirements for reporting, which constitutes a legal requirement for a mine and which must be complied with. The IWWMP also has a monitoring and reporting component associated with it. It is proposed that the reporting on the implementation of WC/WDM be aligned with these other reporting requirements in order to minimise duplication. If all the components of a Water Conservation Plan are addressed in a mine's IWWMP there is no need to compile a separate Water Conservation Plan.

However, if a mine operates without a water use authorisation and an IWWMP does not adequately address WC/WDM, the mine is required to compile the annual Water Conservation Plan as outlined in this guideline.

The format of the proposed annual Water Conservation Plan is contained in Appendix B. This proposed format is structured as a stand alone document without any cross referencing to other documents or reports, such as an IWWMP.

Table 16 provides details of the inputs, methodology and outputs for WC/WDM reporting. Section 5 describes additional detail of the DWA's reporting requirements and pro formas.

Table 16: WC/WDM Reporting: Inputs, methodology and outputs

Stage	Activity	Details
Input	Summary reports and implementation plans	Summary report on implementation and impact of WC/WDM measures. Implementation plans for future WC/WDM initiatives.
	Monitoring information	From mine water monitoring system
Methodology	Review available data	Review all monitoring data against benchmarks and mine targets.
	Discuss monitoring results and summary reports	Discuss results and data within the mine water management team.
	Prepare reports	Prepare mine water management report in the form of an IWWMP or a Water Conservation Plan, which includes an assessment of the WC/WDM measures that were implemented during the report period. Report on: The performance and success of the WC/WDM measures that have been implemented; The plans for future implementation of WC/WDM measures; and The overall performance of the mine in relation to water conservation and demand management.
	Confirm WC/WDM targets	Review the performance of the mine water systems against the applicable benchmarks and mine targets; and Plan future WC/WDM initiatives.
Output	Annual mine Water Conservation Plan or updated IWWMP	

5. WC/WDM REPORTING GUIDELINES

5.1. INTRODUCTION

All mines have the responsibility to implement WC/WDM, irrespective of whether it is using water in terms of a water use authorisation or not. The process of assessment, planning, implementation and management of WC/WDM results in the generation of a Water Conservation Plan. Therefore all mines have to generate a Water Conservation Plan. There is a need for streamlining of the reporting on the implementation of WC/WDM measures and prevention of duplication with other requirements for reporting contained in water use licence conditions and IWWMPs.

If all the components of a Water Conservation Plan are addressed in a mine's IWWMP there is no need to compile a separate Water Conservation Plan. However, if a mine operates without a water use authorisation and an IWWMP, the mine is required to compile the annual Water Conservation Plan as outlined in this guideline. It is recognised that the proposed approach regarding reporting presented in this guideline could be adopted in order for a mine to comply with site specific licence conditions.

In order to demonstrate that water is used efficiently the Water Conservation Plan which will be generated for mine management and DWA and it therefore needs to reflect the performance and success of the WC/WDM measures that have been implemented, plans for future implementation of WC/WDM initiatives and the overall performance of the mine in terms of continual improvement in water use efficiency. The format of the Water Conservation Plan is detailed in Appendix B.

It is acknowledged that there are other Corporate Social Reporting (CSR) initiatives, such as the Global Reporting Initiative (GRI), which also reflects on water use efficiency, and it is briefly discussed in the chapter.

5.2. GLOBAL REPORTING INITIATIVE

The GRI is a long-term, multi-stakeholder, international process whose mission is to develop and disseminate globally applicable Sustainability Reporting Guidelines (the Guidelines). These Guidelines are for voluntary use by organisations (corporate, governmental and non-governmental) for reporting on the economic, environmental and social dimensions of their activities, products and services. The aim of the Guidelines is to assist reporting organisations and their stakeholders in articulating and understanding contributions of the reporting organisations to sustainable development.

The GRI Guidelines are a framework for reporting on an organisation's activities. The Guidelines:

Present reporting principles and specific content to guide the preparation of organisation-level sustainability reporting;
Assist organisations in presenting a balanced and reasonable picture of their economic, environmental and social performance;
Promote comparability of sustainability reports, while taking into account the practical considerations related to disclosing information across a diverse range of organisations, many with extensive and geographically dispersed operations;
Support benchmarking and assessment of sustainability performance with respect to codes, performance standards and voluntary initiatives;

Serve as an instrument to facilitate stakeholder engagement; and
The Guidelines are not a code or set of principles of conduct, a performance standard or a management system.

In addition, the Guidelines do not:

Provide instruction for designing an organisation's internal data management and reporting systems; or
Offer methodologies for preparing reports or for performing monitoring and verification of such reports.

The two Guideline documents particularly applicable to WC/WDM reporting are:

GRI Mining and Metals Sector Supplement, Pilot version 1.0, February 2005, incorporating an abridged version of the GRI 2002 Sustainability Reporting Guidelines; and
The Water Protocol, February 2003, for use with the GRI 2002 Sustainability Reporting Guidelines.

For the purpose of clarity, some pertinent details have been extracted from these documents and are briefly mentioned in the following sections.

5.3. REPORT CONTENT

The GRI Mining and Metals Sector Supplement provides guidance on the recommended content for reporting.

Table 17 overleaf gives a summary of the typical content of a GRI report.

Table 17: Typical content of a GRI report

Section No.	Section Title		Details
1	**Vision and strategy**		This section encompasses a statement of the reporting organisation's sustainability vision as well as a statement from the CEO.
2	**Profile**		This section provides an overview of the reporting organisation and describes the scope of the report. The section thus provides the reader with a context of understanding and evaluating information in the rest of the report. The section also includes organisational contact information.
3	**Governance structure and management systems**		This section provides an overview of the governance structure, overarching policies and management systems in place to implement the reporting organisation's vision for sustainable development and to manage its performance.
4	**GRI Content index**		The purpose of this section is to enable report users to quickly assess the degree to which the reporting organisation has included the information and indicators contained in the GRI *Guidelines*. Specifically, the reporter should identify the location of the various GRI elements.
5	**Performance indicators**	**Economic**	These indicators concern an organisation's impact on the economic circumstances of its stakeholders and on economic systems at the local, national and global levels. Economic impacts can be divided into direct and indirect impacts.
		Environmental	These indicators concern an organisation's impact on living and non-living natural systems, including ecosystems, land, air and water. Environmental performance indicators should be reported both as absolute figures and normalised measures (e.g. resource use per unit of output).
		Social	These indicators concern an organisation's impact on the social system within which it operates. Social performance can be gauged through an analysis of the organisation's impacts on stakeholders at local, national and global levels. In some cases, social indicators influence the organisation's intangible assets, such as human capital and reputation.

5.4. REPORTING ON WC/WDM PERFORMANCE INDICATORS

Reporting on WC/WDM measures falls within the environmental performance indicators of a GRI report. Table 18 provides details of the core and additional performance indicators for WC/WDM reporting, as contained in the GRI Mining and Metals Sector Supplement. These are defined as follows:

- Core Indicators include information that is expected to be reported on, as a minimum; and
- Additional indicators examine, qualitatively or quantitatively, the impact of the organisation's water use and recycling on the water sources and associated ecosystems.

Table 18: Details of Core and Additional Indicators for WC/WDM reporting

Indicator No.	Core Indicator	Indicator No.	Additional Indicator
EN5	Total water use (including water used per production output i.e. water intensity)	**EN20**	Water sources and related ecosystems/habitats significantly affected by the use of water
EN12	Significant water discharges to water by type	**EN21**	Annual withdrawal of ground and surface water as a percentage of available water in the local water sources
		EN22	Total recycling and reuse of water
		EN32	Water sources and related ecosystems/habitats significantly affected by discharges of water and run-off

5.5. GUIDELINES FOR INDICATOR MEASUREMENT

The GRI Water Protocol, 2002, provides guidelines on the methodology for measuring the core and additional indicators.

5.5.1. Specific Mine-Based WC/WDM Report

The GRI Guidelines provide a framework for overall performance reporting on an organisation's activities measured against economic, environmental and social indicators. In order to enable the DWA to effectively manage South Africa's scarce water resources all mines are required to implement WC/WDM. As part of the implementation process it has to compile an annual Water Conservation Plan. This report has to reflect a mine's continual improvement in terms of water use efficiency and should contain information related to the mine's current performance and future WC/WDM action plans.

If all the components of a Water Conservation Plan are addressed in a mine's IWWMP there is no need to compile a separate Water Conservation Plan. However, if a mine operates without a water use authorisation and an IWWMP does not adequately address WC/WDM, the mine is required to compile the annual Water Conservation Plan as outlined in this guideline. Appendix B contains an example of a Water Conservation Plan. This format could be used by a mine to report on performance in terms of WC/WDM as required by DWA. A mine should submit its updated Water Conservation Plan or updated IWWMP to DWA on an annual basis.

6. REFERENCES

Department of Water Affairs, 2008. Best Practice Guideline H1: Integrated Mine Water Management.

Department of Water Affairs, 2007. Best Practice Guideline H2: Pollution Prevention and Minimization of Impacts.

Department of Water Affairs, 2006. Best Practice Guideline H3 Water Reuse and Reclamation.

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Global Reporting Initiative, 2005. GRI Mining and Metals Sector Supplement, Pilot version 1.0, incorporating an abridged version of the GRI 2002 Sustainability Reporting Guidelines. February 2005.

The Water Protocol, 2003. For use with the GRI 2002 Sustainability Reporting Guidelines. February 2003.

Water Conservation and Water Demand Management Strategy for Industry, Mining and Power Generation Sector, 2004.

APPENDIX A

Status quo assessment of WC/WDM measures at a mine

PURPOSE OF QUESTIONNAIRE

To assist DWA officials and mine personnel, not familiar with the details of WC/WDM, with the evaluation of the extent to which WC/WDM has been implemented at a mine through checking which aspects have already been considered and addressed by the mine. The DWA official or mine management can then determine what the next step is in the process of assessment, planning, and implementation of WC/WDM at the mine.

The checklist is structured in a progressive manner aligned with to the overall WC/WDM process. Answering NO to any of the questions in the checklist below will guide the user to the point of entry and applicable step in the overall process of assessment, planning, and implementation of WC/WDM at a mine.

Item	Yes	No	Relevant WC/WDM process step
Does the mine have Water and Salt Balance? The Water and Salt Balance should be regularly updated and consider the different hydrological cycles. (Refer to BPG G2: Water and Salt Balances)			**Step A2**
Have target confidence levels been set for the mine water and salt balance and has it been tested against the target confidence levels?			**Step A3**
Does the mine have a water monitoring system that adheres to the water monitoring principles and is it effectively implemented? (Refer to BPG G3 Water Monitoring Systems)			**Step A4**
Are monitoring, maintenance, inspections and audits conducted?			**Step A4**
Has the mine set mine-specific water use benchmarks and targets by adapting generic water use benchmarks to reflect mine specific conditions? Alternatively, has the mine compared its current water use and demand with other similar water uses via the process of benchmarking of water use?			**Step A5**
Are process changes and technologies considered for implementation as part of WC/WDM?			**Step P1**
Are details provided in terms of the mine/plant water users and their water requirements (quantity and quality), their sensitivity to changes/variability and contaminants of concern (COC)?			**Step P2**
Has a Water Reuse and Reclamation plan developed? (Refer to BPG H3: Water Reuse and Reclamation & BPG H4: Water Treatment)			**Step P2**
Has a range of potential WC/WDM measures been identified?			**Step P3**
Has the range of potential WC/WDM measures been ranked and divided into short-, medium-, and long term measures?			**Step P4**
Has an implementation plan been developed for the WC/WDM measures?			**Step P5**
Are WC/WDM measures implemented?			**Step IM1**
Is the impact of the implementation of WC/WDM measured (quantified) by means of the mine monitoring system?			**Step IM2**
Does the mine produce an annual Water Conservation Plan or updated IWWMP, summarizing the implementation and impact of the selected WC/WDM measures?			**Step IM3**

APPENDIX B

Example of a Water Conservation Plan

WATER CONSERVATION AND WATER DEMAND MANAGEMENT REPORT

General information	
Name of mine	
DWA reference number:	
Date of report:	
Period of reporting:	
Owner:	
Address:	
Tel. No:	
Person in control of mine/Mine Manager:	
Address:	
Tel. No:	

MINE WATER AND SALT BALANCE

Attach mine water and salt balance to Water Conservation Plan as Appendix A.
Statement on the comparison of the calculated confidence level to target confidence level of mine Water and Salt Balance.

MINE WATER MONITORING SYSTEM

Attach mine water monitoring system to Water Conservation Plan as Appendix B (This could be the monitoring component of the IWWMP).

WC/WDM TARGETS

Statement on applicable benchmarks for mine water use.

Describe water use targets for specified time frames in the following table.

Indicator	Phase	Year	Mine performance
Total water use Water intake (t/m³)	Historic performance	Year -3	
		Year -2	
		Year -1	
	Current and future goals	Current year	
		Short-term (1 to 3 years)	
		Medium-term (3 to 10 years)	
		Long-term (> 10 years)	
Total water discharged (m³)	Historic performance	Year -3	
		Year -2	
		Year -1	
	Current and future goals	Current year	
		Short-term (1 to 3 years)	
		Medium-term (3 to 10 years)	
		Long-term (> 10 years)	

Figure 7 below illustrates the graphical presentation of the total water use for a mining operation as listed in the table of water use targets.

Figure 7: Proposed graph for WC/WDM reporting on total water used by a mine

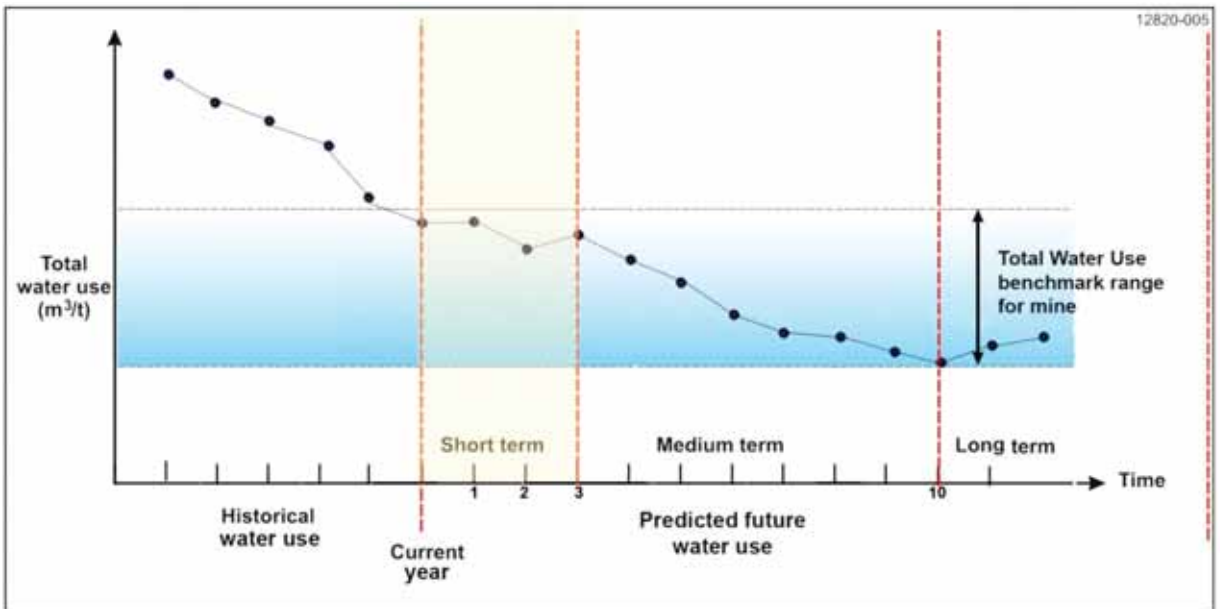
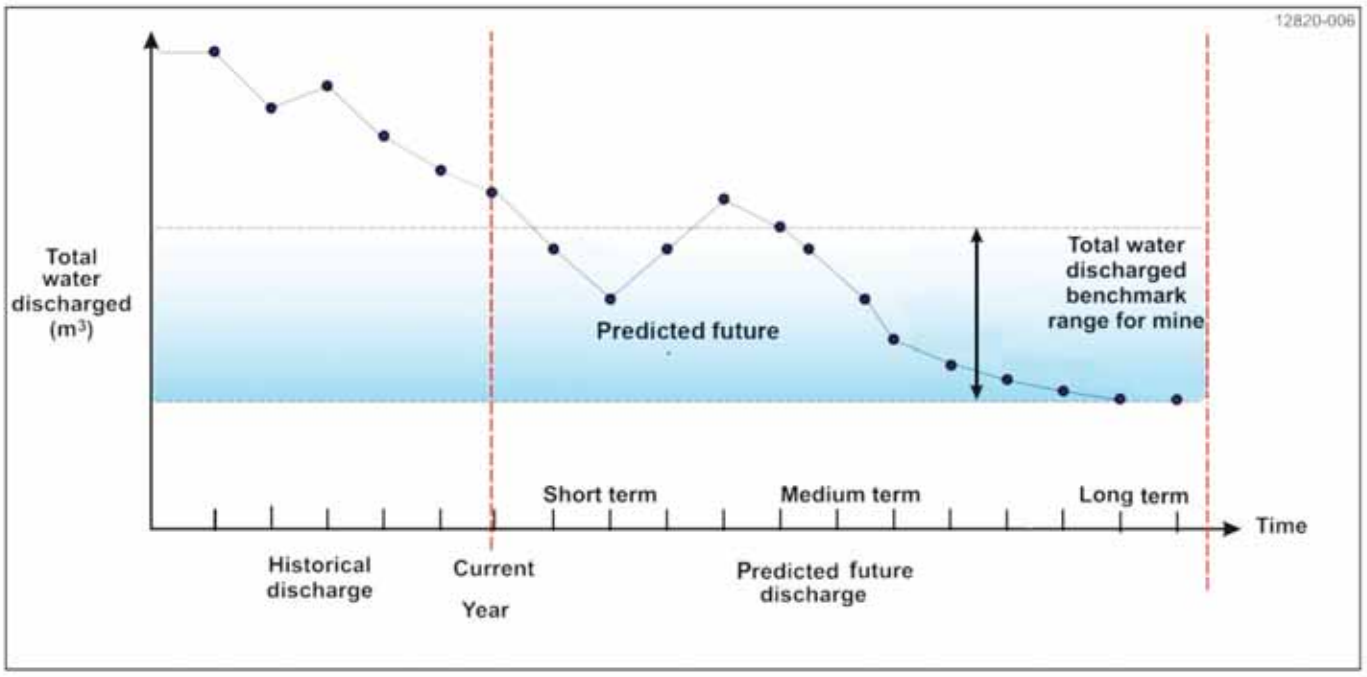


Figure 8 illustrates the graphical presentation of the total water discharged for a mining operation as listed in the table of water use targets.

Figure 8: Proposed graph for WC/WDM reporting on total water discharged by a mine



MINE WATER REUSE AND RECLAMATION PLAN

Attach mine Water Reuse and Reclamation Plan to Water Conservation Plan as Appendix C.

WC/WDM MEASURES

Summary statement on the implementation and impact of WC/WDM measures at the mine, supported by results of monitoring system indicating percentage improvement in primary water use improvements).

Describe the WC/WDM measures that are being planned at the mine for the short, medium and long term (Attach supporting information, if required).

Time period	Detailed WC/WDM measures
Short term (1 – 3 years)	
Medium Term (3 – 10 years)	
Long Term (>10 years)	

CONCLUSIONS

Provide a statement on the overall performance of the mine in relation to water conservation and demand management.

SIGNATURE OF MINE MANAGER **DATE**

WC/WDM GUIDELINE

THE BOOKLET WAS COMPLED BY THE DIRECTORATE: WATER USE EFFICIENCY

LAYOUT & DESIGN BY THE DEPARTMENT OF WATER AFFAIRS
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