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Witwatersrand Consolidated Gold Resources Ltd (Wits Gold): Southern Free State (SOFS) Mining Operation

Environmental Impact Assessment and Environmental Management Programme (EIA/EMP)

Final Report for Submission (DMR)

In terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)

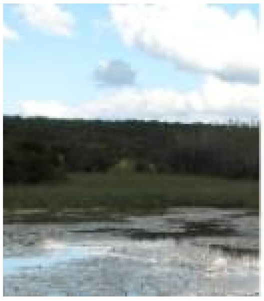
Version - 1

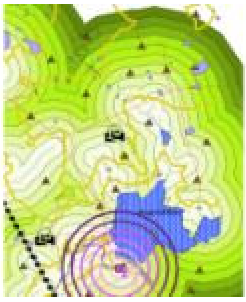
August 2012

Witwatersrand Consolidated Gold Resources (Wits Gold)

GCS Project Number: 11-449

DMR Reference No: FS 30/5/1/2/2/10005 MR

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DOCUMENT ISSUE STATUS

Report Issue	DRAFT for Review		
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	Name	**Signature**	**Date**
Author	Tarryn Hendry		July 2012
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DISCLAIMER

Information contained in this report is based on data/information supplied to GCS Water and Environment (Pty) Ltd (GCS) by the client and other external sources (including previous site investigation data and external specialist studies). It has been assumed that the information provided to GCS is correct and as such the accuracy of the conclusions made are reliant on the accuracy and completeness of the data supplied. No responsibility is accepted by GCS for incomplete or inaccurate data supplied by the client and/or other external sources. Opinions expressed in this report apply to the site conditions and features that existed at the time of the start of the relevant investigations and the production of this report.

EXECUTIVE SUMMARY

Background

Witwatersrand Consolidated Gold Resources (herein after referred to as “Wits Gold”, “the Applicant” or “the Company”) is a dual listed company with listings on the Toronto Stock Exchange and the Johannesburg Stock Exchange Limited. The Department of Mineral Resources (DMR) has granted New Order Prospecting Rights to Wits Gold, covering a total of 119,586 hectares (ha) in three goldfields, namely the Southern Free State (SOFS), Potchefstroom and Klerksdorp goldfields. This application pertains to Phase 1 of the SOFS Mining Operation, namely the DBM Project, which covers an area of 4,024 ha over two of the New Order Prospecting Rights.

The proposed project is located within the following District and Local Municipalities:

- Lejweleputswa District Municipalities;
- Matjhabeng Local Municipality; and
- Masilonyana Local Municipality.

Project Description

Phase 1 of the SOFS Mining Operation, namely the DBM Project, is situated in the Free State Province of central South Africa and is south of the town of Virginia (28°70”S, 26°54”E); whilst the closest major towns to Virginia are Welkom (24 km North-West) and Bloemfontein (136 km South-West), Virginia is approximately 270 km by national road from Johannesburg. It is important to note that the DBM Project extends over numerous farms and/or Prospecting Rights and a portion of the area used to form part of the Harmony Merriespruit Mine lease area that was unmined. This area will be included in the Mining Right Application area once transfer the properties to Wits Gold is notarially executed. Application for ministerial consent in terms of Section 102 of the MPRDA has been granted and the regional office of the DMR is processing the necessary documentation in order to give effect to the transfer of the rights to Wits Gold. Underground mining methods will be implemented at depths starting from 480 metres below surface. Mining is currently planned to be undertaken using narrow reef breast mining approach common to the gold mines of South Africa. Support for the mining will be from a trackless footwall infrastructure below the Leader Reef (bottom reef horizon). This is less common but not unique in underground South African gold mines.

The primary access route to the DBM Project is the N1 national road or freeway; with tarred, main roads (R73, R70 and R34) branching off this freeway. The Wits Gold properties are intersected approximately 86 km from the N1/R34 turnoff (or 21 km via a direct gravel road from the same junction).

The project zone of influence will extend to the township of Meloding, which is approximately 1.8 km from the proposed shaft area. The TSF location is proposed to be situated on an existing Brownfield Tailings Storage Facility (TSF) in the area. The final option will depend on agreements between all affected parties and relevant government approvals. This aspect will be assessed and discussed in more detail during the EIA phase of the project. Access to the mine will probably be via a portal decline and vertical shaft combination, or a twin vertical shaft system. The Engineering Scoping Study envisaged that the decline would be used to transport all rock to surface while men and materials would be transported via the vertical shaft. This mine design was refined and modified in the pre-feasibility study, where a twin vertical shaft system is proposed.

Proposed infrastructure that will form part of Phase 1 of the SOFS Mining Operation, namely the DBM Project will include:

WATER	**BULK POWER SUPPLIES**
Bulk water supplies;	Bulk power supplies;
Surface supply reticulation;	Main Eskom yard;
Underground supply reticulation;	Surface reticulation;
Dirty water pumping and settling; and	Underground reticulation; and
Sewage treatment.	Emergency generators.
SURFACE INFRASTRUCTURE	**UNDERGROUND INFRASTRUCTURE**
Buildings and offices;	Workshops;
Workshops;	First aid facility;
Clinic;	Fire detection;
Stores and marshalling yard;	Rescue chambers;
Core yard;	Stores; and
Sewage treatment and waste disposal;	Pump chambers.
Roads and storm water handling;	
Tailing storage facilities & waste rock dump;	
Rock handling & conveyors;	
Change house;	
Main fans;	
Shaft headgears;	
Winders;	
Ice plant & cooling towers; and	
Metallurgical plant.	

Farm Portions

The proposed SOFS Phase 1 (DBM project) mining operation surface infrastructure is currently envisaged to be located on the following farm portions:

LAND OWNER	FARM	MAGISTERIAL DISTRICT	PORTION	TITLE DEED	SG CODE
Andries Benjamin Pienaar	Florida 633	Ventersburg	1	T11996/1979	F03500000000063300001
Andries Benjamin Pienaar	Florida 633	Ventersburg	4	T28107/1998	F03500000000063300004
Johan van Huysteen	Welgeleggen	Theunissen	RE2	T1072/1986	F03300000000038200002
Piet Nieman	Welgeleggen	Theunissen	24	T5581/1997	F03300000000038200024

Environmental Authorisations

MPRDA Process

The environmental authorisation process required in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) will address the project as a whole including all activities related to the proposed SOFS Mining Operation. The Environmental Impact Assessment and Management Programme (EIA/EMP) developed in terms of the MPRDA will address all the environmental impacts and proposed management measures associated with the planned mining operation, as well as provide background on the current environmental conditions on site. This EIA/EMP will comply with the requirements of the MPRDA and the DMR for an EIA/EMP developed as a prerequisite of a Mining Right Application.

NEMA Process

The environmental authorisation process required in terms of Section 24 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) requires that all listed activities (e.g. construction, infrastructure development, transportation routes, etc.) identified in all phases of the project, which may impact on the environment must obtain an environmental authorisation from a relevant authority before commencement with such activities can be initiated. The specific listed activities are detailed under the NEMA Regulations 544 and 545, dated 2 August 2010, which repeal Regulation 386 and 387 (dated 21 April 2006) of NEMA. In terms of the SOFS Phase 1 (DBM Project) Mining Operation, the National Department of Environmental Affairs (DEA) is regarded to be the competent authority for environmental authorisations required in terms of the NEMA, and as such all applications in terms of NEMA will be completed and sent to DEA for assessment and authorisation. The EIA/EMP developed in respect of the NEMA will comply with the requirements of the NEMA and the DEA. This process can only be initiated once the Prefeasibility Study (PFS) report (received Monday, 30 July 2012) has been reviewed by GCS to confirm the listed activities that will require authorisation for the SOFS Phase 1 (DBM Project) Mining Operation.

NWA Process

According to the National Water Act, 1998 (Act No. 36 of 1998) (NWA), water may not be used without prior authorisation from the leading authority, in this case the Department of Water Affairs (DWA). Due to the requirements of the NWA, an Integrated Water Use License Application (IWULA) will be compiled for the SOFS Phase 1 (DBM Project) and submitted to the DWA to ensure the legality of the identified water uses associated with the proposed operation.

The water uses, in terms of Section 21 of the NWA, that may be applied for by the applicant include the following:

- Section 21(a) - Taking water from a water resource;
- Section 21(b) - Storing water;
- Section 21(c) - Impeding or diverting the flow of water in a watercourse;
- Section 21(d) - Engaging in a stream flow reduction activity contemplated in Section 36;
- Section 21(e) - Engaging in a controlled activity identified as such in Section 37(1) or declared under section 38(1);
- Section 21(f) - Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
- Section 21(g) - Disposing of waste in a manner which may detrimentally impact on a water resource;
- Section 21(h) - Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;
- Section 21(i) - Altering the bed, banks, course or characteristics of a watercourse;
- Section 21(j) - Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and
- Section 21(k) - Using water for recreational purposes.

In addition to the IWULA an Integrated Water and Waste Management Plan (IWWMP) will also be developed and submitted to the DWA for assessment and authorisation. The IWULA and IWWMP developed in respect of the NWA will comply with the requirements of the NWA and the DWA. This process can only be initiated once the PFS report is complete as the PFS is required to confirm the water uses that will require authorisation for the SOFS Mining Operation.

Other Applicable Legislation

The environmental component of the project will also comply with the requirements of, *inter alia*, the following legislation and the Regulations promulgated there under:

- The Constitution of South Africa, 1996 (Act No. 108 of 1996);
- The Environment Conservation Act, 1989 (Act No. 73 of 1989) (ECA);
- The Atmospheric Pollution Prevention Act, 1965 (Act No. 45 of 1965) (APPA);
- The National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEM:AQA);
- The National Environmental Management: Waste Act, 2008(Act No. 59 of 2008) (NEM:WA);
- The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA);
- The National Nuclear Regulator Act, 1999 (Act No. 47 of 1999) (NNR); and
- The National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA).

The objectives of the environmental processes undertaken is to identify the positive/negative impacts associated with the proposed operation as well as to propose potential mitigation/management measures that may lessen the identified impacts. In order to mitigate potentially negative impacts and to identify any potential fatal flaws that may render the project environmentally unacceptable, GCS have adopted an integrated, step-by-step process to identify issues of concern and to thoroughly investigate these issues. The environmental impact assessment undertaken will address all phases related to the proposed mining operation, which include the following phases:

- Pre-construction Phase;
- Construction Phase;
- Operation Phase; and
- Closure and Decommissioning Phase.

To ensure that the negative impacts are identified and mitigated in the early stages of the project, and that the positive impacts are maximised, it will be necessary for the environmental study to meet the following aims:

- Follow the guideline process as outlined by the NEMA and the MPRDA;
- Provide input in the feasibility phases, where possible, to ensure that the most technically feasible, and environmentally sound options are selected;
- Ensure that impacts are identified early through investigations to minimise environmental damage and maximise benefits;
- Appoint sound and competent specialist to investigate the required environmental components;

- Conduct thorough specialist investigations that will allow the project team to develop an adequate understanding of the issues to be dealt with;
- Compile an EIA that will identify, evaluate and address the potential impacts;
- Provide ongoing environmental input into the project planning and development;
- Compile an EMP that will limit the significance of the negative impacts and maximise the positive aspects;
- Provide the regulatory authority with sufficient and confident information in order to make an informed decision;
- Provide a detailed project statement in terms of the recommendation by the Environmental Assessment Practitioner;
- Ensure that all relevant Interested and Affected Parties (I&APs) and/or Stakeholders are consulted and involved throughout the project; and
- Ensure that an open and transparent communication structure is in place during the life of the SOFS Mining Operation.

Public Participation

The Public Participation Process (PPP) is a requirement of the EIA/EMP process under the MPRDA and the NEMA, and ensures that all relevant I&APs are consulted and involved. The process ensures that all stakeholders have an opportunity to raise their comments as part of an open and transparent process, which in turn ensures for a complete comprehensive environmental study.

The main issues raised during the consultation process thus far include the following impacts:

ISSUE / CONCERN	SECTION REFERENCE
Public Participation Process	➢ Refer to Section 4, 5 and 6 of the Environmental Impact Assessment and Environmental Management Plan. ➢ Refer to Appendix F-1 for the I&AP Database
Security • Squatters and their cattle are also a major concern. • Theft and crime of crops and livestock; • Trespassing on property and the safety concerns.	➢ Refer to Section 4.14 and Section 6 of the EIA/EMP ➢ Refer to Appendix D-10
Health	➢ Refer to Section 4, 6, 7 and Section 11 of the EIA/EMP. ➢ Refer to Appendix D-10 ➢ Refer to Appendix C
Cultural	➢ Refer to Section 4.12 and 6. ➢ Refer to Appendix D-8

ISSUE / CONCERN	SECTION REFERENCE
	➢ Refer to Appendix I
Socio-Economic • Measures for local procurement; • Valuation of the farm and affect income and profits; • Job Creation and Opportunities ; • Labour Plan, Mining Charter and Enterprise Development; • Transport, catering, building construction, railway, pipes and painting; • Equity shareholding, social responsibility'; • The value of neighbouring farms will drastically reduce as a result of mining activities; • Connectivity between farms are broken; • Due to the mine, no livestock farming will be able to take place.	➢ Refer to Section 4.14 and 6. ➢ Refer to Appendix D-10 ➢ Refer to Section Appendix C ➢ Refer to Appendix F-1 for the CV's received.
Environmental • Noise, visual and dust	➢ Refer to Section 4, 6, 7 and Section 11 of the EIA/EMP. ➢ Refer to Appendix D-10 ➢ Refer to Appendix C

EIA/EMP Report

Pre-Construction Phase

During the pre-construction phase, the following activities need to be undertaken:

- Environmental authorisations;
- Applicable permitting;
- Additional specialist baseline assessments; and
- Baseline monitoring (key environmental variables).

Construction Phase

During the construction phase, the following activities could impact on the bio-physical environment and the cultural/social setting:

- Stripping of vegetation;
- Stripping of topsoil and subsoil as construction activities start on site;
- Impact on water system and associated wetlands due to the construction activities;
- Construction of the clean and dirty water systems;
- Possible compaction of soils by the establishment of topsoil stockpiles and berms;
- Dust dispersion from infrastructure construction and shaft construction activities; and
- Baseline monitoring (key environmental variables).

Operational Phase

During the operational phase, the following activities could impact on the bio-physical environment and the cultural/social setting:

- Underground mining activities;
- Possible compaction of soils and erosion of soil stockpiles and berms by wind and water;
- Impact on surface- and groundwater system due to the operational activities;
- Dust dispersion from workings;
- Clean and dirty water control and maintenance;
- Sewage management;
- Ancillary activities (workshops, offices, etc); and
- Baseline monitoring (key environmental variables).

Decommissioning and Closure Phase

When the decision is taken to decommission the mine, the following objectives and proposed actions for the decommissioning and closure phase of the mine could be considered:

- Recovery of all saleable infrastructure;
- Demolition of structures;
- Ripping of all compacted areas, which will be followed with amelioration and vegetation;
- Ensure that all remaining dumps, stockpiles and slopes are sufficiently shaped to blend in with the surrounding environment and remaining infrastructure;
- Amelioration and vegetation of all disturbed areas;
- Maintenance of all re-vegetated areas up until such areas initiate succession and create a sustainable cover;
- Monitoring of key environmental variables (i.e. soils, vegetation, groundwater and surface water) in order to demonstrate stability of rehabilitated areas;
- Weed management after closure, limited to areas disturbed by mining, mining infrastructure or included in the mining right area; and
- Monitoring will be undertaken for a specific period after closure or up until such time that all areas create a sustainable cover and ecosystem.

Identified Impacts and Recommended Mitigation Measures

GCS evaluated the SOFS Phase 1 (DBM Project) Mining Operation in terms of the identified activities related to the following phases:

- Pre-Construction Phase;

- Construction Phase
- Operational Phase; and
- Closure and Decommissioning Phase.

The following impacts were anticipated as per the studies completed:

Geology

The alteration of localized geology will be permanent and unavoidable due to the extraction process.

Topography

The surrounding natural relief will be altered through the placement of mining infrastructure. Mining operations in the area have, and will continue to, alter the natural topography. This alteration will be of permanent nature.

Soil, Land Use and Land Capability

The soil, land use and land capability within the mining area will be compromised through the presence of tailings dams, rock dumps, associated mine infrastructure, and ancillary infrastructure. Environmental legislation advocates the return of mining land to some form of sustainable land use as per the closure and decommissioning plan for the operation. The land use and land capability pre-mining is arable and grazing, and these should be considered post-closure.

Fauna and Flora

Mining footprint and infrastructure development invariably results in clearing of vegetation on site, both naturally occurring and established vegetation, as well as potential changes in drainage patterns, and destruction of habitat for wildlife. The clearing of vegetation could in itself destabilise soils, change local water balances, and encourage the spread of alien/invasive vegetation. Infrastructural and solid waste development could result in water pollution that may affect a range of organisms and ecosystems. Major negative impacts would be associated with species of conservation importance as well as impacts on migratory habits of fauna within the project area.

Wetlands

The majority of the wetland types within the project area have been disturbed by cultivation and alien invasive species. Potential impacts are the loss of wetland habitat, increased sediment movement into adjacent wetlands, altered run-off characteristics leading to hydrology changes of wetlands on site, and water quality deterioration. The wetlands in the project area can provide islands for significant flora and fauna species.

Hydrology (Surface Water)

The potential for surface water contamination exists if the operation does not employ adequate and appropriate storm water control measures and if clean and dirty water separation is not implemented on site. Impacts would not be limited to the site area and would thus require monitoring and management throughout the life of the mine.

Geohydrology (Groundwater)

The potential exists that significant ground water impacts, both direct and cumulative, could materialise due the nature and scale of the operation. Impacts associated with groundwater quality changes and impacts to the water table due to dewatering activities could be significant if not adequately managed. Further impacts associated with the potential for acid mine drainage are also possible. Impacts would not be limited to the site area and would thus require monitoring and management throughout the life of the mine.

Air Quality

The impact of the proposed operation on the air quality would be related directly to dust generation and dispersion. Impacts would not be limited to the site area and would thus require monitoring and management throughout the life of the mine.

Heritage

No significant impacts are applicable at this stage. Further clarity is required in respect of the infrastructure location and ancillary infrastructure identification to determine the exact nature of the impact on the two identified sites of potential importance. All graves are considered of high significance.

Social Impacts

The construction, development and operation of a new mining operation with the creation of new jobs will lead to high levels of expectation and possibly result in an influx of job-seekers. Potential negative impacts are associated with the influx of job-seekers to the area, informal housing development, potential safety and security issues for existing land owners, crop and infrastructure theft, and potential impacts on property values for directly and indirectly affected land owners. Potential positive impacts associated with the project include job creation and economic development (local and regional).

In addition the cumulative impacts were assessed and evaluated. Based on the findings of the impact assessment, a number of management measures and action plans were proposed and the identified impacts re-assessed to determine whether mitigation would change the overall significance of the identified impact.

In order for the anticipated impacts to be managed effectively, Wits Gold must adhere to the proposed management and action plans proposed in order to ensure that the anticipated impacts associated with the SOFS Phase 1 (DBM Project) Mining Operation are, indeed, minimised.

Information Gaps, Assumptions and Limitations

Information contained in this EIA/EMP Report is based on technical information received from the client, as well as the outcomes of the Specialist Studies undertaken. The Specialist Studies undertaken were conducted on the basis of the information available at the time. The Specialist Studies undertaken only took into account the area identified for infrastructure placement.

The option to switch from a Greenfields TSF option to that of a Brownfields TSF option occurred after the majority of the studies had been completed. A change in the assessment criteria would have resulted in additional cost time being required for the Specialists to address these changes. Due to the nature of this project and the fact that the identified impacts associated with the Greenfields TSF would be less significant than that of the Brownfields TSF, it was determined by the client in agreement with the Environmental Assessment Practitioner (EAP) that sufficient information regarding the Brownfields TSF site is available. The monitoring programme as presented in the EMP has to be implemented to determine whether this assumption proves to be correct, if not, detailed studies will have to be initiated.

The following gaps in information were identified:

Geohydrological (Groundwater) Assessment

Groundwater levels in the Archaen Witwatersrand Supergroup aquifer are currently unknown. Monitoring boreholes (deep core boreholes) should be drilled and equipped with pressure gauges. Infill drilling/exploration boreholes may be used for this purpose. Regular pressure readings must be taken to monitor changes in the groundwater table. Where possible, these boreholes should be placed throughout the mine to assess the regional groundwater table. It is initially advised that 4 boreholes be drilled to mining depth. Deep boreholes must be drilled in strategic areas such as the shaft or decline area, into the De Bron Fault and proposed underground workings. Flow logging should also be performed on the newly drilled boreholes. The purpose of performing flow logging is to determine aquifer parameters (T-values), identify preferential flow paths and depth of major water strikes that are intersected. Testing of boreholes sections must take place as drilling proceeds, prior to casing installation and/or grouting. Once all the data has been collected, the site conceptual model should be verified and updated using the new information. The numerical groundwater model should then also be update with the newly collected data.

Visual Impact Assessment

No visual impact assessment and modeling has been undertaken to date as infrastructure placement has not yet been finalized. As such the visual impact assessment can only be undertaken once the exact location of the project related infrastructure has been confirmed.

To evaluate the impacts of the proposed activity, the inherent scenic value of the landscape first needs to be determined. Data collected during a site visit would allow for a comprehensive description and valuation of the receiving environment. The following method should be used for the project:

- Site visit - one field survey should be undertaken and the study area scrutinized to the extent that the receiving/impacted environment can be documented and adequately described;
- Project components - the physical characteristics of the project components must be described and illustrated;
- Determine the setting, visual character and land use of the area surrounding the proposed tailings facility, and the sense of place;
- Define the extent of the affected visual environmental, the viewing distance and the critical views/visual receptors that may be affected by the proposed project;
- Determine the Visual Absorption Potential (ability of the landscape to accommodate the proposed project from a visual perspective);
- The significance of the visual impacts and landscape impacts must be assessed;
- Rate the impact on the visual environment of the proposed development; and
- Suggest measures that could mitigate the negative impacts of the proposed SOFS (DBM) Mining Operation.

The environment in the vicinity already has several mining infrastructure in place where visual and landscape impacts are not known to be significant.

Noise Impact Assessment

No noise impact assessment has been undertaken to date as infrastructure placement has not yet been finalized. As such the noise impact assessment can only be undertaken once the exact location of the project related infrastructure has been confirmed.

A noise survey should be carried out in order to:

- Determine the prevailing ambient noise levels in and around the SOFS project area;
- Project the noise impact of the proposed mining method and activities on the environment and identified noise sensitive areas; and
- Recommend engineering control measures to minimise the projected noise impact into the environment and the abutting residential areas.

Blasting and Vibration Assessment

No blast and vibration assessment has been undertaken to date due to the stage of development of the project.

Specific aspects that need to be addressed prior to any construction activities being initiated on site include the following:

- Potential for property damage as a result of blast and vibration events;
- Pre-blasting and post-blasting crack surveys need to be undertaken; and
- Additional issues that need to be assessed include the potential impact of blasting and vibration impacts on the existing adjacent underground operations and associated infrastructure.

Socio-Economic Assessment

An assessment of property values of surrounding properties/small holdings must be undertaken prior to any construction activities being initiated. This is essential in addressing the concerns raised by selected I&APs in the public meetings.

<u>Benefits of the Project</u>

Local Market

Rand Refinery (South Africa) is one of the largest gold refineries globally and is currently refining 100% of newly mined gold and silver in South Africa, and 75% of all the gold mined in Africa. The core product from the SOFS Mining Operation will therefore most likely be sold to the Rand Refinery.

Regional and International Markets

All gold produced locally will be sold to the Rand Refinery. No gold will be sold to other regional or international markets.

Local Municipalities

Following initial consultation with the Matjhabeng and Masilonyana Local Municipalities, regarding needs and priorities, as identified by their Integrated Development Plans (IDPs), the following projects were put forward as requiring further investigation:

- Virginia Farm; and
- Tikwe Lodge to be turned into Eco Tourism, Events Hosting and Agricultural Training.

Wits Gold is also investigating the possibility of taking over projects that are currently being phased out by Harmony Gold.

The DMR has offered to co-ordinate the prioritisation of Local Economic Development (LED) projects with Wits Gold, the relevant municipalities and existing mines in the area. The DMR further requested that additional projects be identified based on new IDP documents that are being finalised by the abovementioned Local Municipalities. Meetings have been initiated with the Matjhabeng Municipality for discussions based on their recently released draft IDP document for the 2012-2016 period. Once the DMR has, in principle, approved of the selected (LED) projects, further consultation with the Local Municipalities and relevant stakeholders will take place to finalise the project implementation requirements as well as the way forward once the Mining Right has been granted.

Small, Micro and Medium Enterprises (SMME) development

Wits Gold will contribute towards mine community economic development by using available Black Economic Empowerment (BEE) compliant companies for the provision of goods and services to the mine. Wits Gold is committed to awarding procurement contracts to companies which demonstrate suitable Historically Disadvantaged South Africans (HDSAs) participation in Management (and general employment) as well as local companies in order to sustain the local economy of the area.

Wits Gold intends to support Small, Micro and Medium Enterprises (SMMEs) where possible, which will be able to provide them with the relevant services. These SMMEs will be appointed on a contractual basis, on the condition that their services are relevant and the quality thereof, acceptable.

Housing and living conditions

In order to reduce single sex accommodation and to prevent the establishment of hostel accommodation, Wits Gold proposes to use local labour to construct houses on available land for purchase by the mine's employees. Housing allowances will be provided to staff and local housing within the towns of Virginia, Theunissen, Meloding and Welkom will be used as far as possible.

The Applicant will promote home ownership; therefore employees will be afforded the opportunity to participate in wealth accumulation through the ownership of property. It is believed that this will in the long term ensure that housing is sustainable even after mine closure. The Company will facilitate housing development in the host municipality area to ensure adequate and acceptable housing and living conditions of the employees. It is believed that this will build a sustainable economy and quality of life of the host community through integration of employees housing needs into the host municipality's housing and settlement plans.

The Company aims to improve the quality of life of all employees and restore the self-respect and dignity of employees in line with the Mining Charter and the aspirations of employees through:

- Conducting individual assessments with employees to determine their current and aspired housing conditions;
- Encouraging employees to take home ownership in existing sustainable areas;
- Establishing an open communication process whereby employees may communicate any problems and suggestions with regards to their housing needs;
- Facilitating the development of housing options that will accommodate employees housing needs;
- Providing programmes to educate employees with regard to home ownership and budgeting; and
- Facilitating private investment from developers and/or banks for assisting home owners.

Provision will be made for a R10,000,000.00 investment over 5 years to improve on the housing conditions of mine workers.

Nutrition

In order to ensure that employees are aware of the advantages of a balanced diet, nutrition awareness will be promoted through a Wellness Programme.

The Company will adopt a comprehensive approach to address nutrition and this will be addressed in the employee Wellness Programme, which will be developed as part of the implementation plan of the Social and Labour Plan (SLP). It is envisaged that the employee Wellness Programme will enhance the standard of living of all employees.

The employee Wellness Programme will focus on:

- Nutrition, where staff will be advised on healthier eating habits which will include:
    - Measures to improve nutrition, which will be done in accordance with the standards set out by the Chamber of Mines of South African Health Standards Authorities;
    - Inducting and informing all employees on the National food based dietary guidelines. The intention will be that employees themselves acknowledge that each one has a role to be conscious of healthy eating habits;
- Educating employees and their families with regard to nutrition and wellness programmes with emphasis on HIV/AIDS and Tuberculosis, and provide information on common injuries that cause back pains;
- Wellness workshops which will include nutrition, exercise, stress management etc;
- Wellness incentive programme: Reward employees for making positive choices; and
- Providing health supplements to employees.

The Company will retain the services of a specialist healthcare services provider in order to compile a comprehensive wellness strategy which will integrate with community health issues. The strategy will include a health improvement programme that will address nutritional wellness, body wellness, emotional wellness and social issues.

<u>No-Go Principle</u>

If the no-go principle were applied, then the area in which the proposed SOFS Phase 1 (DBM Project) Mining Operation is located would continue with the land use and activities that are currently in place, namely commercial agriculture activities. The potential job creation benefit of the project (±1,635 jobs over the life of mine) would not materialise and the opportunity to employ women in mining, as per the requirements of the MPRDA, would also not occur. In addition the potential loss of contribution to economic development in the project area as well as compliance with the regions IDP, based on the SLP developed for the project, would be limited.

The no-go option would ensure that there would be significantly less environmental impacts in the area as a result of mining operations. Impacts would only be related to the existing mining operations within the Virginia area, specifically the Harmony gold mining operation located to the north west of the proposed project area. In addition to this, the existing Harmony Merriespruit TSF would remain as is, with minimal rehabilitation potential.

The continuation of commercial agriculture activities, as are currently taking place, would ensure that the current status quo in terms of revenue, economic contributions, employment and housing would continue. The potential expansion of these commercial agriculture enterprises would be limited to the areas currently being used specifically since the establishment of informal housing within the area is already evident.

If mining was not undertaken in the project area, the area could be utilised for housing developments and, potentially, other small, medium and large scale commercial opportunities. Alternatively, small-scale agricultural developments could take place (i.e. crop and livestock farming).

Motivation for Project

The SOFS Phase 1 (DBM Project) Mining Operation will ensure:

- Provision of sustainable employment (retention);
- Ongoing economic input into the area;
- Provision of a regional socio-economic benefit;
- Economic injection into the region in terms of small business enterprises (e.g. community services); and
- Ongoing supply of gold to the local and international markets.

The EAPs and environmental consultants responsible for the PPP and compilation of this document are of the opinion that the SOFS Phase 1 (DBM Project) Mining Operation should be approved, on condition that the applicant implements all identified management measures, implements the monitoring and rehabilitation plan, as well as addresses all identified information gaps. In addition the applicant must implement the social and labour plan as approved by the DMR.

In addition, the Company must continue with public consultation in order to ensure that the communities surrounding the operation are informed of developments on site throughout the life of mine. A detailed communication strategy must be developed and implemented together with the development of a complaints register to be kept on site for the life of mine.

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LIST OF ABBREVIATIONS/ACRONYMS

ABA	Acid Base Accounting
Al	Aluminium
AM	After Midnight
APPA	The Atmospheric Pollution Prevention Act, 1965 (Act No. 45 of 1965)
As	Arsenic
BBSEC	Broad Based Socio-Economic Empowerment Charter
BEE	Black Economic Empowerment
BFS	Bankable Feasibility Study
BID	Background Information Document
$CaCO_3$	Total Hardness / Calcite
Cl	Chloride
Cr	Chromium
CR	Critically Endangered
Cu	Copper
dBA	A-weighted decibels
DBM	De Bron Merriespruit
DD	Data Deficient
DEA	Department of Environmental Affairs
DEM	Digital Elevation Model
DMR	Department of Mineral Resources
DMS	Dense Medium Separation
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
EC	Electrical Conductivity
ECA	The Environment Conservation Act, 1989 (Act No. 73 of 1989)
EIA	Environmental Impact Assessment
EMP	Environmental Management Programme
EN	Endangered
F	Fluoride
Fe	Iron
GCS	GCS Water and Environment (Pty) Ltd
GDP	Gross Domestic Product
ha	Hectare
HDSA	Historically Disadvantaged South Africans
HIA	Heritage Impact Assessment
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
IDP	Integrated Development Plan/Programme
IFC	International Finance Corporation
I&APs	Interested and Affected Parties
IUCN	International Union for Conservation of Nature

IWULA	Integrated Water Use License Application
IWWMP	Integrated Waste and Water Management Plan
km	kilometre
LED	Local Economic Development
LM	Local Municipality
LOM	Life of Mine
LSU	Large Stock Unit
mamsl	Meters above mean sea level
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
MRA	Mining Right Application
MPRDA	The Mineral and Petroleum Resources Development, 2002 (Act No. 28 of 2002)
NAG	Net Acid Generating
NECSA	Nuclear Energy Corporation of South Africa
NEMA	The National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEM:BA	The National Environmental Management: Biodiversity Act (Act No. 10 of 2004)
NEM:AQA	The National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)
NGA	National Groundwater Archive
NHRA	The National Heritage Resources Act, 1999 (Act No. 25 of 1999)
Ni	Nickel
NWA	The National Water Act, 1998 (Act No. 36 of 1998)
NEM:WA	The National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)
OHS Act	The Occupational, Health and Safety Act, 1993 (Act No. 85 of 1993)
Pb	Lead
PM	Past Midday
PM_{10}	Particulate Matter
PPP	Public Participation Process
ROM	Run of Mine
PCD	Pollution Control Dam
PFS	Pre-Feasibility Study
POSA	Plants of Southern Africa
SANBI	South African National Biodiversity Institute
SANS	South African National Standards
SAR	Sodium Absorption Ratio
SAWS	South African Weather Services
SLP	Social and Labour Plan
SMME	Small, Micro and Medium Enterprises
SOFS	Southern Free State
TDS	Total Dissolved Solids
TFR	Transnet Freight Rail

TIA	Traffic Impact Assessment
TSF	Tailings Storage Facility
TSP	Total Suspended Particulates
USEPA	United States Environmental Protection Agency
VU	Vulnerable
WMA	Water Management Area
XRD	X-ray Diffraction

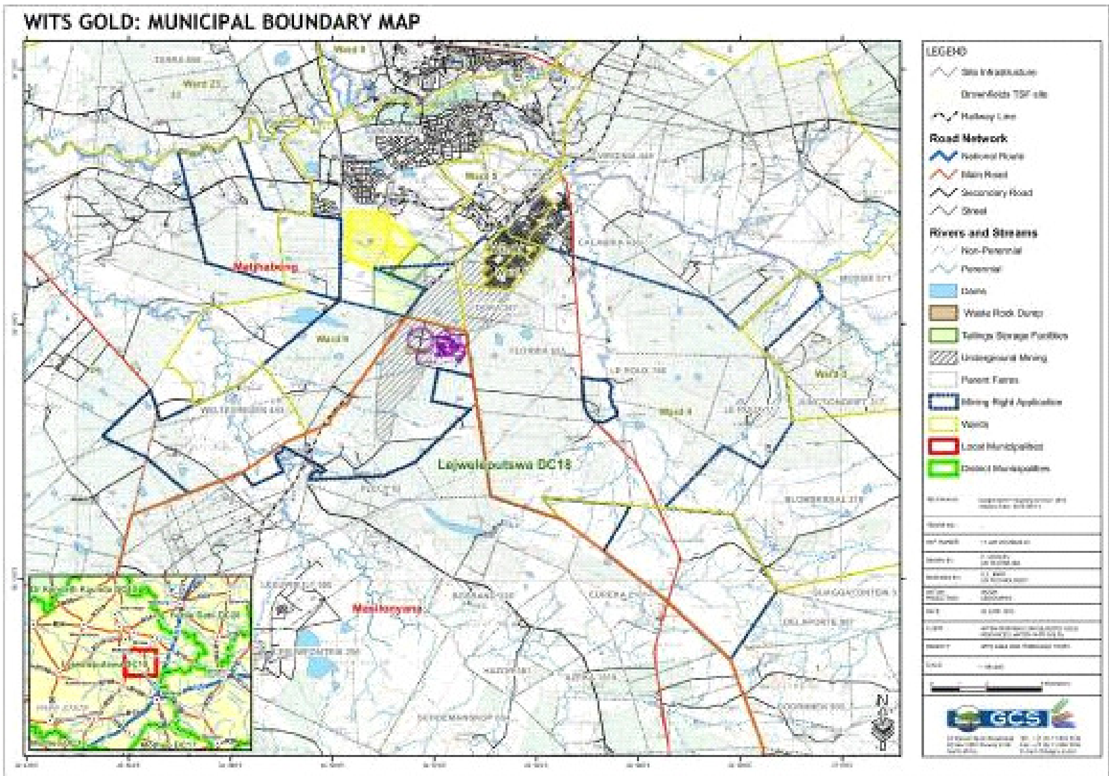
1 INTRODUCTION AND BACKGROUND

1.1 Background

Witwatersrand Consolidated Gold Resources (herein after referred to as "Wits Gold", "the Applicant" or "the Company") is a dual listed company with listings on the Toronto Stock Exchange and the Johannesburg Stock Exchange Limited. The Department of Mineral Resources (DMR) has granted New Order Prospecting Rights to Wits Gold, covering a total of 119,586 hectares (ha) in three goldfields, namely the Southern Free State (SOFS), Potchefstroom and Klerksdorp goldfields. This application pertains to Phase 1 of the SOFS Mining Operation, namely the DBM Project, which covers an area of 4,024 ha over two of the New Order Prospecting Rights.

The proposed project is located within the following District and Local Municipalities (**Figure 1.1**):

- Lejweleputswa District Municipalities;
- Matjhabeng Local Municipality; and
- Masilonyana Local Municipality.



(Figure not to scale. Please refer to Appendix A for the A3 figure.)

Figure 1.1: Municipal Map of the Proposed SOFS Mining Operation.

1.2 Brief Project Description

Phase 1 of the SOFS Mining Operation, namely the DBM Project, is situated in the Free State Province of central South Africa and is south of the town of Virginia (28°70”S, 26°54”E); whilst the closest major towns to Virginia are Welkom (24 km North-West) and Bloemfontein (136 km South-West), Virginia is approximately 270 km by national road from Johannesburg. It is important to note that the DBM Project extends over numerous farms and/or Prospecting Rights and a portion of the area used to form part of the Harmony Merriespruit Mine lease area that was unmined. This area will be included in the Mining Right Application area once transfer the properties to Wits Gold is notarially executed. Application for ministerial consent in terms of Section 102 of the MPRDA has been granted and the regional office of the DMR is processing the necessary documentation in order to give effect to the transfer of the rights to Wits Gold. Underground mining methods will be implemented at depths starting from 480 metres below surface. Mining is currently planned to be undertaken using narrow reef breast mining approach common to the gold mines of South Africa. Support for the mining will be from a trackless footwall infrastructure below the Leader Reef (bottom reef horizon). This is less common but not unique in underground South African gold mines.

The primary access route to the DBM Project is the N1 national road or freeway; with tarred, main roads (R73, R70 and R34) branching off this freeway. The Wits Gold properties are intersected approximately 86 km from the N1/R34 turnoff (or 21 km via a direct gravel road from the same junction).

The project zone of influence will extend to the township of Meloding, which is approximately 1.8 km from the proposed shaft area. The TSF location is proposed to be situated on an existing Brownfield Tailings Storage Facility (TSF) in the area. The final option will depend on agreements between all affected parties and relevant government approvals. This aspect will be assessed and discussed in more detail during the EIA phase of the project. Access to the mine will probably be via a portal decline and vertical shaft combination, or a twin vertical shaft system. The Engineering Scoping Study envisaged that the decline would be used to transport all rock to surface while men and materials would be transported via the vertical shaft. This mine design was refined and modified in the pre-feasibility study, where a twin vertical shaft system is proposed.

1.3 Description of the Land

1.3.1 Applicant Contact Details

The applicant's contact details are provided in **Table 1.1**.

Table 1.1: Applicant Contact Details

Name of the Applicant	Witwatersrand Consolidated Gold Resources Limited
Company Registration Number	2002/031365/06
Contact Person	Mr. Hethen Hira (On behalf of Witwatersrand Consolidated Gold Resources Limited)
Physical Address	70 Fox Street Johannesburg 2001
Postal Address	PO Box 61147, Marshalltown, Johannesburg, 2107
Email	hethenh@witsgold.com
Telephone	011 832 1749
Fax	011 838 3208

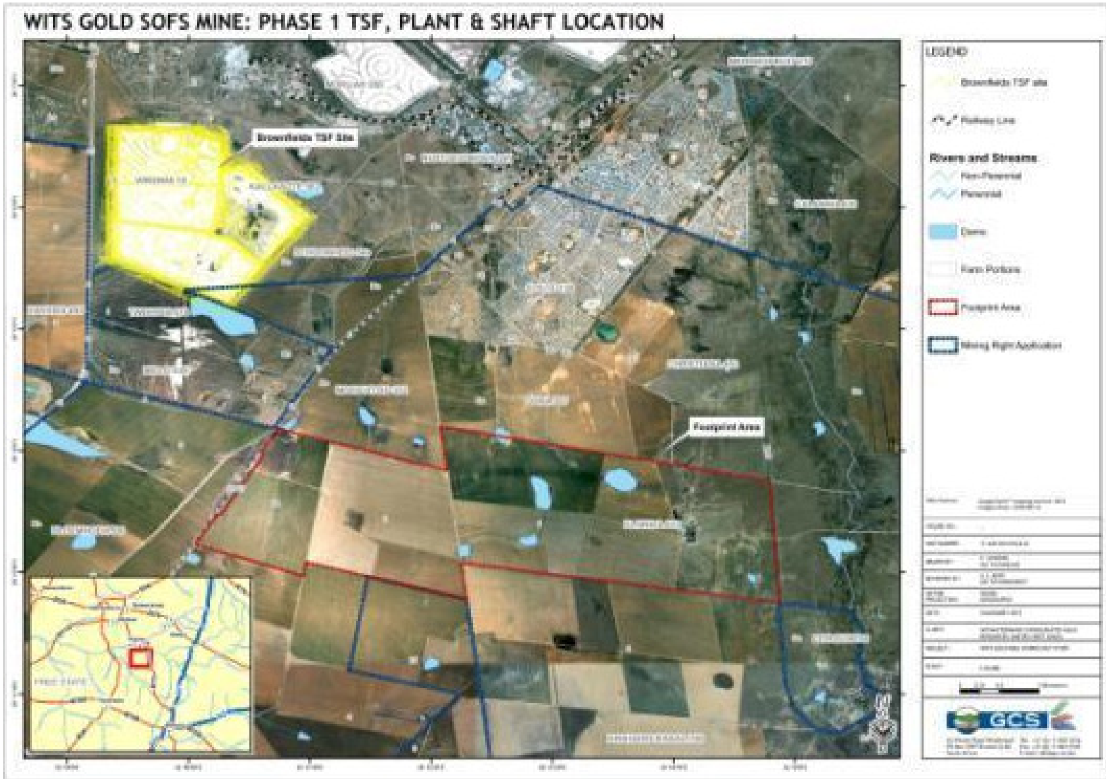
1.3.2 Description of Land and Land Ownership

The proposed SOFS (Phase 1 DBM Project) mining operation surface infrastructure is currently being planned to be located within the following farm portions (**Table 1.2**):

Table 1.2: Registered Surface Rights Owners

LAND OWNER	FARM	MAGISTERIAL DISTRICT	PORTION	TITLE DEED	SG CODE
Andries Benjamin Pienaar	Florida 633	Ventersburg	1	T11996/1979	F03500000000063300001
Andries Benjamin Pienaar	Florida 633	Ventersburg	4	T28107/1998	F03500000000063300004
Johan van Huysteen	Welgeleggen	Theunissen	RE2	T1072/1986	F03300000000038200002
Piet Nieman	Welgeleggen	Theunissen	24	T5581/1997	F03300000000038200024

Please refer to **Figure 1.1** for the location of the farm portions as it relates to the SOFS Mining Rights Boundary and refer **Figure 1.2** to for the proposed Phase 1 TSF, plant and shaft.



(Figure not to scale. Please refer to Appendix A for the A3 figure.)

Figure 1.2: Proposed Phase 1 TSF, plant and shaft

1.4 Environmental Process

The project environmental process was undertaken in accordance with the MPRDA in order to develop an EIA/EMP Report in support of the MRA submitted to the DMR, Free State Province. The various environmental authorisation processes being followed for this project are described in the sections that follow.

1.4.1 MPRDA Process

The environmental authorisation process required in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) will address the project as a whole including all activities related to the proposed SOFS Mining Operation. The Environmental Impact Assessment and Management Programme (EIA/EMP) developed in terms of the MPRDA will address all the environmental impacts and proposed management measures associated with the planned mining operation, as well as provide background on the current environmental conditions on site. This EIA/EMP will comply with the requirements of the MPRDA and the DMR for an EIA/EMP developed as a prerequisite of a Mining Right Application area, prior to the commencement of construction and mining phases of the project.

1.4.2 NEMA Process

The environmental authorisation process required in terms of Section 24 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) requires that all listed activities (e.g. construction, infrastructure development, transportation routes, etc.) identified in all phases of the project, which may impact on the environment must obtain an environmental authorisation from a relevant authority before commencement with such activities can be initiated. The specific listed activities are detailed under the NEMA Regulations 544 and 545, dated 2 August 2010, which repeal Regulation 386 and 387 (dated 21 April 2006) of NEMA. In terms of the SOFS Phase 1 (DBM Project) Mining Operation, the National Department of Environmental Affairs (DEA) is regarded to be the competent authority for environmental authorisations required in terms of the NEMA, and as such all applications in terms of NEMA will be completed and sent to the DEA for assessment and authorisation. The EIA/EMP developed in respect of the NEMA will comply with the requirements of the NEMA and the DEA. This process can only be initiated once the Prefeasibility Study (PFS) report (received Monday, 30 July 2012) has been reviewed by GCS to confirm the listed activities that will require authorisation for the SOFS Phase 1 (DBM Project) Mining Operation.

1.4.3 Integrated Water Use License Application Process

According to the National Water Act, 1998 (Act No. 36 of 1998) (NWA), water may not be used without prior authorisation from the leading authority, in this case the Department of Water Affairs (DWA). Due to the requirements of the NWA, an Integrated Water Use License Application (IWULA) will be compiled for the SOFS Phase 1 (DBM Project) and submitted to the DWA to ensure the legality of the identified water uses associated with the proposed operation.

The water uses, in terms of Section 21 of the NWA, that may be applied for by the applicant include the following:

- Section 21(a) - Taking water from a water resource;
- Section 21(b) - Storing water;
- Section 21(c) - Impeding or diverting the flow of water in a watercourse;
- Section 21(d) - Engaging in a stream flow reduction activity contemplated in Section 36;
- Section 21(e) - Engaging in a controlled activity identified as such in Section 37(1) or declared under section 38(1);

- Section 21(f) - Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
- Section 21(g) - Disposing of waste in a manner which may detrimentally impact on a water resource;
- Section 21(h) - Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;
- Section 21(i) - Altering the bed, banks, course or characteristics of a watercourse;
- Section 21(j) - Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and
- Section 21(k) - Using water for recreational purposes.

In addition to the IWULA an Integrated Water and Waste Management Plan (IWWMP) will also be developed and submitted to the DWA for assessment and authorisation. The IWULA and IWWMP developed in respect of the NWA will comply with the requirements of the NWA and the DWA. This process can only be initiated once the PFS report is complete as the PFS is required to confirm the water uses that will require authorisation for the SOFS Mining Operation.

1.4.4 Other Applicable Legislation

The environmental component of the project will also comply with the requirements of, *inter alia*, the following legislation and the Regulations promulgated there under:

- The Constitution of South Africa, 1996 (Act No. 108 of 1996);
- The Environment Conservation Act, 1989 (Act No. 73 of 1989) (ECA);
- The Atmospheric Pollution Prevention Act, 1965 (Act No. 45 of 1965) (APPA);
- The National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEM:AQA);
- The National Environmental Management: Waste Act, 2008(Act No. 59 of 2008) (NEM:WA);
- The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA);
- The National Nuclear Regulator Act, 1999 (Act No. 47 of 1999) (NNR); and
- The National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA).

The objectives of the environmental processes undertaken is to identify the positive/negative impacts associated with the proposed operation as well as to propose potential mitigation/management measures that may lessen the identified impacts. In order to mitigate potentially negative impacts and to identify any potential fatal flaws that may render the project environmentally unacceptable, GCS have adopted an integrated, step-by-step process to identify issues of concern and to thoroughly investigate these issues. The environmental impact assessment undertaken will address all phases related to the proposed mining operation, which include the following phases:

- Pre-construction Phase;
- Construction Phase;
- Operation Phase; and
- Closure and Decommissioning Phase.

To ensure that the negative impacts are identified and mitigated in the early stages of the project, and that the positive impacts are maximised, it will be necessary for the environmental study to meet the following aims:

- Follow the guideline process as outlined by the NEMA and the MPRDA;
- Provide input in the feasibility phases, where possible, to ensure that the most technically feasible, and environmentally sound options are selected;
- Ensure that impacts are identified early through investigations to minimise environmental damage and maximise benefits;
- Appoint sound and competent specialist to investigate the required environmental components;
- Conduct thorough specialist investigations that will allow the project team to develop an adequate understanding of the issues to be dealt with;
- Compile an EIA that will identify, evaluate and address the potential impacts;
- Provide ongoing environmental input into the project planning and development;
- Compile an EMP that will limit the significance of the negative impacts and maximise the positive aspects;
- Provide the regulatory authority with sufficient and confident information in order to make an informed decision;
- Provide a detailed project statement in terms of the recommendation by the Environmental Assessment Practitioner;
- Ensure that all relevant Interested and Affected Parties (I&APs) and/or Stakeholders are consulted and involved throughout the project; and
- Ensure that an open and transparent communication structure is in place during the life of the SOFS Mining Operation.

1.5 Environmental Assessment Practitioner

In terms of Section 17 of the NEMA, the applicant has to appoint Environmental Assessment Practitioners (EAPs) before applying for an environmental authorisation of any activity listed in terms of GN 544 and 545. For this purpose Wits Gold has appointed GCS (Pty) Ltd (GCS) to undertake the necessary environmental assessments and to ensure that all legislative requirements are adhered to as part of the environmental authorisation processes. See Appendix E for the GCS Company Profile.

GCS provides a professional, independent consulting service in the fields of water, environmental, engineering and earth sciences. The GCS team consists of highly trained staff that has extensive experience in the fields of geohydrology, hydrology, pedology, engineering geology, engineering and environmental science.

GCS have considerable experience in Southern Africa and undertake investigations for environmental assessments. The environmental scientists carry out all aspects of environmental assessments and management programmes.

GCS was founded in 1987 and the broad GCS client base ranges from individuals, engineers, municipalities and mines, to Independent States and Governments. GCS is an independent practice, which is wholly owned by the partners of the company.

GCS is an independent environmental consulting firm and has undertaken the EIA/EMP Report development. GCS is also responsible for the updated Public Participation Process (PPP) (Section 5, and Appendix F) pertaining to the proposed operation.

GCS is fully BEE compliant with an empowerment scorecard rating of 8.

1.6 Reporting

Based on the outcome of the Environmental Scoping Phase (Refer to Appendix B for the DMR acceptance letter and correspondence), an EIA/EMP Report must be submitted to the DMR for consideration and approval within 6 months of acceptance of the MRA.

1.6.1 Environmental Impact Assessment (EIA)

The EIA portion of the report must determine the nature, extent, duration, probability, significance and status of the environmental, social and cultural impacts of the project, the assessment of reasonable alternatives and the required mitigation measures for each impact during the life of the mine. An EIA report must contain all information that is necessary for the competent authority to consider the application and to reach a decision regarding the project. The EIA must therefore include the following (as per GN 543 of NEMA):

a) Details of –
   i. The EAP who compiled the report;
   ii. The expertise of the EAP to carry out an environmental impact assessment.
b) A detailed description of the proposed activity;
c) A description of the property on which the activity is to be undertaken and the location of the activity on the property, or if it is -
   i. A linear activity, a description of the route of the activity; or
   ii. An ocean-based activity, the coordinates where the activity is to be undertaken;
d) A description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity;
e) Details of the public participation process conducted in terms of sub-regulation (I), including -
   i. Steps undertaken in accordance with the plan of study;
   ii. A list of persons, organisations and organs of state that were registered as interested and affected parties;
   iii. A summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; and
   iv. Copies of any representations, objections and comments received from registered interested and affected parties;
f) A description of the need and desirability of the proposed activity and identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity;
g) An indication of the methodology used in determining the significance of potential environmental impacts;
h) A description and comparative assessment of all alternatives identified during the environmental impact assessment process;
i) A summary of the findings and recommendations of any specialist report or report on a specialised process;
j) A description of all environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of

each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures;

k) An assessment of each identified potentially significant impact, including -
    i. Cumulative impacts;
    ii. The nature of the impact;
    iii. The extent and duration of the impact;
    iv. The probability of the impact occurring;
    v. The degree to which the impact can be reversed;
    vi. The degree to which the impact may cause irreplaceable loss of resources; and
    vii. The degree to which the impact can be mitigated.
l) A description of any assumptions, uncertainties and gaps in knowledge;
m) An opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;
n) An environmental impact statement which contains -
    i. A summary of the key findings of the environmental impact assessment; and
    ii. A comparative assessment of the positive and negative implications of the proposed activity and identified alternatives;
o) A draft environmental management plan that complies with Regulation 33;
p) Copies of any specialist reports and reports on specialised processes complying with Regulation 32; and
q) Any specific information that may be required by the competent authority.

It is the role of the relevant environmental authorities to make a decision on whether the project should proceed or not, based on the information provided in the EIA, and this report therefore cannot make a recommendation on whether the project should proceed or not.

1.6.2 Environmental Management Programme (EMP)

Each specialist was required to identify means of avoiding, mitigating and/or managing the negative impacts in his/her particular aspect of the investigation. The recommended management strategies are synthesised in this report by GCS to formulate the EMP for the proposed listed activities and the operation as a whole. Management strategies are based on extensive knowledge within GCS and the specialists commissioned by GCS. The management measures will be incorporated into the mine systems to avoid, or appropriately manage impacts from the outset.

A draft environmental management plan must include -

a) Details of -
    i. The person who prepared the environmental management programme; and
    ii. The expertise of that person to prepare an environmental management programme.
b) Information on any proposed management or mitigation measures that will be taken to address the environmental impacts that have been identified in a report contemplated by these Regulations, including environmental impacts or objectives in respect of -
    i. Planning and design;
    ii. Pre-construction and construction activities;
    iii. Operation or undertaking of the activity;
    iv. Rehabilitation of the environment; and
    v. Closure, where relevant.
c) A detailed description of the aspects of the activity that are covered by the draft environmental management programme;
d) An identification of the persons who will be responsible for the implementation of the measures contemplated in paragraph (b);
e) Where appropriate, time periods within which the measures contemplated in the draft environmental management programme must be implemented; and
f) Proposed mechanisms for monitoring compliance with the environmental management programme and reporting thereon.

The EIA ensures that the needs of the environment (biophysical and socio-economic) are identified. The EMP in turn provides a tool for meeting the objective to reduce or avoid negative environmental impacts associated with a project within a certain environment by providing detailed mitigation measures and management commitments.

All of these sections (i.e. EIA/EMP) will become legally binding on the approval of this report.

1.6.3 Reporting Structure (EIA/EMP)

The EIA/EMP Report has been compiled to identify the impacts associated with the mining activities and to determine the management measures that need to be implemented. The structure of the report is based on that of a complete EIA/EMP Report and contains the following sections:

Chapter 1: Background and Introduction

- This chapter provides a description of the location and the land ownership of the mine, as well as the purpose, approach and methodology followed for the completion of this project.

Chapter 2: Detailed Project Description

- This chapter provides a detailed description of the proposed project and how it is planned to be initiated and operated should the environmental investigations be sufficient and thereby approved.

Chapter 3: Project Alternatives

- This chapter details the project alternatives considered for the project and conducts a comparative assessment to indicate why the final option was selected (if required).

Chapter 4: Detailed Environmental Description

- This chapter provides a description of the current environment (which includes the bio-physical and socio-economic components) prior to the commencement of the proposed project.

Chapter 5: Public Participation Process

- This chapter details the process undertaken for stakeholder engagement and provides a discussion on the issues raised and how these will be addressed.

Chapter 6: Identification and Assessment of Environmental Impacts (EIA) and Issues with Management Measures and Action Plans (EMP)

- This chapter outlines the activities of the proposed project and accordingly, the activities the environmental objectives for each stage were identified. In addition this chapter assesses and rates the potential impacts on the environment, prior to the consideration of mitigation measures, as well as the potential impacts after the implementation of the proposed mitigation measures. This chapter also details the required management measures to be implemented during the construction, operational, decommissioning and closure phases.

Chapter 7: Monitoring Management Programme

- This chapter indicates the monitoring and management measures of environmental impacts (i.e. surface water monitoring, groundwater monitoring, air quality monitoring etc.) for the way forward should this project be approved.

Chapter 8: Environmental Emergency Response Plan and Environmental Awareness Plan

- This chapter details procedures for environmental related emergencies and remediation measures and the details for an environmental awareness plan.

Chapter 9: Financial Provision

- This chapter details the financial provision required for the project.

Chapter 10: Environmental Rehabilitation Programme

- This chapter details a proposed rehabilitation plan for the project.

Chapter 11: Identification of Gaps

- This chapter serves to indicate which gaps have been identified and how these should be addressed.

Chapter 12: Undertaking by Client

- This chapter contains the signatures of the authorised Company representative and the regional director from the DMR to make all information contained in EMP legally binding.

Chapter 13: Conclusion

- The conclusion provides a brief discussion on the findings in the report.

Appendices: All supporting documentation is provided in this section.

2 DETAILED PROJECT DESCRIPTION

The information contained in Section 2 has been sourced from the Pre-Feasibility Study (Appendix I).

Phase 1 of the SOFS Mining Operation, namely the DBM Project, is situated in the Free State Province of central South Africa and is south of the town of Virginia (28°70"S, 26°540"E); whilst the closest major towns to Virginia are Welkom (24 km North-West) and Bloemfontein (136 km South-West) Virginia is approximately 270 km by national road from Johannesburg. It is important to note that the DBM Project extends over numerous farms and/or Prospecting Rights and the northern portion of the area used to form part of the Harmony Merriespruit Mine lease area that was unmined. This area will be included in the Mining Right application area once transfer the properties to Wits Gold is notarially executed. Application for ministerial consent terms of Section 102 of the MPRDA has been granted and the regional office of the DMR is processing the necessary documentation in order to effect the transfer of the rights to Wits Gold.

Ore body mining will be entirely underground at depths starting from 480 metres below surface. Mining is currently planned to be undertaken using narrow reef breast mining approach common to the gold mines of South Africa. Support for the mining will be from a trackless footwall infrastructure below the Leader Reef (bottom reef horizon). This is less common but not unique in underground South African gold mines.

As part of the environmental approval process for a Mining Right application, a Scoping Report has already been submitted to the DMR, Free State Province. The remaining requirement in terms of the environmental approval process, this EIA/EMP Report in terms of the MPRDA is now being submitted to the DMR.

2.1 Project Area Infrastructure

Existing Infrastructure

There is no underground mining infrastructure on the site. There is however a gravel access road that comes off the R73 Provincial road. The road will be upgraded for 30 tonne delivery trucks.

Initially process, service and potable water will be sourced from Sedibeng Municipality until the mine underground workings are established and able to provide the required service and process water.

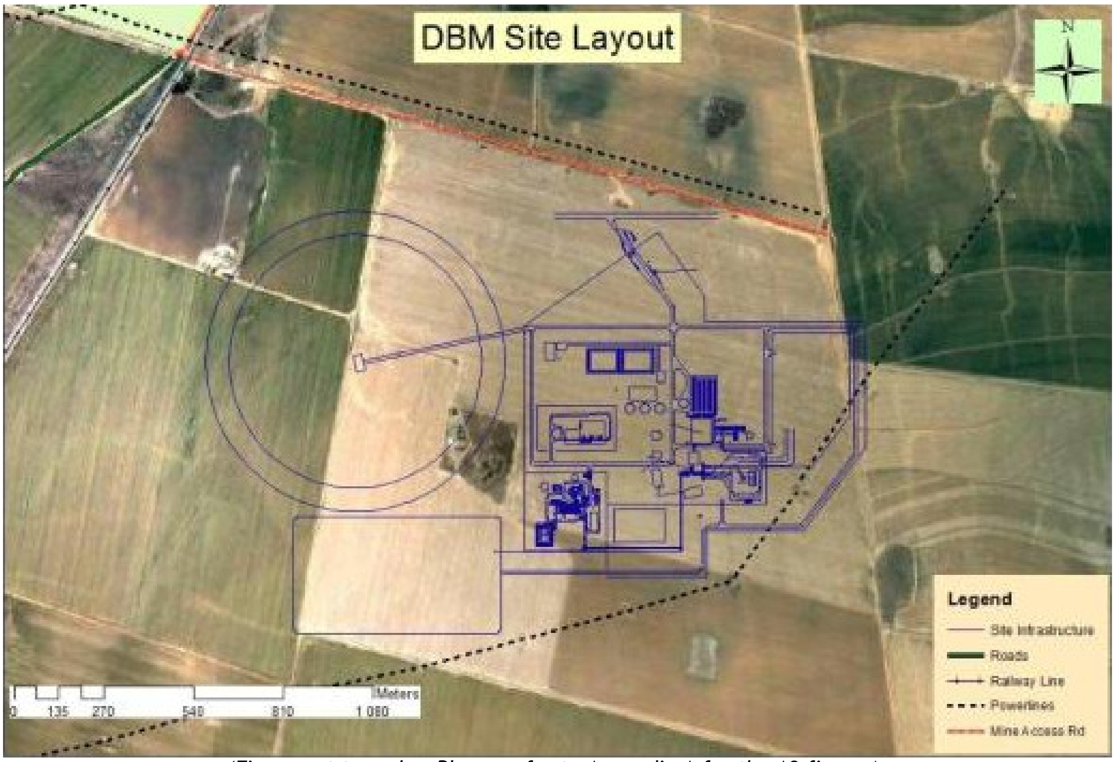
Harmony Gold has an existing brownfields Tailings Facility which Wits Gold is in discussions with Harmony to acquire (See Appendix J).

Required Infrastructure

The SOFS Mining Operation (**Figure 2.1**) will consist of underground mining operations, associated workshops and stores. All infrastructure required to support the planned mining operation has been included and allowed for in the capital and operating costs. Infrastructure allowed for includes:

- Water:
  - Bulk water supplies;
  - Surface supply reticulation;
  - Underground supply reticulation;
  - Dirty water pumping and settling;
  - Sewage treatment;
  - Water treatment plant to potable quality; and
  - Brine storage dams.
- Bulk power supplies:
  - Bulk power supplies;
  - Main Eskom yard;
  - Surface reticulation;
  - Underground reticulation; and
  - Emergency generators.
- Surface infrastructure:
  - Buildings;
  - Workshops;
  - Change houses and lamp room;
  - Clinic;
  - Stores and Salvage yard;
  - Core yard/shed;
  - Sewage treatment and disposal;
  - Roads and storm water handling;
  - Ice plant and cooling towers;
  - Metallurgical plant;
  - Rock handling;
  - Tailings disposal facilities; and
  - Waste rock dump.
- Underground infrastructure

- Workshops;
- First aid facility;
- Fire detection;
- Rescue chambers;
- Pump station;
- Trackless footwall development; and
- Stores.



(Figure not to scale. Please refer to Appendix A for the A3 figure.)

Figure 2.1: Locality Map with the proposed surface infrastructure

2.1.1 Workshops and Offices

2.1.1.1 Workshops

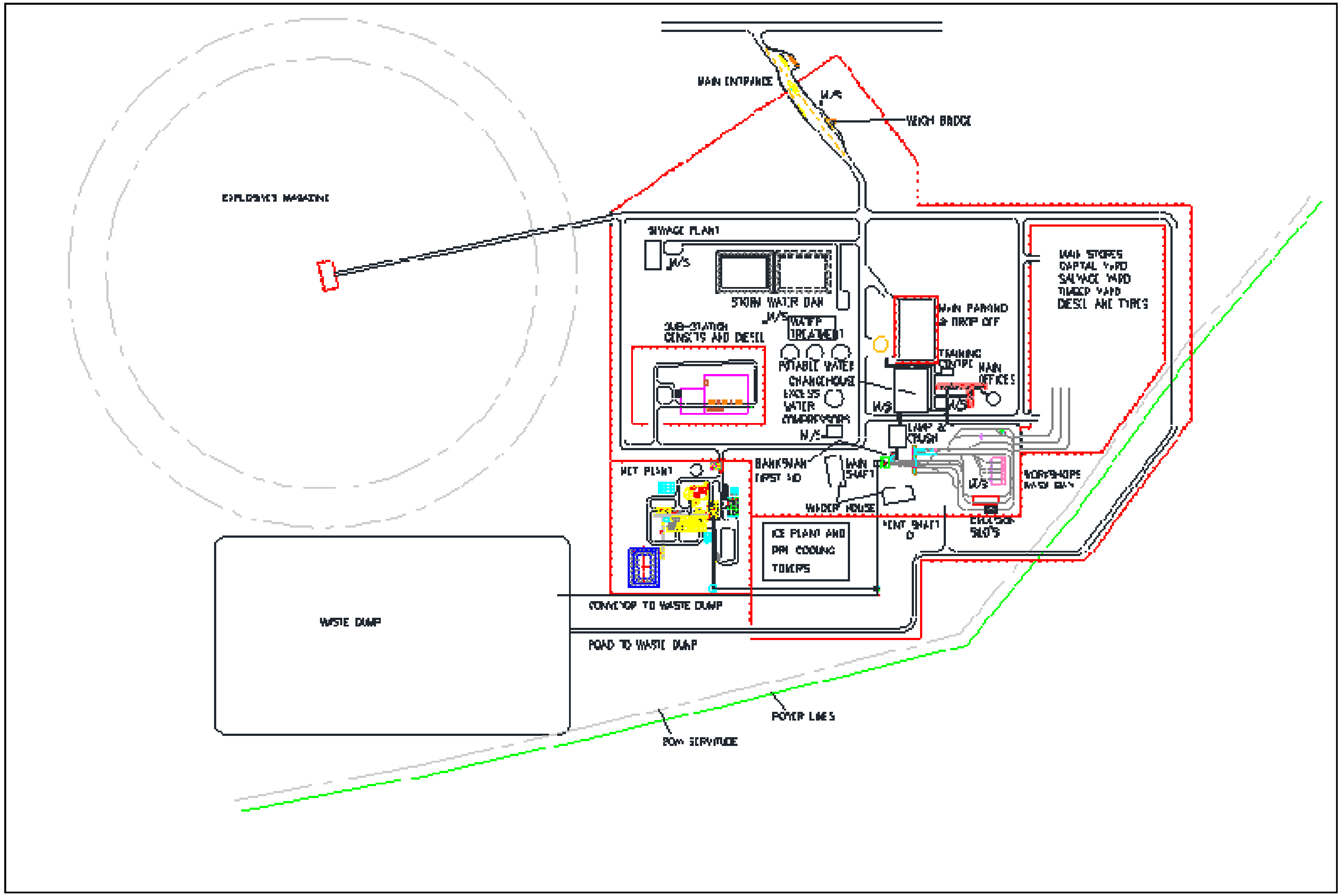
Workshops catering for the following have been proposed:

- Electrical repairs and production;
- Mechanical fitting, machining and production;
- Boiler making;
- Rigging;
- Hydropower repairs workshop;
- Riggers workshop;

- Instrumentation workshop;
- Light vehicles repair workshop; and
- Skip gantry.

The proposed workshops will be of steel construction with corrugated galvanised iron cladding on the sides and similar sheets for roof cover. All workshop structures can be dismantled and re-located at mine closure. The concrete pad upon which the workshop complex sits will be about 435 m^3. The workshops will be located just east of the shaft position. Refer to **Figure 2.2**. Lean-to type structures will be constructed within the workshop complex to provide office accommodation for foremen.

All workshops will be in place by Year 6.



(Figure not to scale. Please refer to Appendix A for the A3 figure.)

Figure 2.2: Proposed Surface Infrastructure Layout for the DBM Gold Mine

2.1.2 Offices

The administration offices will be of pre-fabricated design consisting of steel columns and top rails manufactured from 1.6 mm mild steel plate. All steel components will be corrosion protected.

External walls will be from a 9 mm fibre board panel with a fire retarding skin bonded to a 40 mm polystyrene core covered by a 12.5 mm Rhino board on the inside.

The internal walls between offices will be drywall. Two 12.5 mm Rhino board will be installed using the galvanized track and stud method of partitioning. The roof is of timber trusses and 0.5 mm galvanized corrugated sheeting covering. The ceiling will be of 6.4 mm Rhino board. Office floors and corridors will be of carpet tiles while kitchens and bathrooms will have vinyl tiles.

The total office foot print has a concrete pad of about 1,609 m^2.

All offices to be in place by Year 6 of the project.

2.1.2.1 Change House and Lamp Room

The change house will be located adjacent to the shaft administration offices. It is a planned to be a pre-fabricated structure with galvanized steel columns and Chromadek sheet panels, insulated with 60 mm polystyrene. There will not be a ceiling due to the amount of steam normally generated in such a facility, although there will be whirlybird fans in the roof to exhaust steam. Timber trusses will be enamel painted and sisalation will be laid under the roof sheets. The roof sheets will be of the IBR type galvanized sheets.

The change house will occupy a concrete pad of about 1,475 m^2.

The first of the two modules will be installed in Year 1 and the second one in Year 7.

2.1.2.2 Stores and Salvage Yard

The store building is a steel structure similar to the workshop buildings with a floor space of 483 m^2 and a concrete volume of about 145 m^3.

The fuel storage facility is also within the stores area. It is sized to service all surface mine vehicles and the standby generator sets (gensets) which will be required if Eskom power is unavailable. The vehicles are estimated to consume about 1.4 kl of fuel per day and the gensets about 2.9 kl when required to run. The underground operations will consume about 16.5 kl per day. The quantity stored is 183 kl, which is about 7 days consumption if all gensets are running at 60 percent diversity.

The proposed tank is a self-bunded unit complete with fuel dispensing pumps, flow meter, inlet and outlet fittings, overfill protection, anti-siphon valve, access manhole, level indicator, air breather and safety valve. There will be 8 for the 80,000 120,000 tpm option) units of 46 kl capacity each. They will be placed on a specially prepared concrete pad.

The cost of the tanks and the civil costs to prepare the depot surface have been included. This infrastructure is to be installed by Year 3 of the project.

2.1.2.3 Core Shed

A Core shed has been provided for and is of the same design as the workshops and stores buildings. It occupies a pad of 450 m^3 concrete volume.

This infrastructure is to be installed by Year 1 of the project.

2.1.2.4 Fire Detection and Suppression

Provision for fire pumps, fire water tanks, fire hydrants and hydrant reticulation, fire extinguishers hose reels and alarms has been made. Fire water is drawn from the potable water system. Water supply pipes will be sized to be able to charge fire water tanks in reasonable time. All facilities and major fixed equipment, such as offices, stores, timber yard, winder houses and fuel depot are protected. Provision has been made for a light diesel vehicle, equipped with water and foam tanks and pumps to fight small veldt fires around the site. Mobile equipment will have fire extinguishers on board.

2.2 Roads, Railway Lines and Power Lines

2.2.1 Roads

Existing Infrastructure

The Wits Gold DBM Mine will obtain access from the S239 Road. Currently, this access can be considered as an informal access and might require a formal approval. The adequacy of this access needs to be investigated further as currently the access is an uncontrolled railway crossing (**Figure 2.3**).

The major routes in the study area are described in **Table 2.1** and **Figure 2.3** below:

Table 2.1: Overview of the existing road network and jurisdiction

ROAD LINK	JURISDICTION	CLASS OF ROAD	FUNCTION OF THE ROAD	ROAD SURFACING	CROSS SECTION (TYPICAL WIDTH OF THE ROAD)
R30	Free State Department of Public Works, Roads and Transport (FDPWRT)	R3	The road is a Provincial Class 3 road with a collector-distributor function. The road runs in the north-south direction. The R30 connects Odendaalsrus with Theunissen.	The road is paved and the surface condition is fairly adequate.	Single carriageway (2 lanes: one lane per direction)
R73	Free State Department of Public Works, Roads and Transport (FDPWRT)	R3	The road is a Provincial Class 3 road with a collector-distributor function. The road runs in the north-south direction. The R73 connects Welkom with the R30.	The road is recently paved and the surface condition is adequate.	Single carriageway (2 lanes: one lane per direction)
S1279	Free State Department of Public Works, Roads and Transport (FDPWRT)	R4	The road is a Provincial Rural Road. The road runs in the north-south direction. The S1279 Road connects with the S239 Road.	The road is a gravel road	Single carriageway (2 lanes: one lane per direction)
S239 (Theunissen Street)	Free State Department of Public Works, Roads and Transport (FDPWRT)	R4	The road is a Provincial Rural Road. The road runs in the east-west direction. The S239 Road becomes Theunissen Street and connects with the R73 Road.	The road is mostly gravel road	Single carriageway (2 lanes: one lane per direction)
Jan Hofmeyer Street	Free State Department of Public Works, Roads and Transport (FDPWRT)	R3	The road is a Provincial Class 3 road with a collector-distributor function. The road runs in the north-south direction. Jan Hofmeyer Street becomes the R73 further south and connects to the N1.	The road is paved and the surface condition is fairly adequate.	Single carriageway (2 lanes: one lane per direction)

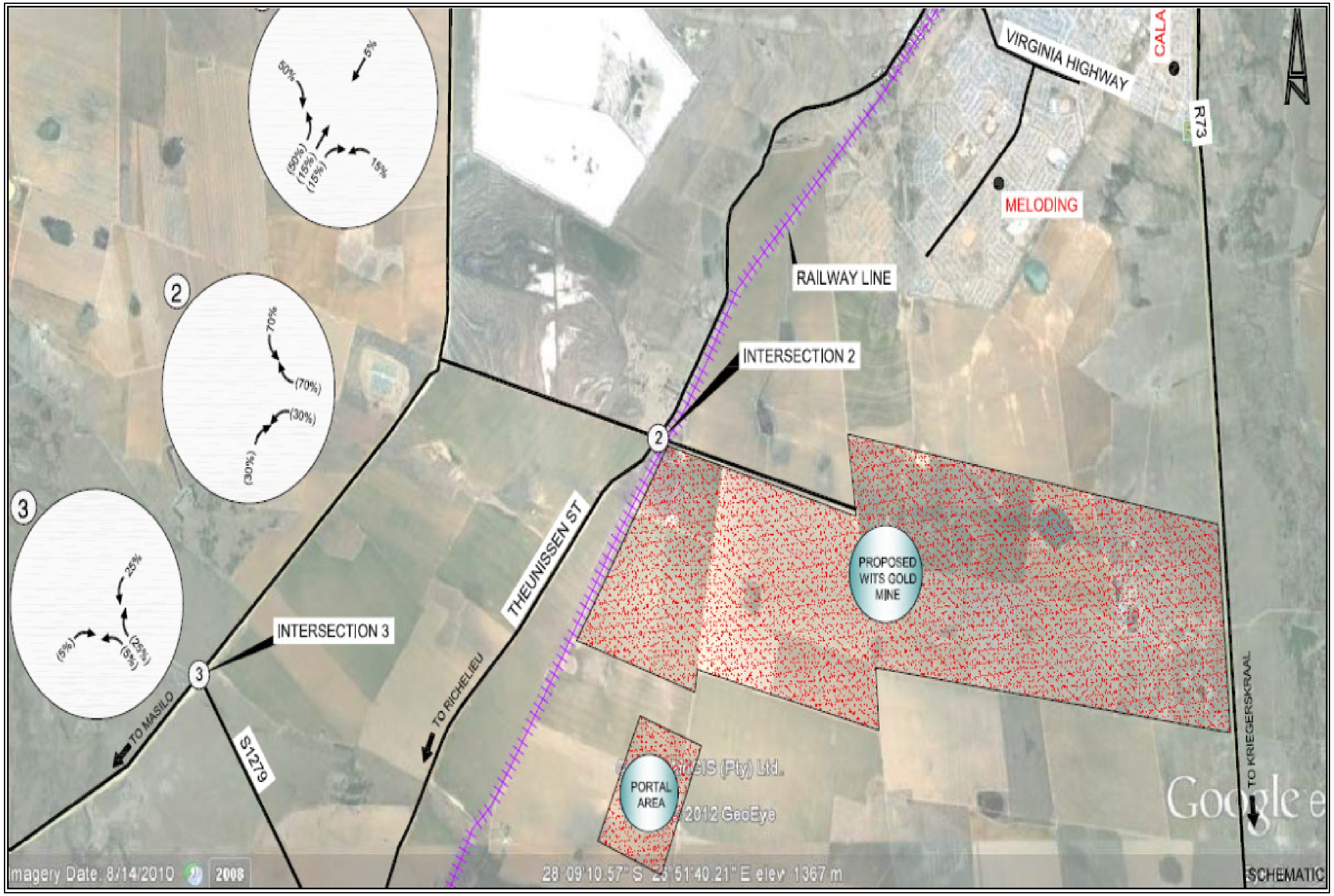


Figure 2.3: Road and Railway routes associated with the study area

Required Infrastructure

Approximately 2 km of access tarred road 10 m wide will be required as the main access to site. The road will consist of 2 x 150 mm layers of roadbed from borrow pit material (G7), a 200 mm thick stabilized sub-base layer (G5) from commercial sources and a 150 mm thick base layer, finishing off with a layer of bitumen, as well as storm water drainage channels.

Internal roads will be of a similar design to the access road, except that they are compacted gravel and are about 9 km long.

These roads are specifically designed for use by surface support vehicles, such as stores delivery trucks and light service trucks.

2.2.2 Power Lines

Required Infrastructure

The mine has requested a bulk supply from Eskom at 11 kV, as the mine reticulation will be performed at this level. The proposal is for Eskom to construct a 132 kV line from their Thesues substation to the mine site, using an existing transmission line servitude. The 35 MVA, 132/11kV substation will be constructed on the mine site.

2.2.3 Conveyors and Railway Lines

Existing Infrastructure

There are no existing conveyors on site.

2.3 Mining Process

2.3.1 Mining Method

2.3.1.1 Conventional Stoping Method:

The mining method selected for application at the DBM Project is a conventional labour intensive breast mining method supported by a trackless footwall infrastructure.

The conventional breast mining method is commonly used on the gold deposits of the Witwatersrand. This method lends itself to selective mining in an ore body which is known to be highly channelised. In addition, this method has the advantage of being able to negotiate faulting thus minimising the risk of high dilution and associated losses.

Use of a trackless footwall infrastructure is less common, though not unique in South African gold mines. The use of a trackless supporting infrastructure has been driven by the selection of the primary access method. Based on the Scoping Study, the short shaft and decline combination was proposed with the primary consideration being time to early ore recovery. The flexibility of trackless equipment in the off reef development assists the negotiation of major and minor faulting and the ability to generate excess pre-developed ore reserves for selective mining.

A number of trade-off studies have been undertaken in the PFS. Eventually the option of a conventional deep shaft with tracked haulages and belt conveyors to replace trackless rock hauling was pursued.

2.3.1.2 Stoping Design

The stoping method applied to the reefs (Figure 2.4) at the DBM Project is a conventional breast mining approach. Mining is complicated by the fact that there are three reef horizons in relatively close proximity to each other, meaning a strict mining sequence must be applied as discussed previously. For purposes of this study, the B Reef horizon which is situated between the Kalkoenkrans/Beatrix and Leader Reef horizons is ignored due to the minimal amount of payable reef and the sporadic nature of this ore body.

The mining method consists of a reef access centre gully developed in a true dip direction in the plane of the reef between mining levels, a dip distance of approximately 225 m. The reef is carried in the hanging wall of the centre gully with footwall waste mined to give additional height. Centre gully dimensions are typically 2.4 m high by 1.5 m wide.

Mining panels of approximately 30 m in length including pillars (in the dip direction) are then established from this centre gully and mined in a strike direction. The height of these panels is planned to be kept at 1.0 m plus an allowance of 0.2 m for dilution. There will be 7 panels each side of the centre gully between mining levels.

On the down dip edge of each mining panel a secondary gully or strike gully is carried slightly in advance of the face. This Advanced Strike Gully (ASG) will be 2.2 m deep and 1.5 m wide excluding additional unplanned dilution.

A centre gully is developed every 180 m on strike meaning that mining advances a maximum of 90 m from the centre gully in either direction.

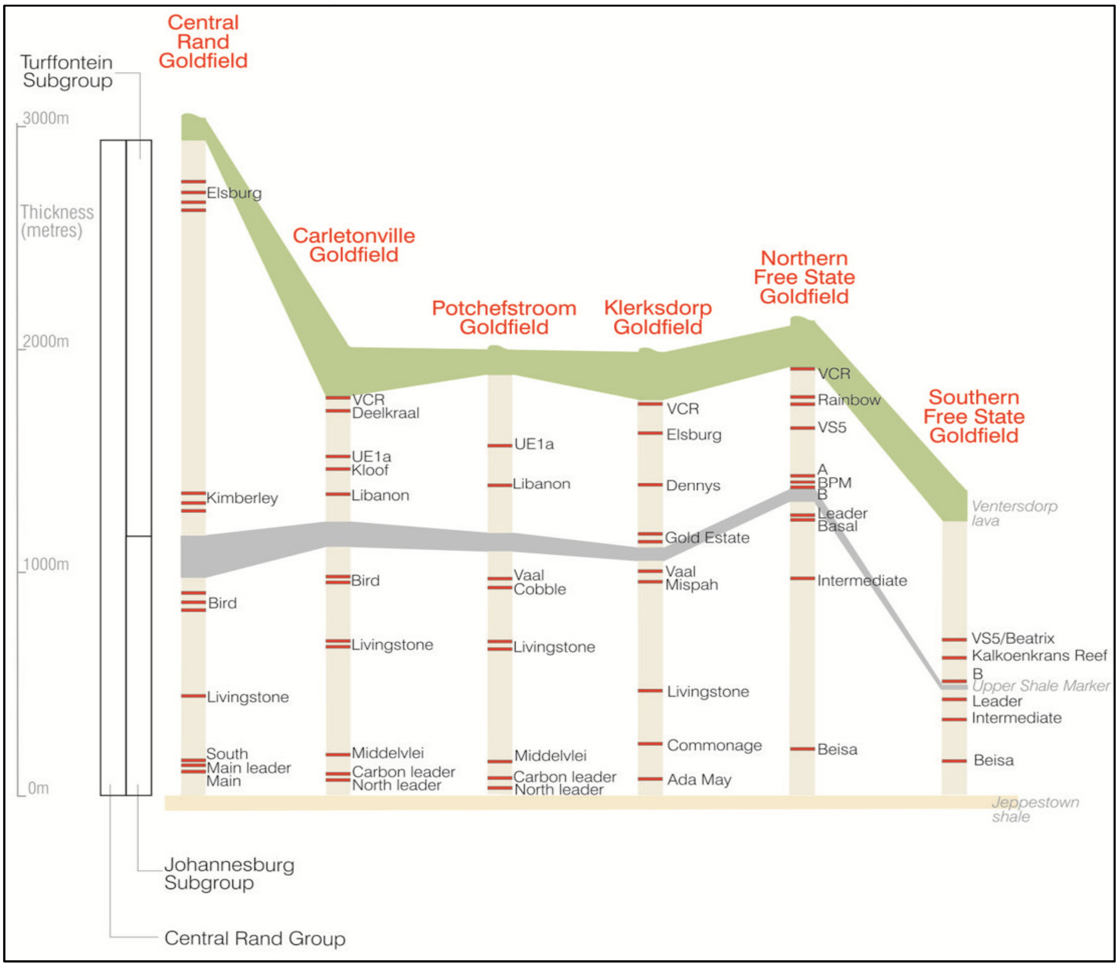
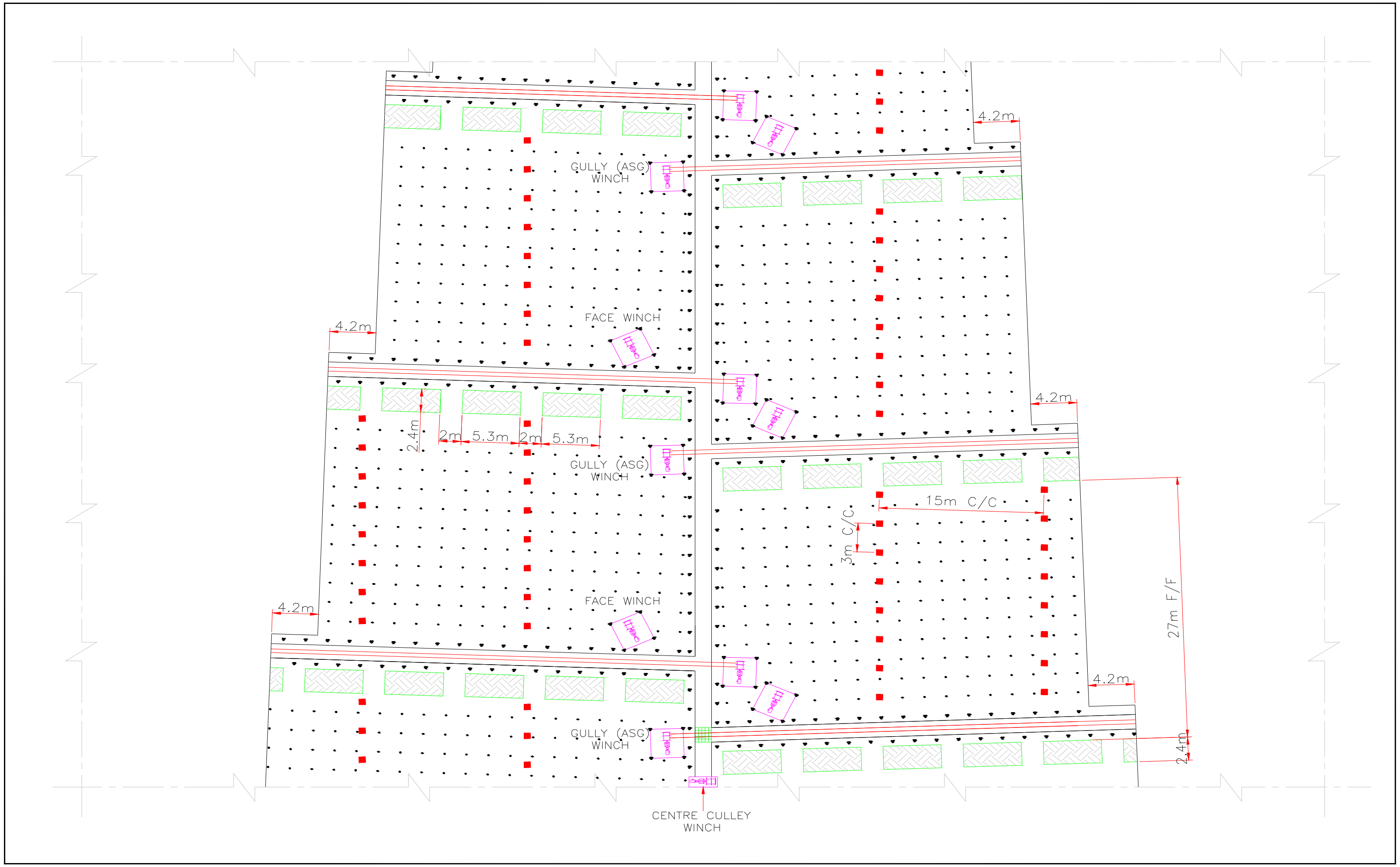


Figure 2.4: Principal Conglomerate Reefs In The Central Rand Group, Western Witwatersrand Basin (Adapted By Muntingh D.J., 2007)

Figure 2.5 shows a plan and section of a typical stope.



(Figure not to scale. Please refer to Appendix A for the A3 figure.)

Figure 2.5: Schematic Plan of a stope panel

2.3.2 Development

2.3.2.1 Footwall Development

The Footwall Drive (FWD) will be developed in the strike direction of the ore body at a distance of approximately 30 m below the lowest reef horizon. The development will be 4.8 m by 4.5 m in cross-section.

At intervals of 180 m, crosscuts will be developed off the FWD toward the reef horizon to access the raise position of each of the two ore bodies. The intersection point of each of the three reefs will be used as a platform for development of the centre gullies.

Mechanised trackless mining methods will be used to develop all footwall development, equipment deployed will include:

- Electro-hydraulic drill rigs for face drilling and drilling of support holes;
- LHD's for cleaning of the blast;
- 30 tonne haul trucks for hauling broken rock to the waste tips; and
- Various auxiliary vehicles for support and construction activities.

Figure 2.6 overleaf shows a cross-section of a typical development end.

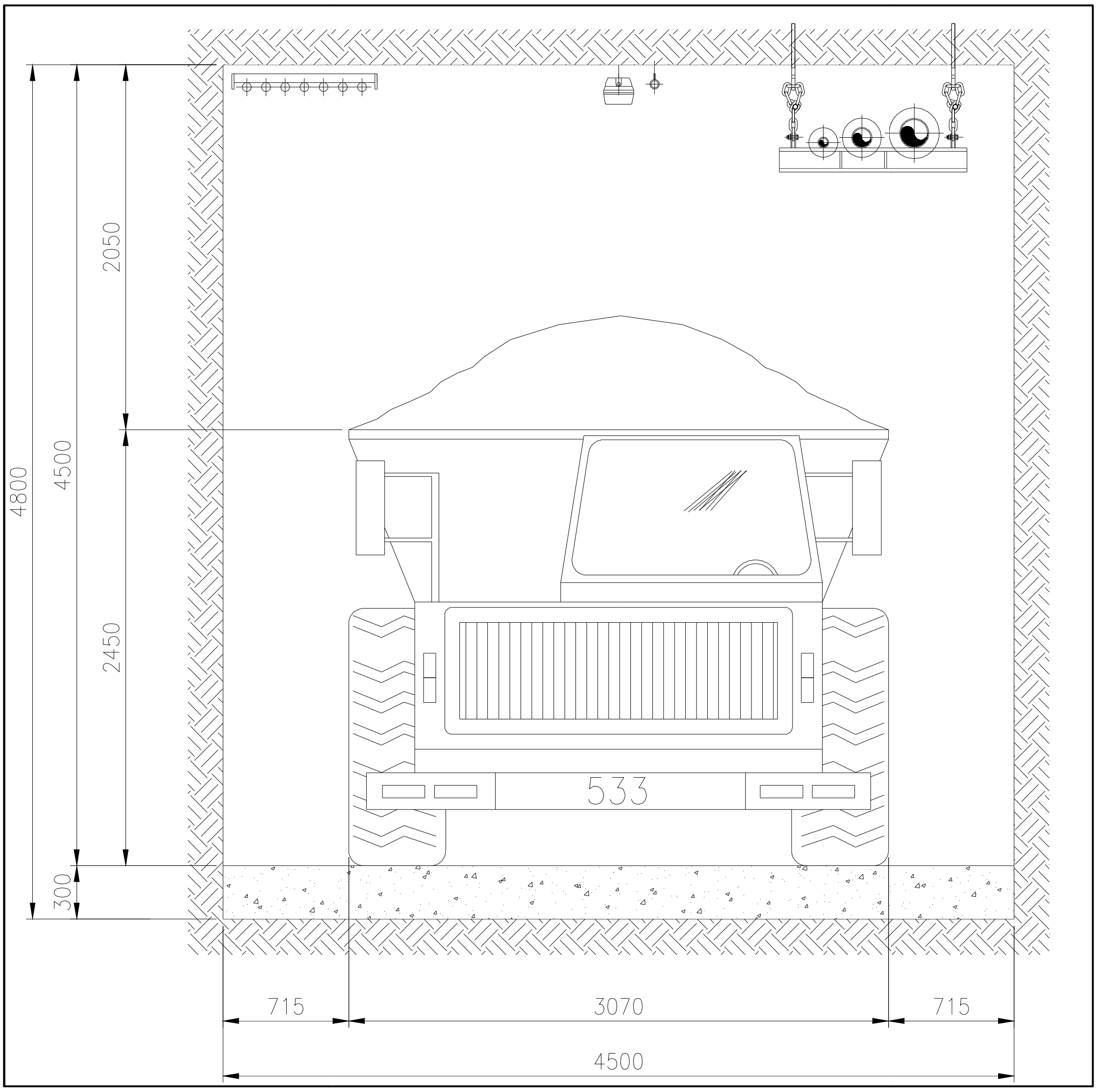


Figure 2.6: Cross section through footwall development

2.3.2.2 Stope Access

Access to the stopes will be from the crosscuts intersecting each reef horizon. A short cubby will be developed at the reef intersection from which the centre gully development will be launched. This will be developed using the same equipment as for the footwall development.

2.3.2.3 Stope Ore Passes

Two ore passes per stope will be developed from the cross cuts equipped for centre loading for ease of truck loading.

Each ore pass will go through both reefs to enable delivery of ore from mining on all reef horizons to the crosscut. Only one reef horizon at any one time will use a particular ore pass for reasons of safety.

Stope ore passes will be developed using drop raising methods or other mechanised mining equipment (**Figure 2.7**).

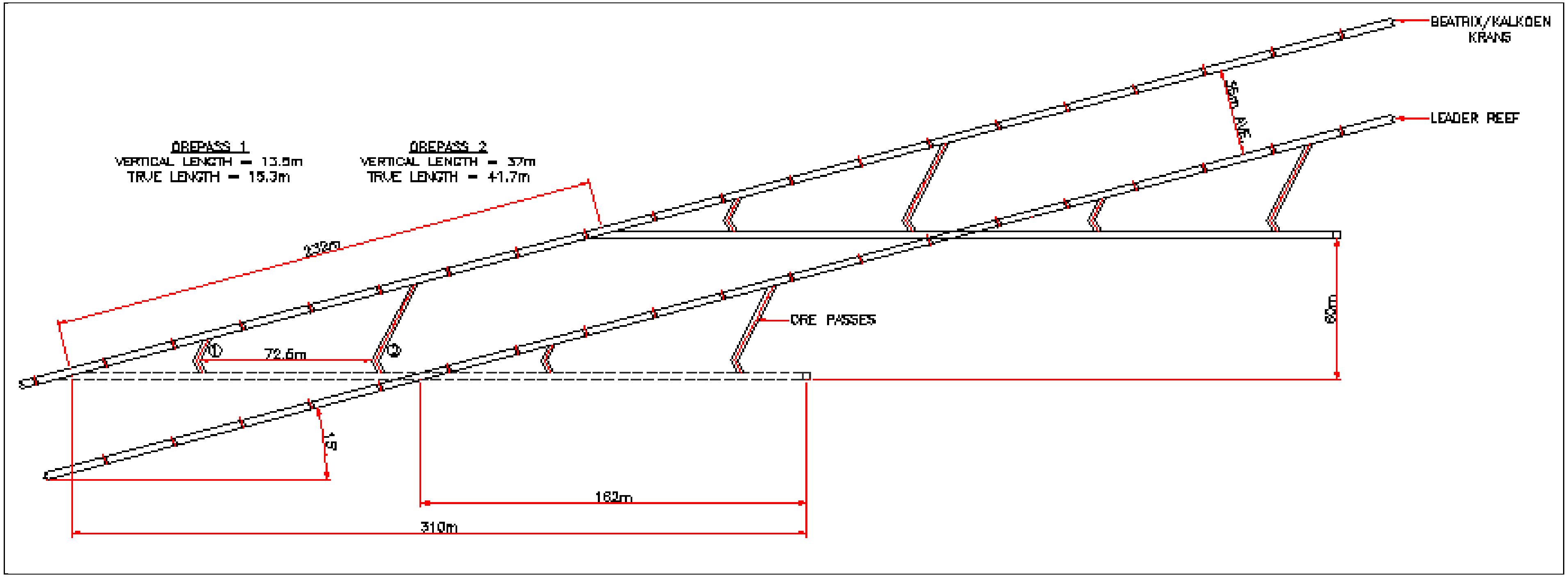


Figure 2.7: Section through stope showing stope ore passes connecting to crosscut development

2.3.3 Trackless Declines

Two main trackless declines will be developed from the subcrop elevation to access the North and South mining blocks. The North decline will start from the vertical shaft area. The South decline will be developed from a position approximately 1.8 km from the vertical shaft. Both these inclines will be equipped with 50 ton dump trucks from hauling of ore and waste rock.

Figure 2.8 shows a cross section of a trackless decline.

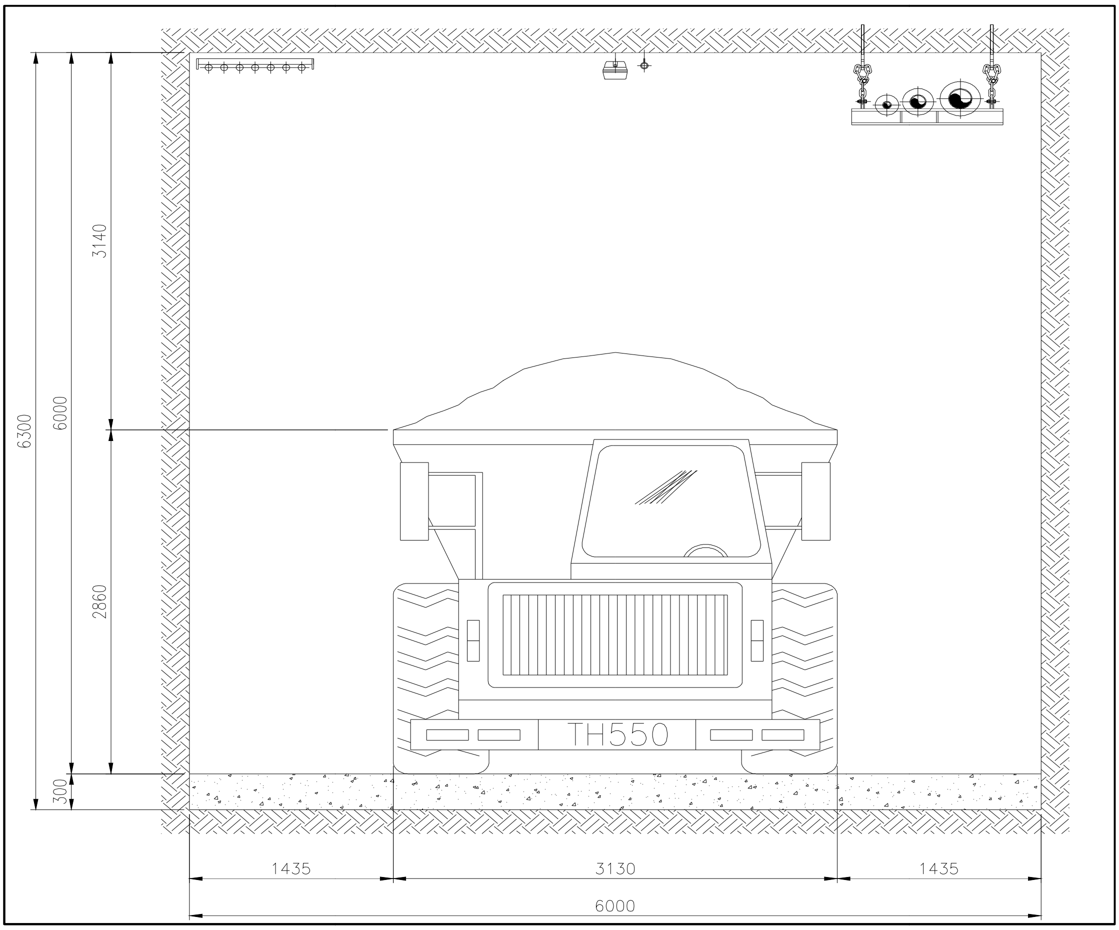


Figure 2.8: Cross-section of trackless decline

2.3.4 Development Productivities

The following development productivities have been applied to the development operation.

- All decline ramps and footwall development accessing the ore body has been planned at 90 m linear metres advance per month. Additional cost was allowed for this development to cater for use of contractors to ensure advances are achieved at the early stages of the mine's development.

- All on reef conventional development will be at a rate of 30 m per month. All ore passes have been planned at the same rate of 30 m per month.

2.3.5 Mine Scheduling

The design life of the mine in accordance with the mining schedule is 19 years. Accordingly, all engineering designs are based on a minimum of a 19 year life span requirement. First production is expected 47 months after shaft sinking.

2.4 Processing Method

2.4.1 Rock handling

2.4.1.1 Ore Handling

Stope cleaning will be done with conventional winches and scraper. Hydro powered water jets will be utilised in the cleaning of stope panels. Conventional gully and centre gully scraping will be done to stope ore passes.

Reef will be collected in the cross-cuts utilising 30 ton dump trucks and hauled to the main decline ore passes. Ore will be hauled to the main shaft in the main declines utilising 50 ton dump trucks.

2.4.2 Mineral Processing

The tonnage throughput rate for the DBM plant has been set at 120,000 tons per month, based on the mine design.

2.4.2.1 Metallurgical Testwork

Based on the mining plan from the Concept Study, over the life of mine, ore will be mined in varying proportions from four reefs – the Kalkoenkrans reef, Beatrix reef, B reef and the Leader reef. The Leader reef has high and low carbon areas. The Kalkoenkrans reef made up more than 50% of the ore to be mined.

No metallurgical testwork was carried out prior to the commencement of the pre-feasibility study.

Samples of leach tailings will be available for tailings dam design testwork and for various groundwater studies.

2.4.2.2 Selection of Process Route

For the purposes of process and plant design for the pre-feasibility study, it was assumed that the ore to be processed will be similar in mineralogy and ore processing characteristics to the ores which are currently being mined in the area. The closest metallurgical plants to the DBM area are the old Harmony Merriespruit plant, the Joel plant and the Beatrix plant. As the Harmony plant was designed many years ago, its processing route was not considered. Joel plant uses run-of-mine (ROM) milling followed by cyanide leaching and carbon-in-pulp (CIP). Beatrix also uses ROM milling followed by carbon-in-leach (CIL). The Beatrix ore contains smectite type clays, which are preg-robbing, so CIL is well suited to this ore. Neither Joel nor Beatrix make use of gravity concentration.

Based on the above it was decided that the process route would be ROM milling, followed by CIL, with the gold being recovered by elution, carbon reactivation, electrowinning and smelting. Should the testwork show that gravity concentration could make a significant contribution to gold recovery, it could then be included in the flowsheet. Similarly, if the ores do not contain any preg-robbing minerals, then CIP could be considered. A consideration is that a number of gold plants around the world which have not identified preg-robbing minerals in their ores, still elect to use the CIL process over CIP as it is lower capital cost and has a simpler flowsheet (no CIP tanks). CIL does result in a lower gold loading on the activated carbon than CIP plants, which then requires a larger elution plant. Overall, a CIL plant is lower capital cost than a CIP plant and installing a CIL plant ensures that no gold will be lost to preg-robbing minerals.

This process route utilises technology and equipment that is well proven on the metallurgical plants on the gold mines of the Witwatersrand and Free State.

2.4.2.3 Evaluation of Viability of Uranium Recovery

A study was carried out to determine whether it would be viable to recover uranium from any or all of the DBM reefs.

During the DBM Concept Study the various reefs were analysed for uranium (as U_3O_8). The High Carbon Leader reef showed the highest uranium grade, at 280 ppm. The highest uranium content of the other reefs was 140ppm. Based on the planned mining rates from the various reefs a uranium plant feed rate of 15 000 tons per month of High Carbon Leader Reef was assumed. The capital and operating costs for a plant of this capacity were determined, and the revenue calculated, all in current money terms.

The study showed that treating ore from the High Carbon leader Reef, the highest grade reef in terms of uranium content, will require a uranium price of $85 per pound of uranium (in current money terms) to make the process viable. This compares to the current uranium price of $55 per pound. It is therefore unlikely that uranium recovery will be viable in the near future from any of the DBM reefs..

2.4.2.4 Process Description

The proposed plant flowsheet is shown in Figure 2.9 below.

ROM ore is withdrawn from the shaft headgear bin with vibrating feeders onto the conveyor that transfers the ore to the mill silos. No crushers are included in the circuit as the ore from underground will have a top size of 400mm, which is an ideal feed size for ROM milling. It is possible that the ore produced by the Long Hole Stoping mining method may be finer than this, but 400mm is the preferred top size. In ROM milling, the large rock particles are used for grinding in the mill. An absence of these sized particles will result in increased steel ball consumption.

Ore is withdrawn from the mill silos with vibrating feeders and fed to the ROM mills. The mill discharge is pumped to the cyclones where classification by particle size takes place. The cyclone underflow containing the coarse particles is returned to the mill for regrinding while the cyclone overflow containing the fine particles passes to the thickener. A linear screen on the thickener feed removes woodchips and any tramp material such as plastic particles. These particles, if not removed, will blind the carbon screens in the CIL circuit.

If gravity concentration is included in the flowsheet, a portion of the cyclone underflow will be fed into the gravity concentrator. The tailings from the gravity concentrator will be returned to the mill, while the gravity concentrate will pass to the smelthouse for further upgrading and smelting.

Lime and flocculant are added to the thickener feed to aid settling of the finer particles. The lime addition is controlled to provide the optimum pH in the CIL for gold leaching. Thickener underflow is pumped to the CIL circuit. Thickener overflow water is returned to the mill process water tank. The plant feed sample for gold accounting purposes will be taken from the feed to the CIL tanks using an automatic cross cut sampler.

Sodium cyanide is added to the CIL tanks to dissolve the gold. Granular activated carbon made from coconut shells is added into the last CIL tank to absorb the dissolved gold. The carbon is pumped up the CIL circuit counter current to the pulp flow using recessed impeller pumps that minimise abrasion of the carbon. Carbon from the first (head) CIL tank is pumped to the loaded carbon screen. The screen underflow (pulp) flows back into the CIL tank and the loaded carbon is washed on the loaded carbon screen.

The loaded carbon then passes to the loaded carbon tank, from where it is fed into the elution column. The loaded carbon tank is also used as an elutriator, to wash any remaining woodchip and plastic particles out of the loaded carbon. There are two elution processes commonly used in the gold industry, the Zadra process and the Anglo American Research Laboratories (AARL) process. In the Zadra process, eluting solution (eluate) containing sodium cyanide and sodium hydroxide (caustic soda) at 120°C is passed through the elution column to strip the gold off of the carbon. The solution then passes to the electrowinning cells where the gold is electrolytically plated from the solution. From the electrowinning cells the solution returns to the elution column to strip more gold off of the carbon. This circulation of eluate through the elution column, to the electrowinning cell and back to the elution column typically takes approximately 16 hours, until the gold has been virtually completely eluted off of the carbon.

In the AARL process, the eluate does not pass directly to the electrowinning cell but is stored in the eluate tank. Fresh eluate is passed through the elution column until the elution process is complete. The eluate is then passed through the electrowinning cell to electroplate the gold.

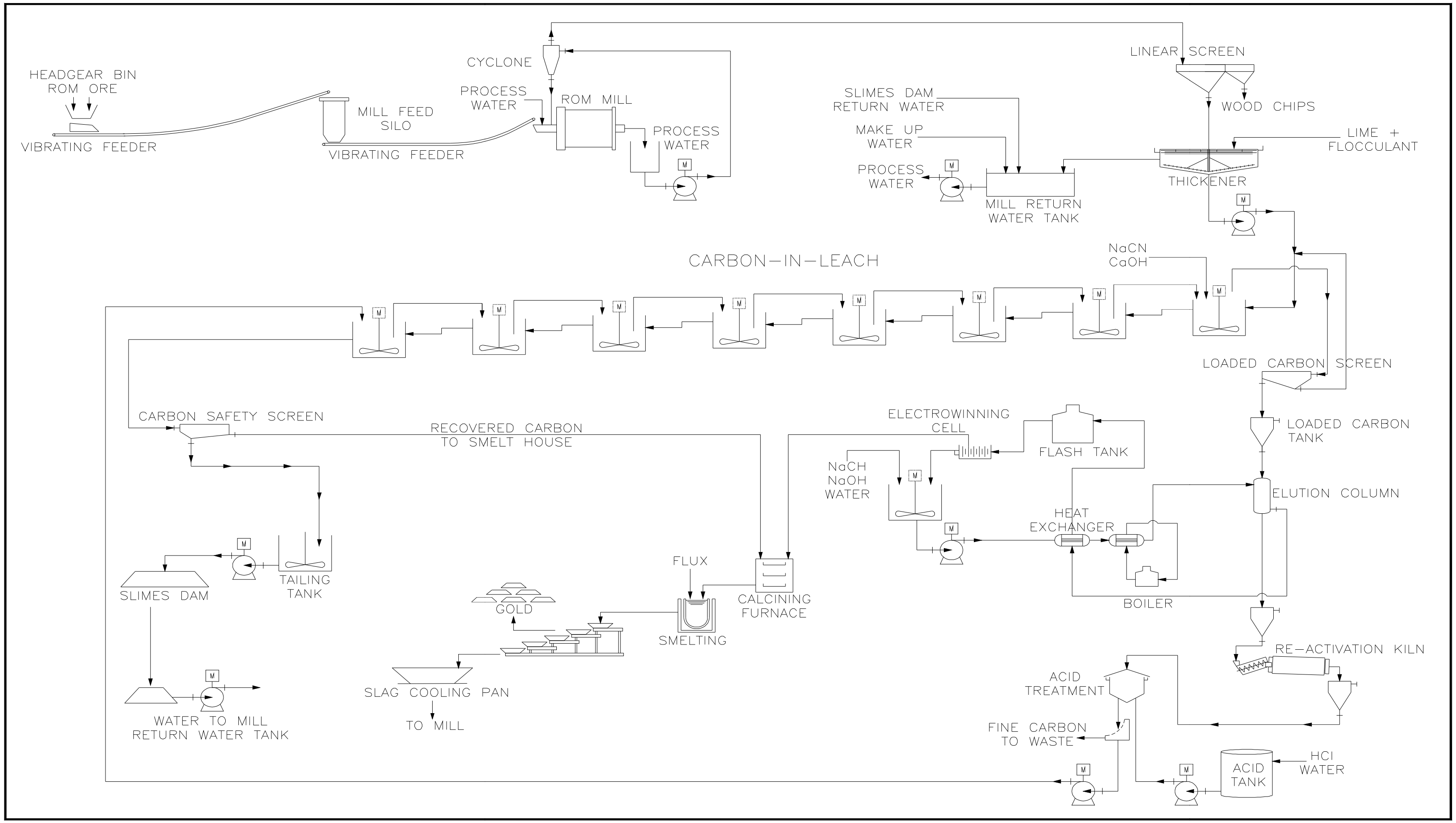
The Zadra process is considered to be simpler to operate than the AARL process, so the Zadra process has been selected for the DBM plant.

In the electrowinning cells, the gold is plated onto steel wool cathodes. Once electroplating is complete, the cathodes are removed from the cells, washed and calcined in a furnace. The product from calcining is then mixed with fluxes and smelted, to produce gold bullion bars containing approximately 90% gold. The slag resulting from smelting is crushed, milled and tabled on a gravity table to recover any gold prills from the slag. The gold concentrate is added to the smelt, while the slag is returned to the plant ROM mill.

Once the elution process is complete, the eluted carbon is washed and transferred to the regeneration kiln feed tank. The carbon is fed into the regeneration kiln. At a temperature of 750°C any volatile organic matter is distilled from the carbon. This process reactivates the carbon. The carbon exits the kiln into a quench tank. From the quench tank the carbon is screened to remove fines, and is then acid treated with dilute hydrochloric acid to dissolve any calcium and base metals which have adsorbed onto the carbon during the gold adsorption process. The acid washed regenerated carbon is then washed to remove residual traces of acid and returned to the last CIL tank for the adsorption process to be repeated. A quantity of fresh activated carbon needs to be added to the plant on a regular basis to make up for carbon losses caused by abrasion of the carbon in the CIL agitators and pumps. Fresh carbon, receive in bulk bags, is poured into an agitated tank to which water has been added. The carbon is agitated in the tank to remove the rough edges on the carbon particles. If this is not carried out, these rough edges will be abraded off shortly after the carbon has been added to the CIL tanks and will leave the CIL tanks in the tailings, but having adsorbed some gold, resulting in gold losses.

The pulp passes from tank to tank down the CIL train of tanks, counter currently to the carbon. When the pulp exits the last CIL tank, it passes to the carbon safety screen. Here the pulp passes through the screen to the cyanide detoxification tanks, and any carbon particles that have passed through the last interstage screen due to a hole in the screen will be recovered on the safety screen. This recovered carbon will either be smelted or sent to a by-product smelter to recover contained gold.

The CIL tailings then passes to the tailings tank prior to be pumped to the tailings dam. On the tailings dam, water is recovered through a penstock system and flows to the return water dam, from where it is pumped back to the plant for re-use.



(Figure not to scale. Please refer to Appendix A for the A3 figure.)

Figure 2.9: Proposed plant flowsheet

2.5 Plant Equipment Selection

2.5.1 Mill Feed Silos

The mill feed silos were selected on the basis of providing 24 hours of live ore capacity each. This may need to be changed if the mining operation dictates otherwise.

2.5.2 Thickener

The plants designed in the 1990's and before made use of conventional large diameter low settling rate thickeners. Since then, high rate thickeners have become the norm on most metallurgical plants. High rate thickeners make use of water dilution and a flocculant addition to assist settling of the solids in the pulp. A linear screen will be used on the thickener feed to remove woodchips, pieces of plastic and other tramp material.

2.5.3 Elution, Regeneration, Acid Washing, Electrowinning and Smelting

There are a number of companies that supply standardised elution, regeneration and acid washing plants, based on a set of design parameters provided by the client. The main design inputs for such a plant is the process route required, the tonnage of loaded carbon to be eluted daily and the gold content. The electrowinning and smelting is also designed on a similar basis.

2.5.4 Cyanide Destruction in Tailings

There is some uncertainty over the requirements of the South African Environmental Authorities regarding the disposal of gold plant tailings containing cyanide. This project will be depositing the gold plant tailings on the existing permitted Merriespruit tailings dam. It is therefore unlikely that there will be a requirement to destroy the cyanide in the tailings prior to deposition on the tailings dam. On this basis the tankage and agitators required for cyanide destruction have been excluded from the plant design.

2.5.5 Analytical Laboratory

The laboratory will provide an analytical service for samples from the plant, underground, geology and the environmental department.

The current trend in the industry is to contract out the chemical analysis function to an outside laboratory. Discussions with SGS Laboratories indicated that they offer two options. In both cases the mine provides a laboratory building. SGS will either provide all of the equipment in the laboratory and charge a monthly fee which covers amortisation of the equipment (over a period of 3 or 5 years) and the monthly operating cost, or the mine will purchase the equipment (from a schedule provided by SGS) on capital expenditure and pay a monthly operating cost. There would be an option where the mine could take over operation of the laboratory after 3 or 5 years. In this study, it has been assumed that the mine would purchase the equipment and pay a monthly fee to cover the operating costs of the laboratory.

2.6 Transportation

2.6.1 Mine Logistics

2.6.1.1 Employees

Employees will be transported from surface to underground via a vertical shaft which accesses the reef sub-crop position approximately 500 m below surface.

During early mining when working places are relatively close to the shaft, personnel will either travel on foot or be transported via man transporters to their designated working place.

As the workings become more remote from the vertical shaft inter-level raises will be developed and chairlifts will be installed for the transport of men.

2.6.1.2 Material

Materials will be loaded into materials cassettes or pallets for transport underground. This will be done at the surface stores yard where there will also be a marshalling area. These cassettes and pallets will then be loaded into the shaft conveyance for transport underground. At the shaft bottom the cassettes and pallets will be collected by trackless flatbed units for transport directly to the appropriate working place.

Empty cassettes and pallets will be taken out in a similar manner and delivered back to the stores yard on surface.

2.7 Solid Waste (Domestic, Industrial and Hazardous)

2.7.1 Waste Handling

Domestic and hazardous industrial waste is to be disposed of off-site.

Domestic waste will be disposed of by an appointed contractor who shall be responsible for the collection and legal disposal of all domestic waste at an approved site.

Hazardous waste will be disposed of off-site. A suitable contractor will be appointed to regularly load the hazardous waste from a dedicated site on-mine, and transport it to a legally compliant disposal facility. The waste will need to be stored in sealed drums temporarily, before being transported away for disposal. This will require a temporary storage facility on-site. The on-site facility is bunded so that any spillage that occurs is contained within the bunded area. A wash facility is also provided for to wash the materials salvaged from underground of any contaminated dust before they can be handled further.

A bioremediation site has also been allowed for in order to rehabilitate soil contaminated by hydrocarbons through mining activities.

The infrastructure is required in the first year of the project.

2.7.2 Tailings Storage Facility (TSF)

Thickened slurry will be discharged through day and night delivery stations in order to form beaches that slope downwards away from the day walls. This will create top surface geometries that will result in supernatant pools that are maintained in the immediate vicinity of the penstock intake towers. An average beach angle of approximately 0.5% is expected for the segregated tailings material. The supernatant will be decanted from the top surfaces of the compartments because retained water could:

- Reduce the freeboard and the storm water storage capacity, and so increase the potential for overtopping.
- Increase the potential for slurry flows in the event of a breach.
- Increase the hydraulic gradient of seepage and pore water pressures, which could lead to lower factors of safety for side slope stability.
- Inhibit consolidation and so reduce the strength and storage capacity of the facility.

- Increase water losses through evaporation and seepage and so increase the environmental impacts on water consumption and groundwater.

In view of the above, it is strongly recommended that decant return should be maximized at all times in order to ensure minimum storage of supernatant. Excess water will therefore only be temporarily stored during high rainfall periods.

The consolidation of the tailings is important in enhancing stability and reducing the probability of a flow failure should structural instability occur. It also ensures the best utilisation of the volume capacity by increasing the stored tons of tailings per cubic metre. The expected low permeability of the non-segregated tailings material implies that there will be virtually no drainage of entrained water by normal consolidation processes during the life of the facility. The effective operation of the facility therefore depends on the consolidation of the tailings by drying, which is a very efficient method. The drying consolidation of the tailings can be inhibited by several factors:

- A large decant pool, preventing drying in the supernatant pool area.
- Concentrated deposition in one area.
- Low slurry densities.
- High rainfall periods.
- High rates of rise.

It is considered that these problems can be overcome by good operation management practice (i.e. thin layer deposition through the implementation of optimised tipping cycles etc.).

2.8 Water Management and Supply

The surface infrastructure for the mine, including the water systems, was planned by Turgis Mining Consultants (Turgis Mining Consultants, 2012). The Turgis information was used extensively in the Conceptual Storm Water Management Plan as well as the water and salt balance conducted by GCS (Pty) Ltd.

2.8.1 Clean and Dirty Water and Storm Water Processes

Storm water control measures will be constructed and implemented within the proposed project area. All the storm water control measures will adhere to the following minimum standards:

- All clean water systems will be designed and operated in such a manner that they are at all times capable of handling the 1:50 year flood event on top of their mean operation level without spilling;
- Any water arising from an area, which causes, has caused or is likely to cause pollution of a water resource, including polluted storm water, must be contained within a dirty water system. In order to reduce the volume of polluted water, contaminated areas should be minimised. While clean water should be diverted to natural water courses, polluted water should be re-used wherever possible, thereby reducing the use of clean water; and
- All dams and/or discard facilities that form part of the dirty water system will be designed, constructed, maintained and operated to have a minimum freeboard of 0.8 m above full supply level.

2.8.2 Design of the Pollution Control Dam

Any dam which contains dirty water runoff should be appropriately lined to ensure that contaminants do not seep into the ground and pollute surface or groundwater resources. As mentioned previously, in this case the Mine has opted to treat contaminated runoff and to then discharge the treated water into the environment. This has significantly decreased the storage capacity required for a Pollution Control Dam.

2.8.2.1 PCD Simulation

According to the Turgis Report (Turgis Mining Consultants, 2012), the proposed PCD was designed for a peak 1:50 year 24 hour storm event. GCS simulated a water balance around the storage volume as proposed by Turgis (68 Ml) to ensure that storm peaks, combined with the operational philosophy as proposed by Turgis, will not result in any spills from this facility more than once, on average, in 50 years.

In this water balance simulation, two scenarios were assumed. The first scenario assumed that the stormwater dams (Pollution Control Dam (PCD)) volume is fixed at 68 000 m^3 and calculates the treatment capacity required to ensure that the PCD does not spill more than once, on average, in 50 years while also taking into account operational treatment requirements.

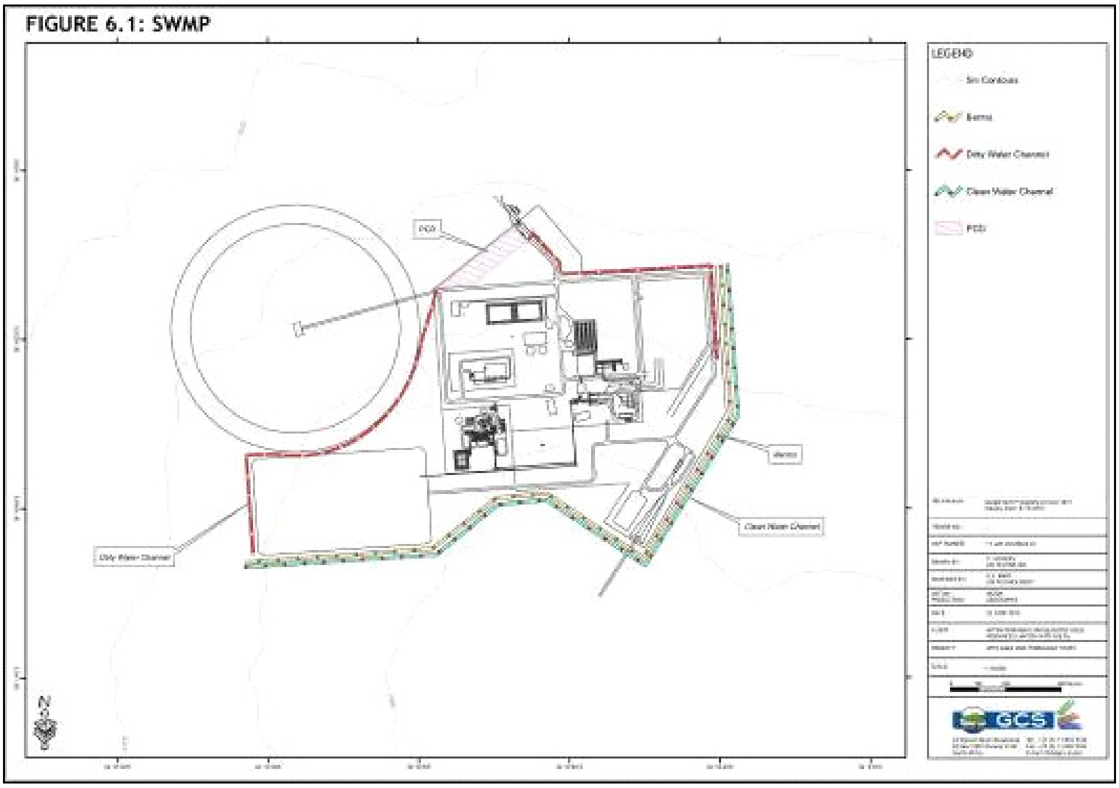
The second scenario assumes that the PCD volume could be adjusted in order to ensure that the treatment requirements can be limited as far as possible. The second scenario will therefore attempt to ensure that larger runoff events could be more effectively balanced; ensuring reduced operational costs from a smaller treatment works.

The following assumptions apply to both scenarios:

- Dirty water catchment of 120 ha;
- Runoff as calculating using WR2005 rainfall data and runoff simulation;
- An additional 139,000m3/month treatment capacity from excess water from mining processes, over and above the treatment capacity required for stormwater handling;
- Monthly evaporation figures as given in the hydrology section were used to calculate average monthly evaporation from the PCD surface area;
- An average depth of 2 m was assumed for the PCD;
- Rainfall directly onto the PCD surface area was taken into account; and
- Dust suppression of 12,000m3/month from the PCD was assumed.

2.8.3 Storm Water Drainage

Figure 2.10 shows the conceptual locations for the clean water diversion channels, the clean water diversion berms and the dirty water channels. The proposed infrastructure must be designed by a registered Engineer.



(Figure not to scale. Please refer to Appendix A for the A3 figure.)

Figure 2.10: Storm water management system

Storm water run-off from other areas apart from the ones described in the above section constitutes clean storm water. Clean water run-off will be diverted around the dirty water

areas by means of berms and diversion drains. The water will end up in natural water courses around the area. An allowance has been made for the berms and drains.
The infrastructure is required in the first year of the project.

2.8.4 Sewage Treatment Plant

The sewage treatment plant proposed is a self contained vendor supplied system designed to handle raw sewage generated by about 3,300 people, at a maximum flow rate of about 600 kl per day at the steady state operation of the mine. The plant will be installed in three modules of 200 kl per day each to allow phasing in as the mine ramps up to full production. Effluent will be treated to DWA standards for use as irrigation water for the gardens around the site. Treated humus will be drawn out of the humus tank (once per year) and be transported to the nearest municipality sewage treatment works for disposal, by arrangement.

Sewerage pipes will be PVC and will be buried about 1 m below ground to protect them from inadvertent damage and ultraviolet light. PVC pipes are more cost effective than steel pipes. As the site is fairly flat raw sewage from areas where it cannot flow by gravity will be pumped to the treatment plant. Provision has been made in the costs for transfer pump stations.

The first of the three modules will be installed in Year 1 and the second one in Year 5 and the final one in Year 7.

2.8.5 Potable and Process Water Supply

2.8.5.1 Potable Supply

The potable water usage was estimated at 202 Ml per month, made up of 65 Ml for domestic use and 137 Ml for the Ice Plant. A cost provision based on a quotation received from the municipality was made for the connection.

Water will be stored in three 2.4 Ml tanks (about a day’s consumption), located north of the shaft. The tanks are of galvanised steel construction, mounted on concrete pads. These can be translocated at mine closure.

One tank is required in Year 1, the next in Year 6 and the third in Year 7.

2.8.5.2 Process Water Supply

Clarified water excess to the requirements of the underground workings will be pumped to an excess water transfer tank on surface, and distributed to the plant. Water not required for the plant will be treated to potable water quality for use on the mine. Any excess water after treatment will be discharged into natural water courses.

The residue (Brine) will be stored in 6 x dams, specially constructed and triple lined to prevent seepage of contaminated water into the ground water table.

Two dams are required in Year 1, the next two in Year 8 and the third pair in Year 15.

The schematic in **Figure 2.11** shows the proposed water reticulation.

2.8.6 Tailings Storage Facility (TSF)

2.8.6.1 Decant System

The penstocks are sized to remove the runoff generated by a 50-year, 24-hour design storm in less than 3 days. This is to minimise the time that a large pool is stored on the tailings storage facility basins. The storm water volume generated during a 50-year, 24-hour storm event is approximately 111 000 m^3, which can be split as follows:

- Compartment 5A: 45 000 m3;
- Compartment 5B-1: 33 000 m3; and
- Compartment 5B-2: 33 000 m3.

Compartment 5A requires a penstock capable of decanting 15 050 m^3/day, or 627 m^3/h, assuming a 24-hour decanting day. Two 510 mm diameter penstock intakes and a 500 mm ID outlet pipe will have sufficient capacity to decant this volume. This will ensure that the pool volume rarely exceeds 50 000 m^3 provided that the penstock is operated to the design intent. By inference, the same penstock arrangement will suffice for the two 5B compartments.

2.8.6.2 Water Storage System

The return water dam receives decant water from the tailings storage facility. Clean storm water diversion trenches are assumed to divert clean storm runoff around the return water dam.

The water balance is a deficit water balance. As a result negligible storage occurs in the return water dam, as most inflows are consumed during the month. However, it should be noted that while negligible storage occurs on a monthly time step, significant storage could occur within the month. The return water dam must comply with Government Notice 704 of the South African National Water Act, Act 36 of 1998. The dam sizing methodology was based on the principle that the dam needs to accommodate the greater of:

- Runoff generated from a 50-year, 24 hour rainfall event, or
- The excess water resulting from a long-term monthly water balance.

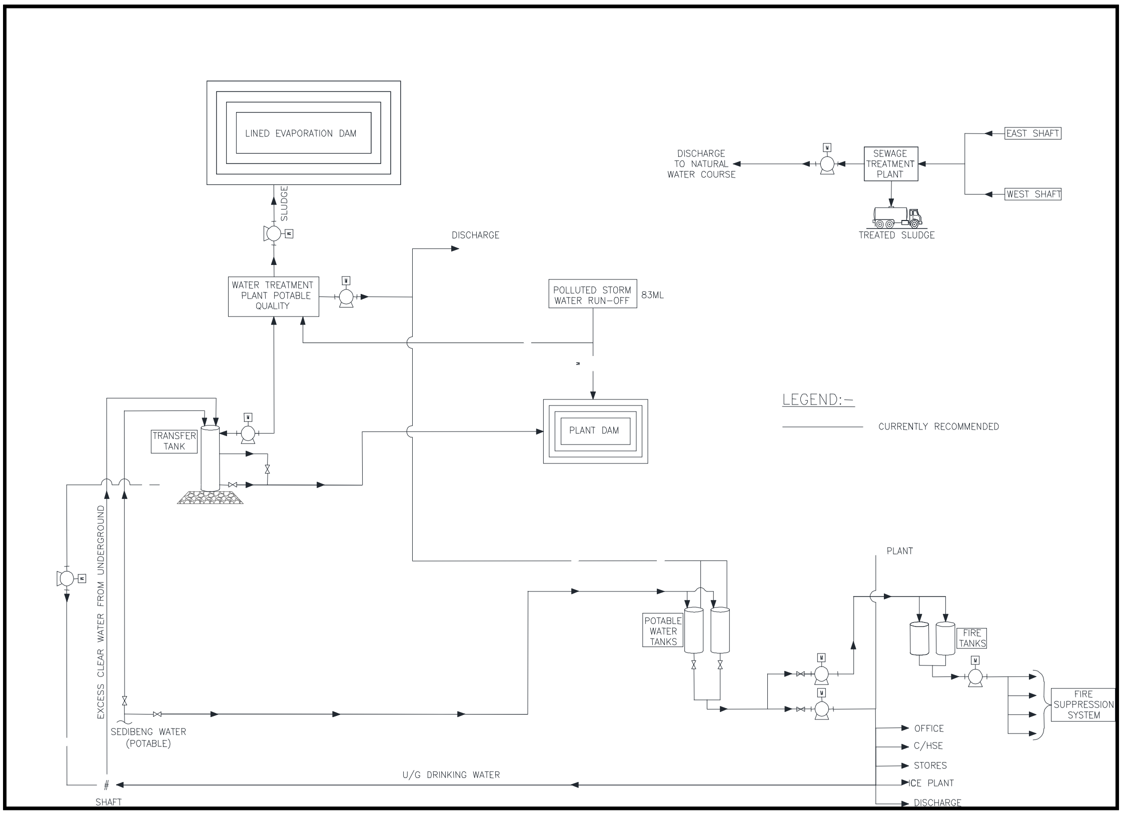
In view of the above, it is concluded that the return water dam should be sized for the 1 in 50 year, 24 hour storm event with an associated capacity of at least 111 000 m^3.

2.8.6.3 Water Return System

The water return system should be sized to return 100% of the slurry water requirement. This is 120 000 m^3/month or 3 943 m^3/day. Assuming a 22-hour pumping day, this equates to 179 m^3/hour.

2.9 Water Balance

Information for the Water and Salt balances was mainly sourced from the Turgis report and diagrams (Turgis Mining Consultants, 2012) as well as further spreadsheets with preliminary water balances as also supplied by Turgis. **Figure 2.10** below shows the process flow diagram as supplied by Turgis in their report.



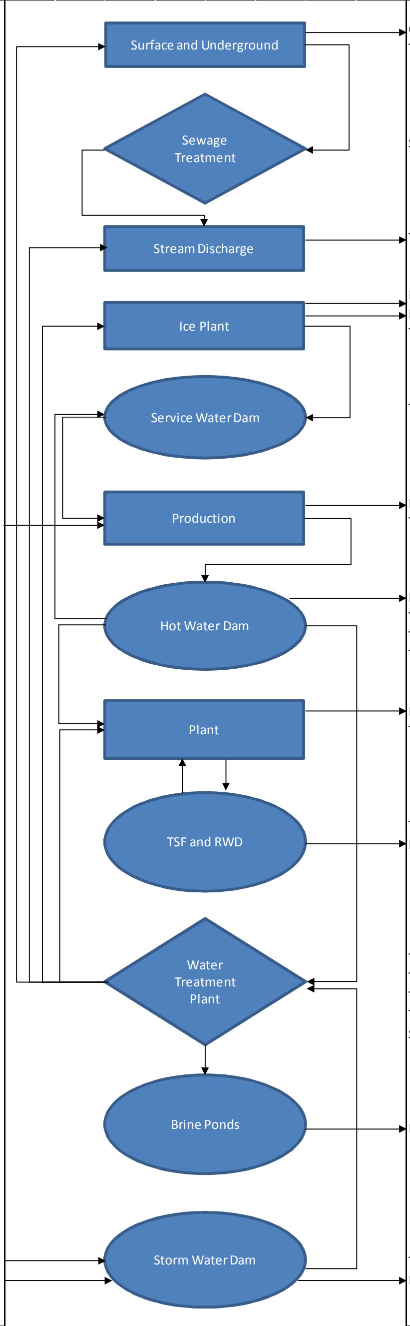
(Figure not to scale. Please refer to Appendix A for the A3 figure.)

Figure 2.11: Water reticulation diagram

Refer to **Figure 2.12** and **Figure 2.13** for the proposed wet and dry water balances for the SOFS (Phase 1 DBM project) Mining Operation.

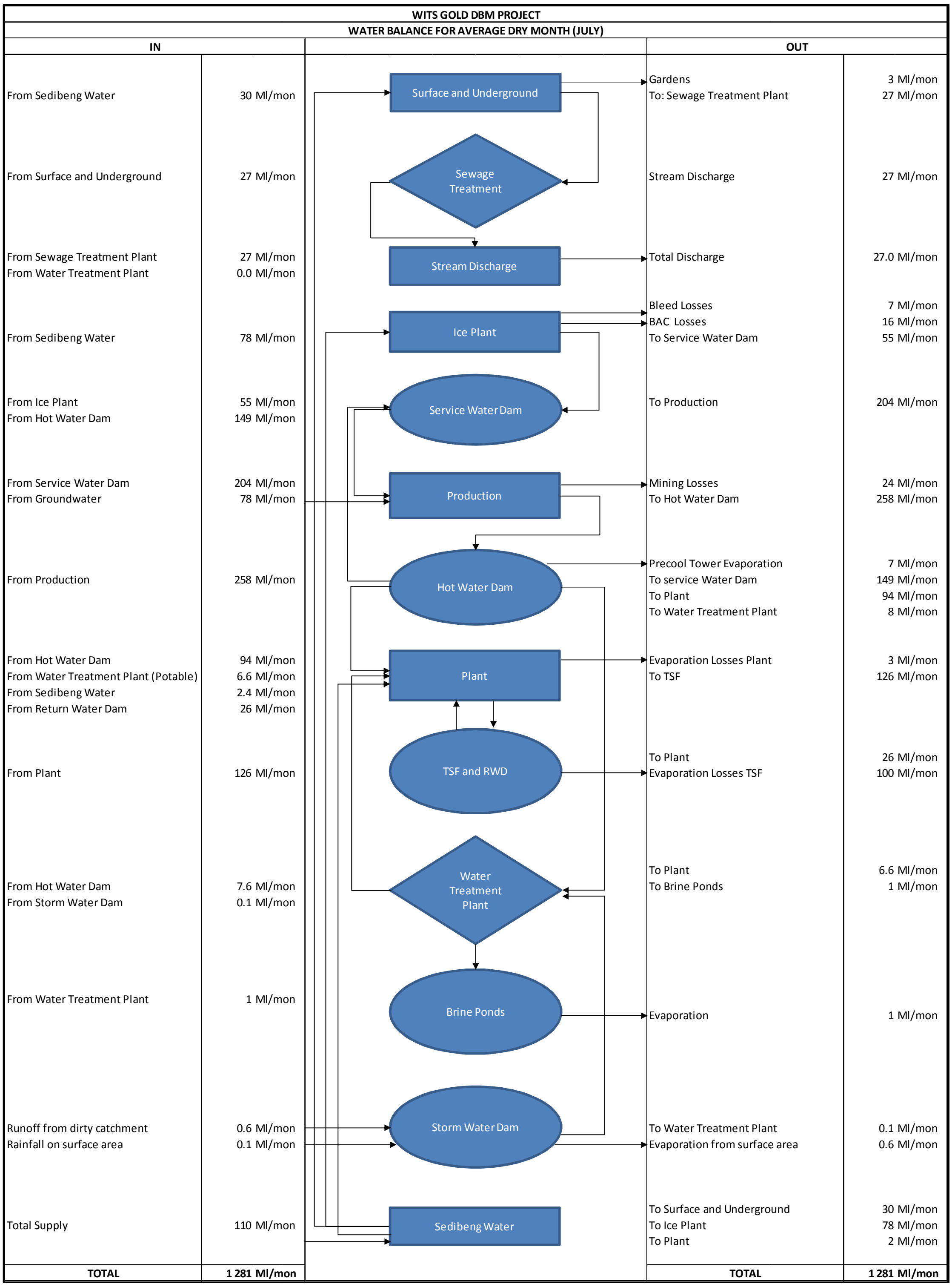
WITS GOLD DBM PROJECT
WATER BALANCE FOR AVERAGE WET MONTH (JANUARY)

IN		OUT	
From Water Treatment Plant (Potable)	30 Ml/mon	Gardens To: Sewage Treatment Plant	3 Ml/mon 27 Ml/mon
From Surface and Underground	27 Ml/mon	Stream Discharge	27 Ml/mon
From Sewage Treatment Plant From Water Treatment Plant	27 Ml/mon 8.9 Ml/mon	Total Discharge	35.9 Ml/mon
From Water treatment Plant (Potable)	78 Ml/mon	Bleed Losses BAC Losses To Service Water Dam	7 Ml/mon 16 Ml/mon 55 Ml/mon
From Ice Plant From Hot Water Dam	55 Ml/mon 149 Ml/mon	To Production	204 Ml/mon
From Service Water Dam From Groundwater	204 Ml/mon 189 Ml/mon	Mining Losses To Hot Water Dam	24 Ml/mon 369 Ml/mon
From Production	369 Ml/mon	Precool Tower Evaporation To service Water Dam To Plant To Water Treatment Plant	7 Ml/mon 149 Ml/mon 74 Ml/mon 139 Ml/mon
From Hot Water Dam From Water Treatment Plant (Potable) From Return Water Dam	74 Ml/mon 5 Ml/mon 44 Ml/mon	Evaporation Losses Plant To TSF	3 Ml/mon 120 Ml/mon
From Plant	120 Ml/mon	To Plant Evaporation Losses TSF	44 Ml/mon 76 Ml/mon
From Hot Water Dam From Storm Water Dam	139 Ml/mon 4.9 Ml/mon	To Plant To Surface and Underground To Ice Plant To Brine Ponds Stream Discharge	5 Ml/mon 30 Ml/mon 78 Ml/mon 22 Ml/mon 8.9 Ml/mon
From Water Treatment Plant	22 Ml/mon	Evaporation	22 Ml/mon
Runoff from dirty catchment Rainfall on surface area	5.5 Ml/mon 0.6 Ml/mon	To Water Treatment Plant Evaporation from surface area	4.9 Ml/mon 1.1 Ml/mon
TOTAL	**1 552 Ml/mon**	**TOTAL**	**1 552 Ml/mon**



(Figure not to scale. Please refer to Appendix A for the A3 figure.)

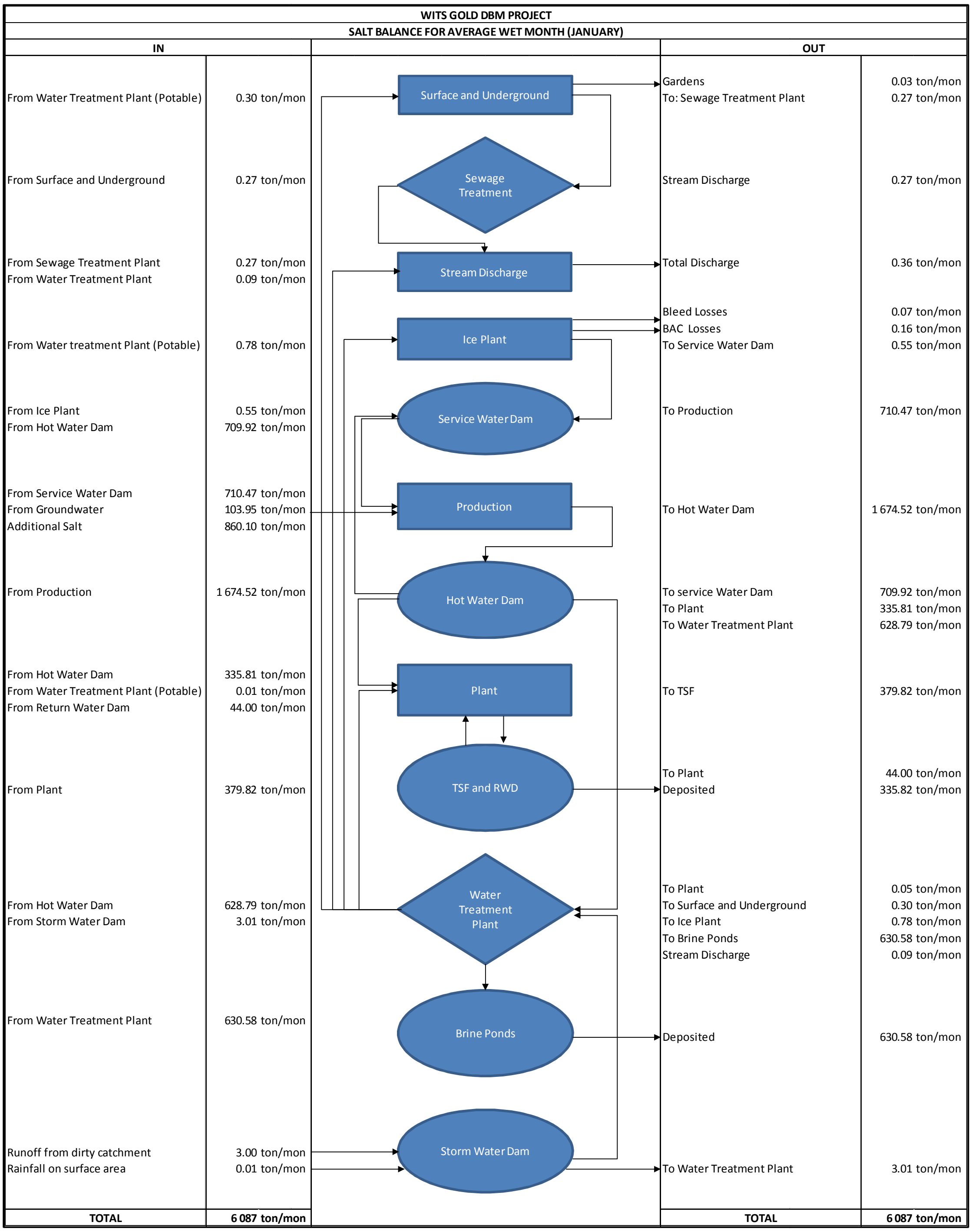
Figure 2.12: Proposed wet water balance



(Figure not to scale. Please refer to Appendix A for the A3 figure.)

Figure 2.13: Proposed dry water balance

Refer to **Figure 2.14** and **Figure 2.15** for the proposed wet and dry salt balances for the SOFS (Phase 1 DBM project) Mining Operation.



(Figure not to scale. Please refer to Appendix A for the A3 figure.)

Figure 2.14: Proposed wet salt balance

WITS GOLD DBM PROJECT				
SALT BALANCE FOR AVERAGE DRY MONTH (JULY)				
IN			OUT	
From Sedibeng Water	0.30 ton/mon	Surface and Underground	Gardens To: Sewage Treatment Plant	0.03 ton/mon 0.27 ton/mon
From Surface and Underground	0.27 ton/mon	Sewage Treatment	Stream Discharge	0.27 ton/mon
From Sewage Treatment Plant From Water Treatment Plant	0.27 ton/mon 0.00 ton/mon	Stream Discharge	Total Discharge	0.27 ton/mon
From Sedibeng Water	0.78 ton/mon	Ice Plant	Bleed Losses BAC Losses To Service Water Dam	0.07 ton/mon 0.16 ton/mon 0.55 ton/mon
From Ice Plant From Hot Water Dam	0.55 ton/mon 709.92 ton/mon	Service Water Dam	To Production	710.47 ton/mon
From Service Water Dam From Groundwater Add Salt	710.47 ton/mon 42.90 ton/mon 417.43 ton/mon	Production	To Hot Water Dam	1 170.80 ton/mon
From Production	1 170.80 ton/mon	Hot Water Dam	To service Water Dam To Plant To Water Treatment Plant	709.92 ton/mon 426.57 ton/mon 34.31 ton/mon
From Hot Water Dam From Water Treatment Plant (Potable) From Sedibeng Water From Return Water Dam	426.57 ton/mon 0.07 ton/mon 0.02 ton/mon 26.40 ton/mon	Plant	To TSF	453.06 ton/mon
From Plant	453.06 ton/mon	TSF and RWD	To Plant Deposited	26.40 ton/mon 426.66 ton/mon
From Hot Water Dam From Storm Water Dam	34.31 ton/mon 0.33 ton/mon	Water Treatment Plant	To Plant To Brine Ponds	0.07 ton/mon 34.57 ton/mon
From Water Treatment Plant	34.57 ton/mon	Brine Ponds	Deposited	34.57 ton/mon
Runoff from dirty catchment Rainfall on surface area	0.33 ton/mon 0.00 ton/mon	Storm Water Dam	To Water Treatment Plant	0.33 ton/mon
Total Supply	1.10 ton/mon	Sedibeng Water	To Surface and Underground To Ice Plant To Plant	0.30 ton/mon 0.78 ton/mon 0.02 ton/mon
TOTAL	**4 031 ton/mon**		**TOTAL**	**4 031 ton/mon**

(Figure not to scale. Please refer to Appendix A for the A3 figure.)

Figure 2.15: Proposed dry salt balance

2.10 Project Planning Phases and Associated Activities

2.10.1 Construction Phase

The following activities are proposed:

- Construction of service roads;
- Construction of power lines where necessary;
- Construction of access roads where necessary;
- Water pollution control structures;
- Construction of shaft access;
- Construction of ancillary infrastructure; and
- Clean and dirty water infrastructure.

During the construction phase, the following activities could impact on the bio-physical environment and the cultural/social setting:

- Stripping of vegetation;
- Stripping of topsoil and subsoil as the construction activities start on site;
- Impact on water system and associated wetlands due to the construction activities;
- Construction of the clean and dirty water systems;
- Possible compaction of soils by the establishment of topsoil stockpiles and berms; and
- Dust dispersion from infrastructure construction and boxcut construction activities.

2.10.2 Operational Phase

During the operational phase, the following activities could impact on the bio-physical environment and the cultural/social setting:

- Underground Mining Activities;
- Possible compaction of soils and erosion of soil stockpiles and berms by wind and water;
- Impact on surface- and groundwater system due to the operational activities;
- Dust dispersion from workings;
- Clean and dirty water control and maintenance;
- Sewage management; and
- Ancillary activities (workshops, offices, etc) .

2.10.3 Decommissioning and Closure Phase

When the decision is taken to decommission the mine, the following objectives and proposed actions for the decommissioning and closure phase of the mine could be considered depending on the outcomes of the EIA and draft EMP:

- Recovery of all saleable infrastructure;
- Demolition of structures;
- Ripping of all compacted areas, which will be followed with amelioration and vegetation;
- Ensure that all remaining dumps, piles and slopes are sufficiently shaped to blend in with the surrounding infrastructure;
- Amelioration and vegetation of all disturbed areas;
- Maintenance of all re-vegetated areas up until such areas initiate succession and create a sustainable cover;
- Monitoring of key environmental variables (i.e. soils, vegetation, groundwater and
- surface water) in order to demonstrate stability of rehabilitated areas;
- Weed management after closure, limited to areas disturbed by mining or included in the mining area.
- Monitoring will be undertaken for a specific period after closure or up until such time that all areas create a sustainable cover and ecosystem.

3 PROJECT ALTERNATIVES

A number of alternative options have been evaluated during the mine design. A high-level qualitative risk assessment was performed to determine the most preferred option from an environmental perspective.

3.1 Mining Methodology

3.1.1 Tailings Facility Site Alternatives

At the onset of the environmental impact assessment process, the EAP was advised that a Greenfields TSF site would be located within the proposed infrastructure footprint area. The option to switch from the proposed Greenfields TSF option to that of a Brownfields TSF option occurred after consultation between the applicant and the current owner of the Brownfields TSF site. Due to the nature of this project it was anticipated that the potential impacts associated with the Greenfields TSF site would be more significant than that of the Brownfields TSF site and for that reason the Brownfields TSF site was deemed the preferred option. Further discussion on the Greenfields and Brownfields sites (Figure 3.1) are included in the sections that follow.

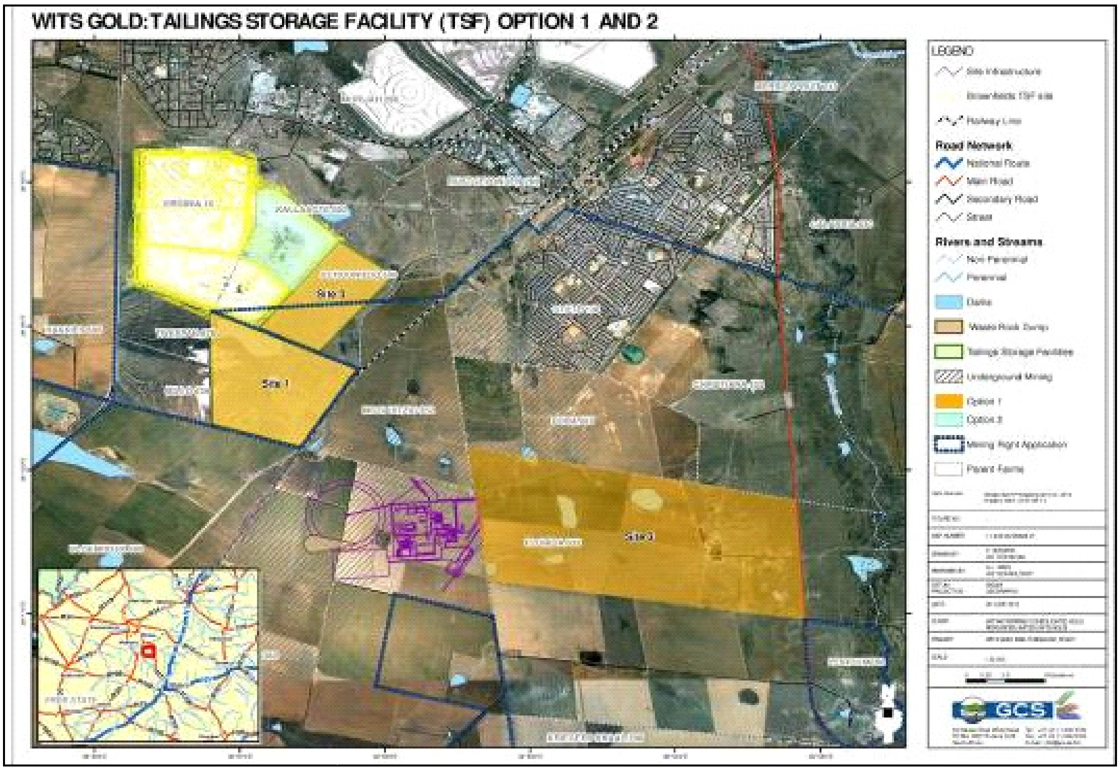
3.1.1.1 Option One (Greenfield Options Site 1-3)

This area is adjacent to Merriespruit tailings dam - No agricultural activities in the form of cultivation is taking place on the land, however the area is used for livestock grazing. Proximity to Meloding township and the influence of dust and noise remains the most compromising factors.

3.1.1.2 Option Two – Preferred (Brownfields Site)

The area is highly disturbed and does not reflect any agricultural and natural land use. The area is furthest from Meloding township and social receptors. Current land use comprises a highly disturbed historical mining area thereby rendering it most suitable for a tailings dam facility (Refer to Appendix J).

The existing rehabilitation liabilities associated with the Brownfields TSF site will be taken over by the applicant, if agreement to make use of this site is reached. This will only be undertaken after a full assessment of the current rehabilitation liabilities pertaining to the Brownfields TSF site has been undertaken by an independent assessor and a full reconciliation of the fund completed.



(Figure not to scale. Please refer to Appendix A for the A3 figure.)

Figure 3.1: Tailings Storage Facility (TSF) Option 1 and 2

3.2 Land Use Alternatives

Primarily the mine project infrastructure area is utilized for agricultural purposes in the form of dry-land, livestock, maize, sunflower and wheat farming. The area of the preferred tailings dam site (Option 2) has been previously utilized for mining purposes. The alternative area (Option 1) is barren natural land, adjacent to Harmony's Merriespruit tailings dam. Land use has been taken into account.

3.3 Benefits of the Project

Following initial consultation with the Matjhabeng and Masilonyana Local Municipalities, regarding needs and priorities, as identified by their Integrated Development Plans (IDPs), the following projects were put forward as requiring further investigation:

- Virginia Farm; and
- Tikwe Lodge to be turned into Eco Tourism, Events Hosting and Agricultural Training.

Wits Gold has also investigated the possibility of taking over certain SLP projects that are currently being phased out by Harmony Gold (Appendix J) and the Beatrix operations of Gold Fields.

The DMR has offered to co-ordinate the prioritisation of Local Economic Development (LED) projects with Wits Gold, the relevant municipalities and existing mines in the area. The DMR further requested that additional projects be identified based on new IDP documents that are being finalised by the abovementioned Local Municipailities. Meetings have been initiated with the Matjhabeng Municipality for discussions based on their recently released draft IDP document for the 2012-2016 period.

Once the DMR has, in principle, approved of the proposed Local Economic Development (LED) projects, further consultation with the Local Municipalities and relevant stakeholders will take place to finalise the project implementation requirements as well as the way forward once the Mining Right has been granted.

3.3.1 Small, Micro and Medium Enterprises (SMME) development

Wits Gold will contribute towards mine community economic development by using available Black Economic Empowerment (BEE) compliant companies for the provision of goods and services to the mine. Wits Gold is committed to awarding procurement contracts to local companies which demonstrate suitable Historically Disadvantaged South Africans (HDSAs) participation in Management (and general employment) as well as local companies in order to sustain the local economy of the area.

Wits Gold intends to support Small, Micro and Medium Enterprises (SMMEs), where possible, which will be able to provide them with the relevant services. These SMMEs will be appointed on a contractual basis, on the condition that their services are relevant and the quality thereof, acceptable.

3.3.2 Housing and living conditions

In order to reduce single sex accommodation and to prevent the establishment of hostel accommodation, Wits Gold proposes to use local labour to construct houses on available land for purchase by the mine’s employees. Housing allowances will be provided to staff and local housing within the towns of Virginia, Theunissen, Meloding and Welkom will be used as far as possible.

The Applicant will promote home ownership; therefore employees will be afforded the opportunity to participate in wealth accumulation through the ownership of property. It is believed that this will in the long term ensure that housing is sustainable even after mine closure. The Company will facilitate housing development in the host municipality area to ensure adequate and acceptable housing and living conditions of the employees. It is believed that this will build a sustainable economy and quality of life of the host community through integration of employees housing needs into the host municipality's housing and settlement plans.

The Company aims to improve the quality of life of all employees and restore the self-respect and dignity of employees in line with the Mining Charter and the aspirations of employees through:

- Conducting individual assessments with employees to determine their current and aspired housing conditions;
- Encouraging employees to take home ownership in existing sustainable areas;
- Establishing an open communication process whereby employees may communicate any problems and suggestions with regards to their housing needs;
- Facilitating the development of housing options that will accommodate employees housing needs;
- Providing programmes to educate employees with regard to home ownership and budgeting; and
- Facilitating private investment from developers and/or banks for home owners.

Provision will be made for a R 10,000,000.00 investment over 5 years to improve on the housing conditions of mine workers.

3.3.2.1 Nutrition

In order to ensure that employees are aware of the advantages of a balanced diet, nutrition awareness will be promoted through a Wellness Programme.

The Company will adopt a comprehensive approach to address nutrition and this will be addressed in the employee Wellness Programme, which will be developed as part of the implementation plan of the Social and Labour Plan (SLP). It is envisaged that the employee Wellness Programme will enhance the standard of living of all employees.

The employee Wellness Programme will focus on:

- Nutrition, where staff will be advised on healthier eating habits which will include:

  - Measures to improve nutrition, which will be done in accordance with the standards set out by the Chamber of Mines of South African Health Standards Authorities;
  - Inducting and informing all employees on the National food based dietary guidelines. The intention will be that employees themselves acknowledge that each one has a role to be conscious of healthy eating habits;
- Educating employees and their families with regard to nutrition and wellness programmes with emphasis on HIV/AIDS and Tuberculosis, and provide information on common injuries that cause back pains;
- Wellness workshops which will include nutrition, exercise, stress management etc;
- Wellness incentive programme: Reward employees for making positive choices; and
- Providing health supplements to employees.

The Company will retain the services of a specialist healthcare services provider in order to compile a comprehensive wellness strategy which will integrate with community health issues. The strategy will include a health improvement programme that will address nutritional wellness, body wellness, emotional wellness and social issues.

3.4 No-Go Principle

If the no-go principle were applied, then the area in which the proposed SOFS Phase 1 (DBM Project) Mining Operation is located would continue with the land use and activities that are currently in place, namely commercial agriculture activities. The potential job creation benefit of the project (±1,635 jobs over the life of mine) would not materialise and the opportunity to employ women in mining, as per the requirements of the MPRDA, would also not occur. In addition the potential loss of contribution to economic development in the project area as well as compliance with the regions IDP, based on the SLP developed for the project, would be limited.

The no-go option would ensure that there would be significantly less environmental impacts in the area as a result of mining operations. Impacts would only be related to the existing mining operations within the Virginia area, specifically the Harmony gold mining operation located to the north west of the proposed project area. In addition to this, the existing Harmony Merriespruit TSF would remain as is, with minimal rehabilitation potential.

The continuation of commercial agriculture activities, as are currently taking place, would ensure that the current status quo in terms of revenue, economic contributions, employment and housing would continue. The potential expansion of these commercial agriculture enterprises would be limited to the areas currently being used specifically since the establishment of informal housing within the area is already evident.

If mining was not undertaken in the project area, the area could be utilised for housing developments and, potentially, other small, medium and large scale commercial opportunities. Alternatively, small-scale agricultural developments could take place (i.e. crop and livestock farming).

4 DETAILED ENVIRONMENTAL DESCRIPTION

This section of the report provides a summarised description of the environment as obtained from specialist investigations commissioned by GCS in 2012 (Appendix D). The information plays an important role in identifying the significance of the potential impacts which may occur as a result of the project.

4.1 Geology

The geological description was obtained from the Geohydrological study dated May 2012 conducted by GCS (Pty) Ltd (Appendix D-1).

4.1.1 Regional Geology

The DBM Project is part of the southern Free State Goldfields, centred close to the town of Virginia. It stretches east to west across the axis of a large north-easterly –plunging synform representing the southern closure of the Central Rand Group of the Witwatersrand Supergroup. Structural deformation is dominated by numerous approximately north-south trending normal faults which predominantly downthrown to the west (Cunningham and Spindler, 2009).

4.1.2 Local Geology

The rocks of the Karoo Supergroup, overlain by a thin layer of Quaternary sand (Q-s), extend over the DBM Project area at surface as indicated in **Figure 4.1**. These strata vary in thickness from 350 m to 960 m as was established through drilling results from numerous exploration boreholes. At surface the Karoo consists of the Adelaide Subgroup (Pa) (Permian age) of the Beaufort Group, comprising mostly of mudstone and shale with subordinate sandstone.

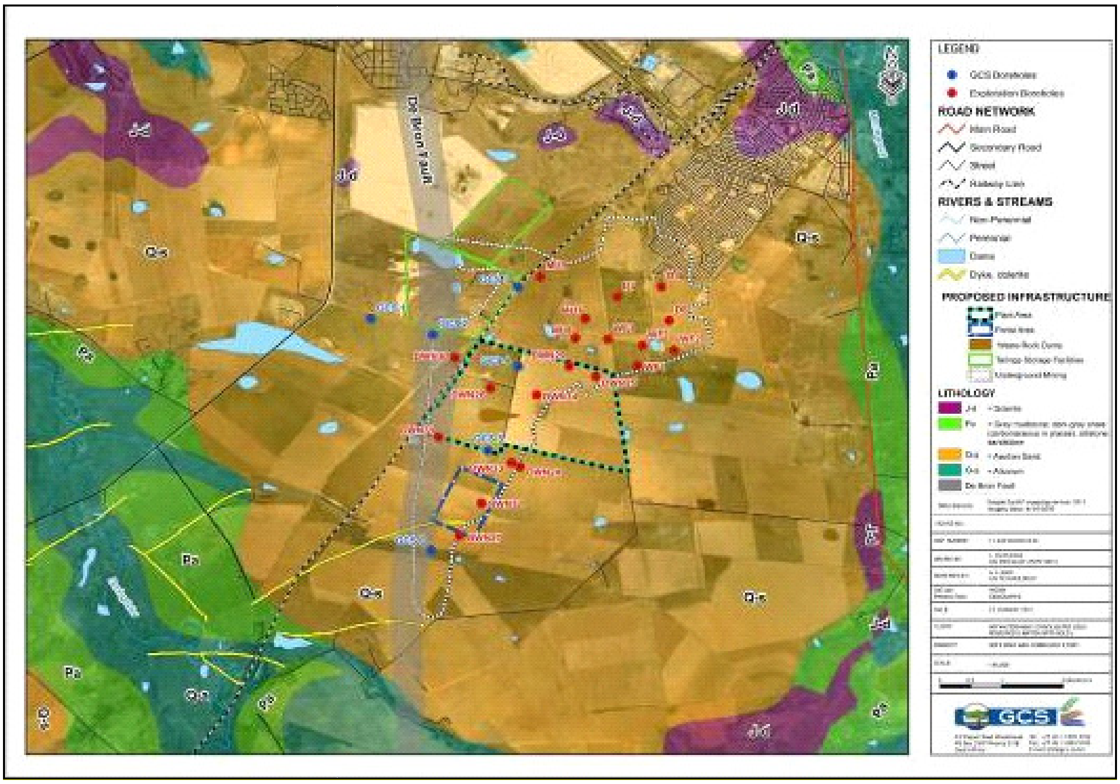
During late Jurassic times the Karoo strata was intruded by dolerite (J-d). These intrusions (highlighted in purple) mainly occur in the south eastern and north eastern sections of the study area. This intrusion into Karoo strata caused the weakening of those lithologies at the contact zone, which resulted in preferential flow paths for groundwater.

Below the Karoo Sequence the stratigraphy of the Ventersdorp Supergroup shows considerable lateral variability across the SOFS study area. Within the western section of the project area this sequence is comprised of thick coarse clastic sediments of the Platberg Group.

The Ventersdorp strata are underlain by the economically important Central Rand Group of the Witwatersrand Supergroup, which comprises the Johannesburg and Turffontein Subgroups of the Central Rand Group. In the Johannesburg Subgroup, five unconformity bounded sequences (UBS's) have been recognised, with the Virginia Formation at the base, passing upwards into the St Helena, Welkom and Dagbreek Formations.

Gold and uranium bearing conglomerates are developed on the basal unconformities of each of these subdivisions, including the Leader Reef (Dagbreek Formation), the B Reef (Spes Bona Formation), the Kalkoenkrans Reef (Aandenk Formation) and the Beatrix/VS5 Reef (Eldorado Formation).

Cunningham and Spindler (2009) reconstructed the Central Rand Group stratigraphy in the southern Free State Goldfield indicating a progressive southerly thinning of the sequence into the DBM Project area. They related this attenuation of the Central Rand Group to uplift during the latter phase of deposition in the Basin, causing erosion by superimposed, on lapping unconformities. These erosional relationships and the resulting sub-cropping of strata are probably the primary control on the distribution of the four gold bearing reefs within the proposed project area.



(Figure not to scale. Please refer to Appendix A for the A3 figure.)

Figure 4.1: Geology Map

4.1.3 Structural Geology

The Beatrix/VS5 unconformity at the base of the Eldorado Formation is developed across the entire southern Free State Goldfield and therefore represents a reference surface for the construction of the structural map of the area. The Central Rand Group within the southern Free State Goldfield is deformed in a broad syncline, with smaller parasitic folds marking the southern limit of the prospective Witwatersrand Basin. This compression was responsible for active uplift towards the southern margin of the Goldfield that resulted in a complex interplay between a series of superimposed unconformity surfaces. Repeated erosion of the footwall sequences caused the incorporation of this detritus into the reefs overlying the unconformities. The north-easterly- plunging fold has been off-set by later normal faults related to the regional Platberg age extensional event. The normal faults generally strike north-south, the most significant being the De Bron Fault, which has a relative down-throw of more than 1000 m towards the west. The De Bron Fault forms the natural western boundary of the De Bron study area. A series of smaller thrust faults, that cause only minor stratigraphical duplication trends northeast-southwest.

The De Bron Fault is Platberg in age, younger than the Wits and Ventersdorp Lavas, and therefore displaces both. To a large extent it also controls the distribution of the Platberg

Graben sediments which forms thick deposits in the graben west of the fault, but not to such an extent on the horst underlying the project area. Variations of the Karoo occur across the De Bron Fault. This is as a result of erosion that occurred faster across the Platberg Sediments west of the fault in comparison with the more resistant Wits quartzites east of the fault zone (Personal communication with D. Muntingh, Wits Gold Exploration Manager).

4.1.4 Sedimentology of the Conglomerate Reefs

In the past, a number of exploration companies have assessed different parts of the southern Free State Goldfield independently, resulting in the identification of up to eight different reefs. Since acquiring a complete set of this historical information, including the borehole core, Wits Gold has collated this previous work and was able to observe the progressive stratigraphic and lateral reef variations across the goldfield.

4.1.4.1 Leader Reef

The Leader Reef is a tabular body above the Dagbreek unconformity. It is however only preserved over the northern portion of the southern Free State Goldfield, before it subcrops against either the Eldorado or Aandenk unconformities. The lower portion of the Dagbreek Formation is generally characterised by interbedded lithic protoquartzites, conglomerates, pebbly quartzites and scattered pebble zones that may be several metres thick. These conglomerates are typically oligomictic with medium to small quartz and blocky chert pebbles.

4.2 Topography

The topographical description was obtained from the Terrestrial Impact Assessment (Appendix D-3).

The topography of the region is described as ‘Plains and Pans’, situated approximately 1,400 meter above sea level. No declared conservation area or centre of endemism is present within the immediate vicinity of the study area. The Willem Pretorius Nature Reserve is situated approximately 25km to the southeast.

4.3 Climate

The climatological description was obtained from the Hydrological Impact Assessment (Appendix D-5).

In general the climate will be typical of the region, with hot and dry summers (average daily peak temperatures in the order of 27°C with individual daily peaks of up to 40°C) and cold and dry winters (average daily minimum temperatures of about 2°C with individual daily minima of down to -4°C). Mean Annual Evaporation (Symons pan) will be in the order of 1620 mm.

4.4 Soil, Land Use and Land Capability

The section below was undertaken by TerraAfrica Consult as part of the detailed Soil, Land use and Land Capability Assessment, February 2012 (Appendix D-2).

4.4.1 Land type data

Two different land types were identified on the proposed Wits Gold DBM project site. These land types are Bd20 and Dc8. Below follows a description of each of the land types identified. Land type Bd20 is found in landscapes where the slope everywhere is between 0 and 2% while the slope length differs for the different positions. For Position 1, slope length is between 1000 and 3000 m and 500 to 2000m for Position 3. Landscape Positions 4 and 5 has slope length between 50 and 300 metres. The soil forms in this land type mainly have sandy clay-loam texture with clay percentages between 6 and 30%. The geology underlying this land type is shale, mudstone and sandstone of the Ecca and Beaufort Groups.

Land type Dc8 is found in four different landscape positions i.e. 5, 5(1), 5(2) and 5(3). Positions 5 have slopes of between 0 and 3% and slope lengths of 200 to 1500m. Positions 5(1), 5(2) and 5(3) all have slopes between 0 and 2% but shorter slope lengths between 50 and 1000m, depending on the position. The soil forms in this land type have a variety of texture classes ranging from clay to sandy clay-loam. The geology underlying this land type is mainly Ecca sandstone, shale and grit. Dolerite sills occur in places.

4.4.2 Land Capability

The soil and land types identified in the study area could be classified into three land capability classes i.e. land with arable land capability (905 ha), grazing land capability (122 ha) as well as land with wetland land capability (23 ha). The deep yellow-brown Clovelly and Avalon soil profiles together with the slightly structured soil profiles of the Oakleaf soil form are the soil forms with arable land capability. The Valsrivier and Mispah soil forms can be classified as land with grazing land capability for the strongly structured B1-horizon of the Valsrivier form as well as the rocky limitations to soil depth of the Mispah form make these soil forms less suitable for crop production.

The Katspruit soil form has hydromorphic properties and is therefore classified as soil with wetland land capability. The areas with wetland land capability should be conserved because of the water purification and water storage capacity of wetland soils.

4.4.3 Land Use and Agricultural Potential

The soil and land types identified in the study area could be classified into three land capability classes i.e. land with arable land capability (905 ha), grazing land capability (122 ha) as well as land with wetland land capability ([1]23 ha), based purely on the soils assessment. The deep yellow-brown Clovelly and Avalon soil profiles together with the slightly structured soil profiles of the Oakleaf soil form are the soil forms with arable land capability. The Valsrivier and Mispah soil forms can be classified as land with grazing land capability for the strongly structured B1-horizon of the Valsrivier form as well as the rocky limitations to soil depth of the Mispah form make these soil forms less suitable for crop production.

The Katspruit soil form has hydromorphic properties and is therefore classified as soil with wetland land capability. The areas with wetland land capability should be conserved because of the water purification and water storage capacity of wetland soils.

4.5 Flora

The section below was undertaken by Bathusi Environmental Consulting as part of the detailed Terrestrial Biodiversity Assessment, 2012 (Appendix D-3).

The largest extent of the study area is located in the Vaal-Vet Sandy Grassland (Endangered Status), with the eastern portion situated in the Highveld Alluvial Vegetation (Least Threatened Status). The SANBI database indicates the known presence of only seven plant species within this particular ¼-degree grid (2826BB). This low diversity is the result of the poor floristic knowledge (under sampling) of the area and is not regarded a true reflection of floristic diversity. No floristic species of conservation importance are indicated to occur

[1] According to the Wetland Study the area consisting of wetlands is 61ha based on wetlands, vegetation and soils.

in this region (POSA, 2011), which is similarly a reflection of the poor floristic knowledge of the area.

The site investigation revealed the presence of 103 plant species in the study area. The diversity is regarded relative diverse, reflecting not only on the species richness of the regional vegetation types, but also the effect of transformation and the influx of weeds and alien invasive species. Grasses and forbs dominate the species diversity a low percentage of the species composition comprises woody individuals. The floristic diversity of the site is represented by 41 plant families, dominated by Asteraceae and Poaceae.

No Threatened plant species were observed during the site investigation. Taking the habitat variability and status into consideration, a medium-low probability for the presence of Red Data species is estimated for the study area. The following species are included in the Declining category:

- *Boophone disticha* (Bushman Poison Bulb, Tumblehead).

The following species are included in the Free State Nature Conservation Act 2007 (Provincially Protected Species, Article 30)1:

- *Boophone disticha* (Bushman Poison Bulb, Tumblehead);
- *Harpagophytum* species (Grapple plant, Wood spider);
- *Asclepias stellifera;* and
- All Helichrysum species (*H. aureonitens, H. caespititium, H. rugulosum*).

Results of the photo analysis and site investigations revealed the presence of the following habitat types:

- Agricultural Fields (878.3ha, 80.6%, Low Floristic Sensitivity);
- Dams/ Impoundments (1.8ha, 0.2%, Medium Floristic Sensitivity);
- Degraded Grassland (89.8ha, 8.2%, Medium-low Floristic Sensitivity);
- Endorheic Pans (32.7ha, 3.0%, Medium-high Floristic Sensitivity);
- Exotic Trees (4.4ha, 0.4%, Low Floristic Sensitivity);
- Homesteads & Infrastructure (22.5ha, 2.1%, Low Floristic Sensitivity); and
- Natural Grassland (59.6ha, 5.5%, High Floristic Sensitivity).

The study area is characterised by severe habitat transformation resulting from agricultural activities, also reflecting regional transformation levels, resulting in extremely limited remaining natural grassland habitat on a local and regional scale. These areas are generally unsuitable for agriculture, either to the ephemeral wetland status of endorheic pans, or shallow and poor soils, as in the case of the remaining grassland areas.

Agricultural fields comprise the largest extent of the study area; no natural vegetation (Vaal-Vet Sandy Grassland) remains in these parts and consequently a low sensitivity is ascribed. Endorheic pans are however situated within the agricultural fields and, although not exhibiting pristine or important floristic attributes, are likely to perform vital ecological roles on a local and regional scale. The importance of these areas cannot be underestimated and hence a medium-high sensitivity is ascribed to these areas. It is strongly recommended that these areas be excluded from the proposed development.

Comments from the wetland specialist should also be considered in terms of these recommendations. Terrestrial grassland habitat is restricted to the eastern part of the study area, comprising the Highveld Alluvial Vegetation Type. A large portion has been subjected to insowing and surface disturbances and, together with a high grazing pressure, consequently exhibit a relative poor status. In contrast, the remaining portion of natural grassland is regarded species rich and relative pristine. A number of provincially protected plants are present within this part of the study area and hence a high sensitivity is ascribed to this portion. It is strongly recommended that this part of the study area be excluded from the proposed development.

4.6 Fauna

The section below was undertaken by Bathusi Environmental Consulting as part of the detailed Terrestrial Biodiversity Assessment, 2012 (Appendix D-3).

The presence of 61 animal species was confirmed during the site investigation, additionally 15 invertebrate families were also observed during the survey period. The animals (species and families) observed in the study area are, for the most part, typical grassland species and representative of grassland animal communities that are widespread in the regional areas of the Vaal-Vet Sandy Grassland and in the larger extent of the Dry Highveld Grassland Bioregion (and associated pans).

It is estimated that 48 of the 66 Red Data animals listed for the Free State Province have a low probability of occurring in the study area, 10 have a moderate-low probability and 10 a moderate probability of occurring in the study area. The presence of three Red Data species was confirmed during the survey period, namely the Lesser Kestrel (VU), Lanner Falcon (NT) and Secretary Bird (NT). Additionally, evidence of Aardvark (Orycteropus afer) was observed on the site. This species is a provincially protected species (Free State Nature Conservation Act 2008, Schedule 1).

The following faunal sensitivities were ascribed to available habitat types:

- Agricultural Fields (Low Faunal Sensitivity);
- Dams/ Impoundments (Medium-high Faunal Sensitivity);
- Degraded Grassland (Medium Faunal Sensitivity);
- Endorheic Pans (Medium-high Faunal Sensitivity);
- Exotic Trees (Low Faunal Sensitivity);
- Homesteads & Infrastructure (Low Faunal Sensitivity); and
- Natural Grassland (High Faunal Sensitivity).

Most of the study area has been transformed by agriculture and associated infrastructure, remaining natural faunal habitat found in the study area is represented by isolated fragments of natural and degraded grassland and a couple of endorheic pans. This significant loss of faunal habitat and fragmentation of the remaining patches of untransformed habitat have undoubtedly led to a loss of species richness and faunal diversity within the area investigated. Furthermore, prosecution of animals, directly by carnivores or indirectly (species such as Cape Vulture) and the use of agrochemicals and pesticides resulted in a loss of species locally (study area) and regionally.

Animals observed in the study area mainly include generalists, but grassland and wetland specialists also are present. Faunal communities of the study area attest to the ecological functionality of both the grasslands and wetlands found in the study area; the presence of three Red Data grassland birds and a provincially protected mammal confirms the sensitivity of the natural grasslands of the study area despite the isolated nature of the grassland fragments remaining.

During the field investigation, none of the endorheic pans had significant surface water; it is reasonable to assume that the species richness of these areas will increase significantly when the presence of surface water attracts a variety of water birds and invertebrates.

4.7 Wetland Assessment

The section below details the wetland assessment as undertaken by Wetland Consulting as part of the detailed Wetland Impact Assessment, May 2012 (Appendix D-4).

The study area is located within the Vaal River Catchment (Primary Catchment C), and more specifically within quaternary catchments C42K, C42H and C42J. No rivers or streams cross the study area, though the Merriespruit, a tributary of the Sandspruit, flows past just to the east of the site.

4.7.1 Wetland Delineation and Classification

Approximately 6.2 % of the study area, equal to roughly [2]61 hectares, was classified as wetland, consisting of two different wetland types, hillslope seepage wetlands and pan wetlands, as well as 3 small farm dams. A map of the delineated wetlands within and immediately adjacent to the study area is provided in Figure 4.2.

The dominant wetland type recorded on site was hillslope seepage wetlands, though most of the seepage wetlands were associated with, and feeding into, the pan wetlands. The landscape of the study area, which is characterised by a largely flat plateau with low slopes and no defined drainage lines and typically sandy soils, meets the main characteristics required for the development of pan fields according to Allan et al (1995):

a. Lack of integrated drainage; and
b. Average slope of less than 1 degree (slope measured at less than 0.2 degrees).

In such areas, given the flat terrain and lack of drainage, water forms pools following rainfall events. Once these pools dry, they leave behind areas of bare soil susceptible to wind erosion and deflation by wind, deepening the pool over time. The pooling and subsequent evaporation of water also leads to an accumulation of salts within the pans, which speeds up the weathering process and further precludes the establishment of vegetation in these areas, maintaining them as bare soil areas prone to wind erosion and deflation (Allan et al., 1995) when dry. Overtime the pools increase in depth and size and form the pans as we now see them in the landscape.

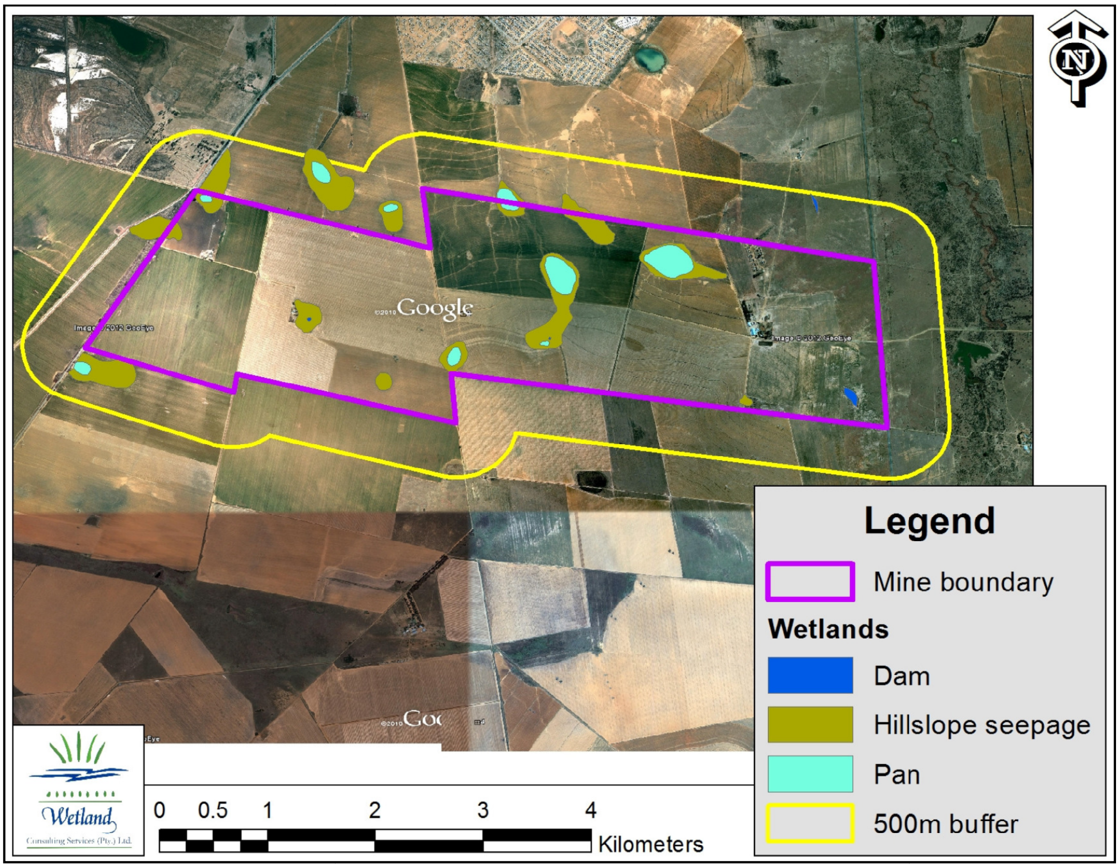
The pan and hillslope seepage wetlands are likely maintained by rain falling within the wetland catchments. The sandy soils of the area as well as the low slopes result in limited surface runoff being generated, with most rainfall entering the soil profile. The dominant soil forms of the area, Clovelly and Avalon, are characterised by aquitards in the soil profile (soft plinthite in the case of Avalons, unspecified material in the case of Clovelly, but assumed to be sandstone) that restrict the deeper infiltration of rainwater into groundwater and thus result in lateral seepage of infiltrated water through the soil profile and the formation of a perched water table. Across most of the site this takes place at

[2] According to the Soils, land-use and land capability assessment 23 ha is classified as wetlands, based purely on soils.

sufficient depth within the soil profile to preclude wetland formation, but where the aquitard approaches the soil surface and seasonal saturation of the soil profile takes place within 500 mm of the soil surface, wetland conditions develop.

The above scenario is expected to take place under normal rainfall conditions. Under extreme rainfall events, such as experienced during the late summer of 2010, surface runoff is likely to play a significant role in water inputs to the pans on site. Heavy rainfall is likely to lead to saturation of the soil profile and thus increased surface runoff generation or, in the case of high intensity storms, the rainfall might exceed the rate of infiltration, also resulting in surface run-off.

The study area is used extensively for cultivation, with more than 776 ha (78.3 % of the site) currently under cultivation and a further 88 ha (8.9 % of the site) previously cultivated. This cultivation extends into the hillslope seepage wetlands in many areas, with roughly 43 % of the wetland extent currently impacted by cultivation (26 ha of wetlands). However, the wetlands not directly impacted by cultivation have also been degraded by indirect impacts such as increased sedimentation as well as invasion by alien and weedy species, and some of these wetlands are also likely to have been cultivated in the past.



(Figure not to scale. Please refer to Appendix A for the A3 figure.)

Figure 4.2: Map of the delineated wetlands on site

The pans on site were considered Moderately Modified (Category C), while seepage wetlands were considered Category D (Largely Modified) mainly due to extensive cultivation within the sub-catchments.

The functional assessment further indicated that the wetlands play only a small role in supporting hydrological benefits as they are mostly isolated from the surrounding stream network. The most important function is likely to be that of sediment trapping, and though this might be seen as a beneficial function performed by the wetlands, excess sediment inputs are at the same time leading to significant deterioration of the wetland habitat and over time could result in some of the smaller pan basins being completely filled.

The wetlands that are not cultivated provide islands of natural vegetation within a large expanse transformed by cultivation, and are thus considered to provide important refuge areas for faunal species occurring on site, especially during those periods where the fields are bare. The pans are also known to support populations of the Giant Bullfrog (Local Landowner, pers. comm.) and the Near threatened Secretary bird was observed foraging in one of the dry pans on site.

4.8 Hydrological (Surface Water) Assessment

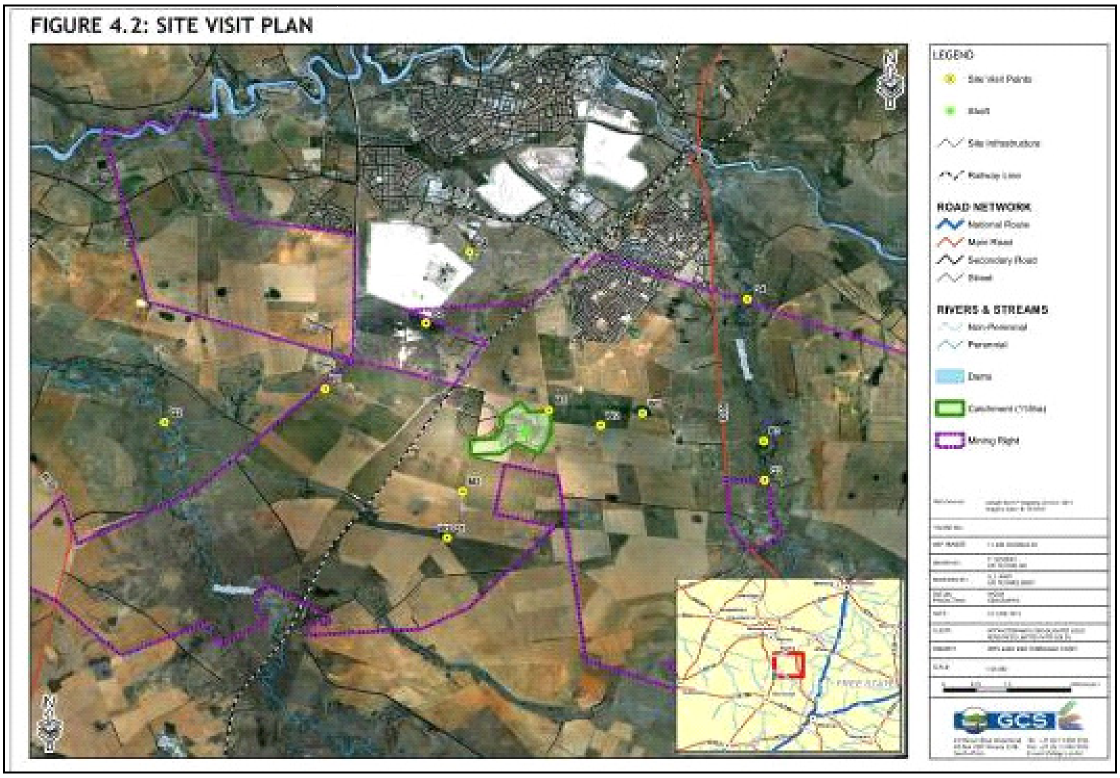
The section below details the surface water assessment was undertaken by GCS (Pty) Ltd as part of the detailed Hydrological Assessment, May 2012 (Appendix D-5).

4.8.1 Floods and Runoff

The proposed mine infrastructure is planned to take place close to the crests of hills and watershed boundaries. There is no threat posed by surface floods. Catchment areas measured at Q1 and Q3 were 8,58 km2 and 28,49 km2 respectively.

4.8.2 Water Quality Results

Test results on base-line water quality samples were taken during the site visit (Figure 4.3). Some base-line quality results exceeded allowable results for drinking water. Of concern were the elevated levels of lead and arsenic found in some samples. Although water quality measured at Q1 indicated brackish water with elevated concentrations of total dissolved salts, water was still of acceptable quality. Elevated levels of lead and arsenic recorded for most base-line samples are, however, a cause for concern, as are elevated levels of magnesium and selenium. These results however could be due to an error in the lab as additional results were taken and there was no evidence of elevated arsenic. Further monitoring is required. The results of base-line sampling tests are summarized in Table 4.1.



(Figure not to scale. Please refer to Appendix A for the A3 figure.)

Figure 4.3: Site Visit Plan

Table 4.1: Water Quality Analyses Results

PARAMETER (ALL PARAMETERS MEASURED AS MG/ℓ UNLESS SPECIFIED)	CLASS I (ACCEPTABLE)	CLASS II (MAX. ALLOWABLE)	CLASS III (EXCEEDING)	SAMPLED 04-NOV-11			
				Q3&WET US	Q4	WET W37 Q1	WET1
pH Value @ 20°C	5-9.5	4-10	<4 or >10	8.2	8.3	8.3	7.6
Conductivity mS/m @ 25°C	<150	150-370	>370	57.2	84.3	244	48.5
Total Dissolved Solids	<1000	1000-2400	>2400	395	728	1496	480
Calcium, Ca	<150	150-300	>300	63	50	65	35
Magnesium, Mg	<70	70-100	>100	32	31	50	19.5
Sodium, Na	<200	200-400	>400	26	111	427	10.3
Potassium, K	<50	50-100	>100	7.7	2.9	28	76
Total Alkalinity as CaCO3	N/S	N/S	N/S	295	384	525	244
Chloride, Cl	<200	200-600	>600	7.7	48	483	23
Sulfate, SO4	<400	400-600	>600	14.4	37	57	<0.2
Nitrate, NO3	N/S	N/S	N/S	0.2	<0.1	<0.1	<0.1
Nitrate as N	<10	10-20	>20	<0.1	<0.1	<0.1	<0.1
Fluoride, F	<1	1-1.5	>1.5	0.3	0.5	0.5	1
Manganese, Mn	<0.1	0.1-1	>1	0.16	0.13	0.3	2.4
Chromium, Cr	<0.1	0.1-0.5	>0.5	<0.003	<0.003	<0.003	<0.003
Nitrite NO2 as N	<10	10-20	>20	<0.1	<0.1	<0.1	<0.1
Selenium, Se	<0.02	0.02-0.05	>0.05	0.04	0.04	0.04	0.04
Vanadium, V	<0.2	0.2-0.5	>0.5	<0.002	0.006	0.012	0.026
Cobalt, Co	<0.5	0.5-1	>1	<0.001	<0.001	<0.001	<0.001
Copper, Cu	<1	1-2	>2	<0.002	<0.002	<0.002	<0.002
Nickel, Ni	<0.15	0.15-0.35	>0.35	<0.003	<0.003	<0.003	<0.003
Lead, Pb	<0.02	0.02-0.05	>0.05	0.02	0.02	0.02	0.02
Zinc, Zn	<5	5-10	>10	0.43	0.5	0.47	0.52
Arsenic, As	<0.01	0.01-0.05	>0.05	0.04	0.04	0.05	0.05
Mercury, Hg	<0.001	0.001-0.005	>0.005	<0.001	<0.001	<0.001	<0.001

It will be important for the mine to sample, test and maintain a record of water quality measured in samples from both upstream and downstream of the mine, in order to demonstrate the mines contribution, if any, to poor surface water quality in the area.

4.9 Geohydrological (Groundwater) Assessment

The groundwater description was undertaken by GCS (Pty) Ltd as part of the detailed Geohydrological Assessment (Appendix D-1).

4.9.1 Existing Borehole Water Use

During November 2011 GCS undertook a hydrocensus investigation within a 2 km radius of the proposed DBM mining area. The purpose of the investigation was to establish the extent of groundwater use and establish borehole yields within the project area.

Water samples from boreholes were collected for analysis and where possible, the water levels were measured (many supply points were equipped with pumps, which made taking water levels impossible).

Boreholes predominantly are used for domestic water supply to farmers and their farm workers. A large proportion of boreholes that was identified are equipped with wind pumps.

The following information was obtained regarding specific farming operations:

- Water use on the farming properties of Mr. Andries Benjamin Pienaar takes place on Christiana 452; Dora 287; Nielle; Florida 633 and Hakkies 695. Boreholes Ni 2; Ni 3 and Ni 6 are all equipped and used for domestic water supply. More than one borehole is used for irrigating the garden (Ni 2; Ni 5 and Ne 7). Most of the boreholes on Mr. Pienaars neighboring farms are equipped with wind pumps that are used for live stock watering. Supply borehole Ch 1 on the farm Christiana also supplies farm workers with water for domestic use. The only supply borehole on Mooi Uitzicht is not equipped (MU 1) and was found, at the time of the assessment, to be contaminated with oil[3]. The borehole was used as a supply source for the exploration drilling programme, which must have been polluted in the process. According to the farm manager, supply borehole Ha1 on the Farm Hakkies 695 is brackish and not suitable for potable water use. Unfortunately the borehole was

The exploration drilling programme that contaminated the hole was not conducted by Wits Gold, but by previous holders of the mineral rights.

equipped with a non-functional wind pump and no water sample could be abstracted for analysis to verify the water quality.

- The Thabo Trust farming operations are managed by M. Niemandt residing on the farm Amorenzia. Similar to the Pienaar farming operations, most of the supply boreholes are within close proximity to the main dwelling serving the purpose of domestic water supply to the main house and farm workers. A number of boreholes are not currently equipped (Am 1; Am 7; Am 8; Am 9; Am 10; and Am 11). The majority of the boreholes on the other farming properties of the Thabo Trust are equipped with wind pumps and used for live stock watering.
- The Van Huysteen Kinder Trust farm gets managed by Mr. Huysteen staying on the farm Plecy 82. His farming operations form the southern extent of the study area. Similar to the previous two water users, most of the supply sources occur within close proximity of the main dwelling. Other water uses within the domain of the trust area includes water supply to a small church for farm workers on Welgelegen 382 (We 1). An additional two dwellings on the farm Welgelee, which also belong to the Trust, are supplied by borehole We 1. The farm dwelling on the farm Moerdersdrift is currently vacant and both the supply sources Mo 1 & 2 are not in use currently.
- The B.J.G. Stadtlander Familie Trust has three farming properties within close proximity of the study area. These farming properties practice the following water uses:
  - The main dwelling and the residence of farm workers occur on Droomland. The main sources of potable water supply to these users are Dr 1 & 3.
  - Bloemhoek 509 has a single residence which is currently vacant. Supply source Bl 1, which is still equipped with a wind pump, used to be the supply source to the house. The other two Bloemhoek supply sources (Bl 2 & 3) were used for water supply to live stock (equipped with wind pumps).
  - All four the Weltevreden supply boreholes are equipped to provide drinking water for live stock. No homestead occurs on the property.

4.9.2 Aquifer Description

According to Cogho et al (1992) two aquifers occurs within the study area, namely:

- A shallow aquifer which lies within the weathered and fractured zones of the Karoo sediments; and
- The deeper fractured rock aquifer within the Ventersdorp and Witwatersrand rocks.

Cogho *et al*. (1992) reports that no obvious hydraulic connection exists between the two aquifers. One of the major reasons for this phenomenon may be the fact that none of the numerous faults that occur in the Ventersdorp and the Witwatersrand rocks can be detected in the Karoo sediments. Therefore at depths (between 300 m -1200 m), due to the absence of faults and the compaction of the sediments, the permeability of the Karoo sediments will be low and groundwater movement will be negligible. However, in the Allanridge region where the Ventersdorp rocks outcrop, vertical leakage between the two aquifers may be possible.

4.9.3 Karoo rock aquifer

According to a WRC report (Report No 224/1/92) a historical borehole survey indicates that the occurrence of groundwater in the shallow aquifer is geologically controlled. Boreholes with moderate to high yields are associated with the intrusion of dolerite. Bedding plane joints in the sediments also contribute to aquifer development. A number of low groundwater yields were intersected during the GCS drilling program on bedding planes on lithological contacts. The drilling results do not indicate a defined intergranular or weathered aquifer, followed by a distinct fractured aquifer with depth. It is however concluded that both weathering and fracturing contribute to aquifer development with no distinct aquifer units based on weathering and fracturing.

Drilling results within the DBM site suggests that only low yielding aquifers exist within the predominantly mudstone/shale rock (Adelaide Subgroup of the Beaufort Group). The hydrocensus results also showed that no large scale groundwater abstraction take place from the Karoo aquifer, most likely a reflection of the relatively low aquifer potential. Groundwater blow-out yields from the newly drilled boreholes range between seepage to 1.1 l/s (average 0.5 l/s).

No site data on the aquifer potential of the deeper Karoo strata was available. Active aquifer systems is likely to decrease with depth (limited to some connate groundwater), with insignificant interaction between the Karoo and deeper Witwatersrand aquifer system.

The potential (safe) yield from an aquifer is linked directly to the recharge it effectively receives. Groundwater recharge is firstly dependent on rainfall. Effective recharge is that part of the daily rainfall which seeps into the ground after allowing for losses through interception by vegetation and by runoff. Of the effective rainfall, only a small fraction infiltrates down to the saturated zone and successfully recharges the groundwater source. The lower the rainfall, the more variable and uncertain recharge is.

Research has been done to try and quantify groundwater recharge, making use of various recharge determination methods. The typical values reported for recharge in the Karoo aquifers vary between 1% and 3% (Sami, 2003). According to Vegter (1995) the groundwater recharge for the Karoo is between 2.5% and 3.5% of Mean Annual Precipitation (MAP). A slightly more conservative value of 1% of MAP is used in this report. This is due to the prevalent occurrence of mudstone in the study area as well as an unsaturated layer of up to 20m thick which is present on site.

4.9.4 Witwatersrand aquifer

The fracturing and faulting in the competent Witwatersrand Group resulted in the development of a relatively high yielding aquifer. Large quantities of groundwater with a dominantly Na-Cl composition, are pumped to surface within the study area. This confined aquifer is not seen as a dynamic system within the study area, i.e. the recharge of the system is insignificantly low. The Na-Cl nature of the water with conductivities in the order of 500 mS/m is a reflection of the stagnant nature of the aquifer.

Currently no historic site information exists of aquifer yields, hydraulic parameters and the piezometric table within the Ventersdorp and Witwatersrand Supergroup.

4.9.5 Aquifer Hydraulics

4.9.5.1 Karoo Supergroup

Aquifer testing was conducted between 15 and 24 December 2011 on all of the newly drilled boreholes with sufficient amount of water for testing. As indicated in the boreholes were pumped at a constant rate and the abstraction rates at the different boreholes varied between 0.5 and 1.33 l/s. Time periods for the constant rate tests ranged between 5 and 105 minutes.

The aquifer test data was interpreted using the Cooper-Jacob (1946) method for drawdown data and the Theis residual drawdown method for the recovery data. Both methods were used to ensure better accuracy from the results obtained. T-values for the Karoo aquifer varies between 0.4 – 1.1 m/d.

4.9.5.2 Witwatersrand Supergroup

Little information currently exists on aquifer parameters of the Witwatersrand Supergroup within the DBM study area. The average transmissivity value used for modelling purposes in the Free State Goldfield was 10 m^2/day according to a Water Research Commission report (No: 224/1//92). The exact water levels and therefore hydraulic gradients within the study area are unknown.

4.9.6 Newly Drilled Monitoring Boreholes

A total of six (6) new monitoring boreholes were drilled with borehole depths ranging between 23 m and 80 m. The drilling commenced on 12 December 2011 and was completed on 15 December 2011.

Results of the drilling are summarised as follow:

- Moisture was encountered in BH1_TSF at 38 m and thereafter some seepage at 40 m with a final blow out yield of 0.6 l/s.
- During the drilling of BH2_TSF water was intersected at 18 m and a final blow out yield of 0.4 l/s was measured.
- There was a water strike at 14 m in BH3_TSF with a final blow out yield of 0.5 l/s.
- Very little seepage was encountered during the drilling of BH4 and the final blow out yield was less than 0.1 l/s.
- BH5_Adit had two water strikes; at 23 and 28 m with a final blow out yield of 0.3 l/s.
- Numerous water strikes in BH6_Adit were intersected at shallow depths (6, 8, and 13 m) and the final blow out yield was 1.1 l/s.

4.9.7 Groundwater Levels

Groundwater levels were measured in 59 boreholes within the DBM area. Groundwater depth varies between 1334.34 and 1465.03 mamsl.

4.9.8 Groundwater Quality

Groundwater quality conditions within the proposed DBM mine area were obtained by means of different investigations and studies.

For the purpose of this study, the results were compared to the SANS 241 Drinking Water Standard. Constituents that exceeded the compliance objective were highlighted in red.

4.9.8.1 MSA Groundwater Study Risk Assessment (January 2011)

Groundwater samples from eight (8) borehole positions across the study area were taken for analysis. As indicated in **Table 4.2** most of the constituents were in compliance with the Drinking Water Standards compliance objective, except for nitrate which could have been a result of either the agricultural activities (fertilizer contains nitrate) and/or the mining related activities (explosives that get used within the mining industry contains nitrate).

Table 4.2: MSA groundwater quality analysis results

BOREHOLE SAMPLE		SAMPLE LOCATION		SAMPLE DESCRIPTION	BOREHOLE WATER LEVEL (MBGL)	BOREHOLE DEPTH (MBGL)
Sample 1	WG/DBM/001	28.175861°S	26.904306°E	Sample taken from a borehole at a homestead.	-	-
Sample 2	WG/DBM/002	28.162111°S	26.890250°E	Sample taken from a borehole nearby a coring rig in the centre of a maize field.	-	-
Sample 3	WG/DBM/003	28.158556°S	26.893417°E	Sample taken from a borehole nearby a coring rig in the centre of a maize field.	6.2	29.4
Sample 4	WG/DBM/004	28.161278°S	26.866528°E	Sample taken from a borehole in a maize field	2.6	53.6
Sample 5	WG/DBM/005	28.185083°S	26.859500°E	Sample taken from a borehole in a maize field.	Borehole closed	Borehole closed
Sample 6	WG/DBM/006	28.167306°S	26.858694°E	Sample taken from a borehole at a homestead.	-	-
Sample 7	WG/DBM/007	28.169250°S	26.857361°E	Sample taken from a borehole in a maize field.	Borehole closed	Borehole closed
Sample 8	WG/DBM/008	28.174972°S	26.865333°E	Sample taken from a borehole at a homestead.	-	-

4.9.9 Tailing Geochemical Characterisation

4.9.9.1 Summary of geochemical results

- Pyrite (FeS_2) is present as minor mineral in the tailings. Pyrite will be the major contributor to the products of acid-mine drainage in the tailings. Carbonate minerals responsible for buffering are absent in the tailings,
- The tailings sample will have a definite potential to produce acid drainage over the long term;
- Various metals were also found in the tailings water in elevated concentrations which exceeded the SANS 241 drinking water standard. These elevated metals include Al, As, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb and Sb. These metals are likely to be associated with the tailings material and could therefore impact on surface water and groundwater resources. The constituents SO_4, EC and NH_3 were also found in levels exceeding the SANS 241 drinking water standard;
- The total cyanide level exceeds the screening level SSV1 for Human Health and water resource protection and therefore poses a potential risk to the groundwater.

4.10 Air Quality

The air quality description was undertaken by Kijani Green Energy as part of the detailed Air Quality Assessment (Appendix D-6).

4.10.1 Wind

The prevailing winds are from the north, meaning that most dispersion from the dump and the mine will be away from the settlements of Virginia and Meloding, and out over the farmland to the south.

4.10.2 Precipitation

The site is on the Free State Highveld, at an altitude of approximately 1350 m above sea level. It is in South Africa's summer rainfall region but is rather dry, with an annual average rainfall of 561 mm per year. Rain peaks mid- season, in January, while the winter months are characterised by a long, dry period.

Even the addition of a small amount of moisture can have a dramatic effect on the reduction of potential dust emissions. Similarly, a long spell without rain will necessitate intervention in the form of dust control measures in order to manage impacts on the surrounding environment. These will be particularly necessary during the months from April to September.

4.10.3 Temperature

The warmest period is December / January, when maximum temperatures average close to 30 degrees centigrade while June is the coldest with daytime temperatures averaging 17.4 degrees and overnight temperatures frequently dropping below freezing. The winter period is also very dry with little or no rainfall and evening relative humidity dropping below the 40% mark.

4.10.4 Summary

The proposed mine is situated in a high altitude region characterized by summer rains but where the winters are cool, dry and windy, resulting in conditions ideal for the desiccation of the environment and the wind entrainment of any loose material.

4.10.5 Results

Dust fallout results are indicated in Figure 4.4.

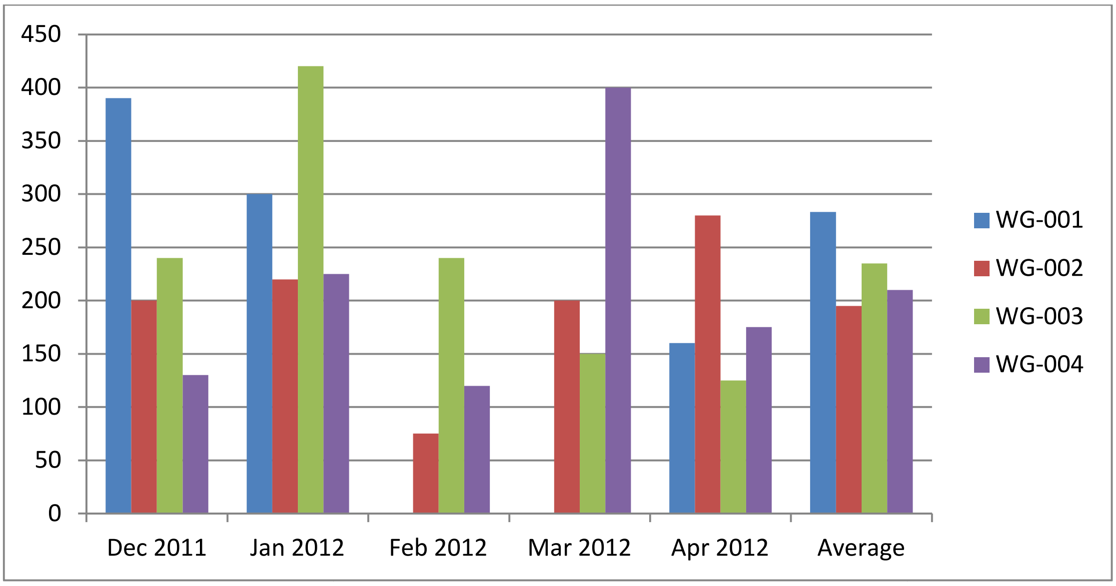


Figure 4.4: Dust fallout results for a four bucket network centred around the proposed Wits Gold DBM mine site south of Virginia, Free State, South Africa Figure (mg/m^2/day)

The results from the dust monitoring show an environment experiencing dustfall that lies between the slight (250mg/m^2/day) and moderate (500mg/m^2/day).

4.11 Radiation

The radiation description was undertaken by African Radiation Consultants as part of the detailed Radiological Impact Assessment (Appendix D-7).

The legal limit in South Africa for material to be classified as radioactive is 0.5 Bq.g-1 (nuclide specific). Naturally occurring radionuclides such as uranium, thorium, and radium are associated with the gold bearing reefs of the Free State. These naturally occurring radionuclides are expected to be present in all ore and will be carried through to the mineral processing residues generated through the Wits Gold DBM Project. The project thus has the potential to generate materials and residues that contain naturally occurring radionuclides, generally referred to as Naturally Occurring Radioactive Materials (NORM) (IAEA, 2007).

Baseline gamma and dose rate surveys as well as full spectrum analysis of environmental media at the proposed site are in progress. The baseline survey includes a terrestrial gamma survey as well as full spectrum analysis of groundwater, surface water, soil, stream sediments, and agricultural crops collected in the areas surrounding the proposed site. Results of this baseline survey will serve as point of departure for future monitoring of environmental media at the site and will further inform the development of radiation management procedures at the site. A summary of the available results are presented in Section 5.3 for ease of reference.

Note that at the time of writing this report, results for some of the environmental samples submitted for full spectrum analysis were not available yet.

4.11.1 Baseline of Radioactivity in the Environment

4.11.1.1 Baseline Nuclide Concentrations in Soil

Soil samples were collected at ten locations in the footprint area of the Wits Gold DBM Project. The samples were collected at these locations to determine the baseline activity concentrations in surface soil, where radioactive dust originating from the mining and mineral processing activities, when operational, may be deposited. The measurements will then serve as a baseline to which future monitoring measurements of soil can be compared.

Ten soil samples were collected. The samples identified as Soil B8 and Soil B9 were small in volume and as they are located in the same general area, were combined to have a sample that is large enough to be analysed. The eight other soil samples plus the one composite sample (9 in total) were sent to the Nuclear Energy Corporation of South Africa (NECSA) RadioAnalysis laboratory for full spectrum analysis.

The analytical results for the nine soil samples are summarised in Table 4.4.

4.11.2 Baseline Radionuclide Concentrations in Groundwater and Surface Water

Samples of groundwater were collected from existing production boreholes used by farmers currently living in the area, as well as monitoring boreholes located to the north of the proposed site.

Samples of groundwater collected from locations close to one another were combined to produce a total of six composite groundwater samples that were submitted to the NECSA RadioAnalysis laboratory for analysis. The samples combined and the numbers of the composite samples submitted for analysis is presented in Table 4.3.

Table 4.3: Groundwater samples included in composites for analysis

COMPOSITE SAMPLE NUMBER	GROUNDWATER SAMPLES INCLUDED IN COMPOSITE
ARC-GW-1	Groundwater 6
ARC-GW-2	Groundwater 8, 9, 10, and 11
ARC-GW-3	Groundwater 13
ARC-GW-4	Groundwater 3 and 4
ARC-GW-5	Groundwater 2 and 7
ARC-GW-6	Groundwater 5 and 12

Table 4.4: Baseline radionuclide concentrations measured in soil samples (Ra-12556 dated 26 April 2012)

Radionuclide	SOIL 1	SOIL 2	SOIL 3	SOIL 4	SOIL 5	SOIL 6	SOIL 7	SOIL 8/9 COMPOSITE	SOIL 10
	BQ.KG-1								
U-238	37.8	21.1	23.8	22.2	20.9	21.4	23	20.9	21
U-234	38.1	21.3	24	22.4	21	21.5	23.2	21	21.2
Ra-226	29	20.7	<MDA	19.2	17.5	18	32	17.8	20
Pb-210	26.1	<MDA	<MDA	21.6	<MDA	15	23	26.4	15
U-235	1.74	0.972	1.1	1.02	0.961	0.983	1.06	0.961	0.966
Th-232	36.1	22.4	23.4	23.7	21.2	21.6	23.5	21.2	19.5
Ra-228	44.9	22.9	<MDA	15.9	19.7	23.6	18.2	14.2	17.1

Th-228	29.2	28	<MDA	27.9	19.2	21.3	27.4	20	25.9
K-40	911	877	442	496	574	920	787	824	748
Gross Alpha	555	343	346	351	304	351	412	309	327
Gross Beta	37.8	21.1	23.8	22.2	20.9	21.4	23	20.9	21

Minimum Detectable Activity Concentration (MDA) for Pb-210 in Soil 2 is reported as 20 $Bq.kg^{-1}$ and 19 $Bq.kg^{-1}$ and 20 $Bq.kg^{-1}$ for Soil 3 and Soil 5 respectively. MDA for Ra-226 in Soil 3 is 9.6 $Bq.kg^{-1}$ and for Ra-228 and Th-228 in the same sample 14 and 9.3 $Bq.kg^{-1}$ respectively.

Ground water samples 1 and 14 were excluded from the samples submitted for analysis due to constraints on the budget for radiological analysis and because these two samples were identified as the least likely to present information that are not already provided by one of the other composite samples. Results of the analysis is summarised in Table 4.5.

Table 4.5: Baseline radionuclide concentrations in groundwater (RA-XXYYZZ dated 26 April 2012)

Radionuclide	ARC-GW-1	ARC-GW-2	ARC-GW-3	ARC-GW-4	ARC-GW-5	ARC-GW-6
	$mBq.L^{-1}$					
U-238	81.9	63.8	77.9	44	49.6	94.3
U-234	256	207	224	171	92.1	308
Ra-226	43.4	9.2	30.7	16	36.6	22.2
Pb-210	-1.7	7.96	3.1	1.9	2.6	-0.93
U-235	3.77	2.94	3.59	2.03	2.29	4.34
Th-232	-1	1.6	4.04	1.9	1.7	0.78
Ra-228	1.3	-0.39	2.9	0.17	0.11	0.72
Th-228	7.47	1.46	3.6	1.3	2.68	0.95
Gross alpha	8.4	1.45	7.92	2.66	0.44	5.22
Gross beta	1.7	<MDA	9.73	3.1	-1	2

Surface water in the project area are mostly small streams and standing water in small isolated pools that only contain water following sufficient rainfall events. Surface water samples were collected at three locations near the proposed site, which were identified as locations both above and below the potential sphere of influence of current and future mining activities.

The first sampling location is on the Merriespruit below a mission school and approximately 50m upstream of a farm boundary fence. The Merriespruit is located east of the proposed site and flows in a northerly direction. The surface water sample collected here is therefore representative of water quality downstream of the DBM Project. The second sample was collected from a standing pool of water in the Merriespruit immediately upstream of a farm access road and represents water quality upstream of the proposed site. The last surface water sample was collected in a small stock-watering dam in an un-named stream that passes to the south of the project area. There is no visible flow in this stream and the water in the dam is standing water.

The samples of surface water were submitted to NECSA for Radioanalysis and the results are summarised in Table 4.6.

4.11.3 Stream Sediment

Samples of sediment were collected from the same three locations where surface water were collected Results of full spectrum radioanalysis performed on the sediment samples are summarised in

Table 4.7.

Table 4.6: Baseline radionuclide concentrations in surface water (RA-XXYYZZ dated 26 April 2012)

Radionuclide	Surface water-1	Surface water-2	Surface water-3
	mBq.L^{-1}		
U-238	84.2	85.2	110
U-234	172	162	175
Ra-226	6.5	32	30.9
Pb-210	6.2	1.2	2.7
U-235	3.88	3.92	5.07
Th-232	2	5.7	4.07
Ra-228	-4.2	1.1	-4.4
Th-228	1.61	5.2	2.4
Gross alpha	1.7	9.47	4.7
Gross beta	-2.7	5.41	-1.4

4.11.4 Baseline Radionuclide Concentrations in Vegetation

As indicated earlier, the project area is located on farmland used for the production of crops including maize and wheat. A composite sample, made up of several samples of different crops collected over the project area, was submitted for full spectrum radioanalysis. The results of this analysis will serve as a baseline to which future samples of vegetation, collected as part of a monitoring programme, can be compared. The radioanalytical results for the composite grass sample are summarised in Table 4.8.

Table 4.7: Baseline radionuclide concentrations in stream sediment (RA-12555 dated 22 May 2012)

Radionuclide	SEDIMENT-1	SEDIMENT-2	SEDIMENT-3
	BQ.KG^{-1}		
U-238	25.6	30.2	50.3
U-234	25.8	30.5	37
Ra-226	21	22	26.4
Pb-210	<MDA	<MDA	83.4
U-235	1.18	1.39	2.31
Th-232	23.4	24.1	45
Ra-228	41.4	22.5	42.4
Th-228	33.1	28	41.7
Gross alpha	643	772	1430
Gross beta	461	510	656

Minimum Detectable Activity Concentration (MDA) for Pb-210 in Sediment-1 and 2 are 89 Bq.kg^{-1} and 87 Bq.kg^{-1} respectively.

Table 4.8: Baseline radionuclide concentrations in composite crop samples (RA-12557)

RADIONUCLIDE	BQ.KG-1 (FRESH WEIGHT)
U-238	1.02
U-234	1.02
Ra-226	2.25
Pb-210	7.02
Po-210	0.0468
U-235	0.718
Th-232	2.94
Ra-228	1.07
Th-228	1.02

4.11.5 Radioactivity associated with the Wits Gold DBM Project

4.11.5.1 General

The radiological conditions associated with the Wits Gold DBM Project relate primarily to the minerals proposed for extraction and processing at the site and therefore include the ore as well as the mining and mineral processing residue (tailings) materials. Radiological release rates specific to these source materials are of importance to quantify the release of radioactivity into the environment. These release rates provides input into the environmental pathway modelling, notably the atmospheric, surface water and groundwater pathways.

4.11.6 Ore

Samples of exploration drill cores representative of three of the most prominent gold bearing reefs that will be mined as part of the Wits Gold DBM Project was submitted to the Necsa RadioAnalysis laboratory for analysis. Multiple drill core samples were supplied for each reef formations, characterised are the Leader, Beatrix and Kalkoenkrans reefs.

The radioanalytical data presented in
Table 4.9 is considered representative of the gold bearing ore processed and handled at the Wits Gold DBM Project.

Table 4.9: Radionuclide content of composite ore samples (Ra-12554 dated Table26 April 2012)

Radionuclide	Leader Reef		Kalkoenkrans Reef		Beatrix Reef	
	Sample Activity	MDA	Sample Activity	MDA	Sample Activity	MDA
	$Bq.kg^{-1}$					
U-238	58 400	160	4 680	33	2 280	30
U-234	58 900	160	4 720	33	2 300	31
Ra-226	34 000	180	2 630	66	1 850	54
Pb-210	44 000	2 800	3 940	720	2 570	750
U-235	2 690	7.3	215	1.5	105	1.4
Th-232	1 330	6	221	1.4	69.4	1.3
Ra-228	1 140	370	245	94	56	73
Th-228	1 250	180	177	56	56.9	50
Gross α	466 000	6 000	33 400	2 700	18 300	2 600
Gross β	176 000	110	13 400	330	11 100	260

4.11.7 Tailings

Since the Wits Gold DBM Project has not yet commenced, there is no mineral processing plant tailings present on site from which samples could be collected for radiological characterisation. Wits Gold therefore arranged that a sample of residue material from the laboratory scale testing of the mineral extraction process proposed for the project be supplied for analysis. According to Wits Gold, the residue is produced from a representative sample of the gold bearing ore that was prepared (crushed and milled) and extracted (cyanide leached and adsorbed with carbon) similar to the process that is planned for the Wits Gold DBM processing plant. Results of the full spectrum radiological analysis performed on this sample is presented in

Table 4.10.

Table 4.10: Radionuclide content of a tailings sample (Ra-12628 dated 26 April 2012)

Radionuclide	Sample Activity	MDA
	$Bq.kg^{-1}$	
U-238	1 160	0.87
U-234	1 170	0.88
Ra-226	1 140	27
Pb-210	1 390	140
U-235	53.3	0.04
Th-232	66.9	11
Ra-228	57.3	37
Th-228	53.1	24
Gross α	11 600	1 800
Gross β	4 490	230

4.11.8 Primary and Secondary sources associated with Wits Gold DBM Project

Some of the primary sources of radiation exposure are expected to change during the life cycle of the Wits Gold DBM Project. The assessment context (van Blerk, 2012a) made distinction between a pre-operational, operational, and post operational period. The nature of the Wits Gold DBM Project is such that some of the sources are present during the pre-operational (construction) period, while others will remain sources long after closure of the operations. One can expect the radiological impact to vary accordingly. The highest number of identified sources is associated with the operational period and will therefore be the primary importance during the definition and justification of the exposure conditions.

These primary sources include:

- Tailings Storage Facility (TSF);
- Waste rock dump;
- Return water dam;
- Ventilation Shaft;
- Metallurgical Plants; and
- Stormwater Management Facilities.

Secondary sources induced by natural processes refer to the release and distribution of radioactivity through the environmental pathways and the subsequent built-up of activity in the associated environmental compartments (e.g. surface soils, surface water bodies and sediments) with time. The development of these secondary sources induced by natural processes is thus as an extension of the environmental pathways and will be addressed in the assessment as such.

Secondary sources induced by operational processes refer to the release and distribution of radioactivity into the environment as part of the operational activities, such as material handling and transport, spillages from pipelines, and controlled or uncontrolled releases to the environment.

4.11.9 Pathways

The most significant pathways through which members of the public may be exposed to radiation at mining and mineral processing operations may be generalised as follows (IAEA, 2002a):

- Atmospheric pathways that can give rise to doses due to inhalation of airborne gases (e.g. radon and its progeny) and airborne radioactive particles;
- Atmospheric and associated terrestrial pathways that can give rise to doses resulting from ingestion of contaminated soil and foodstuff and external radiation; and
- Aquatic pathways that can give rise to doses from the ingestion of contaminated water, foods produced using contaminated irrigation water, fish, and other aquatic biota, food derived from animals drinking contaminated water, and from external radiation.

Given the potential sources of radiation exposure the pathways of concern are the atmospheric and groundwater pathways, and to a lesser extent the surface water pathway.

4.12 Heritage Impact Assessment

The historical and cultural description was undertaken by Archaetnos cc as part of the detailed Heritage Impact Assessment (Appendix D-8).

Two sites were identified in and very close to the surveyed area (**Figure 4.8**). No other archaeological, historical or cultural sites, structures or objects of any significance were identified.

Farmers did however indicate that there are grave yards in the wider mining area. As long as there is no impact (direct or indirect) this would not be a problem. However should any impact arise in future, these will need to be addressed by a heritage expert.

The same is true of any other cultural sites that may in future be impacted on due to a change in mine plan or any other circumstances. It should then immediately be evaluated and assessed by a heritage expert.

4.12.1 Site 1

This is a graveyard consisting of approximately 40 graves. There probably are more as the dense grass cover made it very difficult to do an accurate count. Two types of grave dressing were identified being stone packet or cement borders. Some graves are marked with metal markers. The graves that do have headstones have cement or stone headstones (**Figure 4.5**).

Some surnames identified are Moenvana and Hlokahetse. Dates identified range between 1908 and 1978. Most of the graves does not have names or dates and are therefore classified as unknown.

GPS: 28°10.588’S
26°54.604’E

Figure 4.5: One of the graves at site no 1

Figure 4.6: More graves at site no 1. Note the dense vegetation

The development will have a direct impact on the site. The exact nature thereof is however not known and should be confirmed by the client. Due to the sensitivity of this issue, graves are always regarded as having a **high** cultural significance.

With graves it usually is best to incorporate them into the development plan for the site. Should this be possible, the graveyard should then be fenced off and kept intact. Access to any descendants should also be allowed. A management plan needs to be drafted and implemented and it should also be monitored once a year by a heritage expert.

Should the above not be possible the graves will have to be exhumed and the bodies reburied. This is a lengthy process including social consultation for 60 days in order to find families of the deceased and to obtain their permission.

In the case of graves older than 60 years and those with an unknown date of death (as in this case) an archaeologist as well as an undertaker will have to be part of the team involved. For graves with a date of death of younger than 60 years, only an undertaker is involved.

4.12.2 Site 2

This is the remains of an old station. It consists of at least three buildings, most likely dating to the 1930's/ 40's and the ruins of more buildings (**Figure 4.7**).

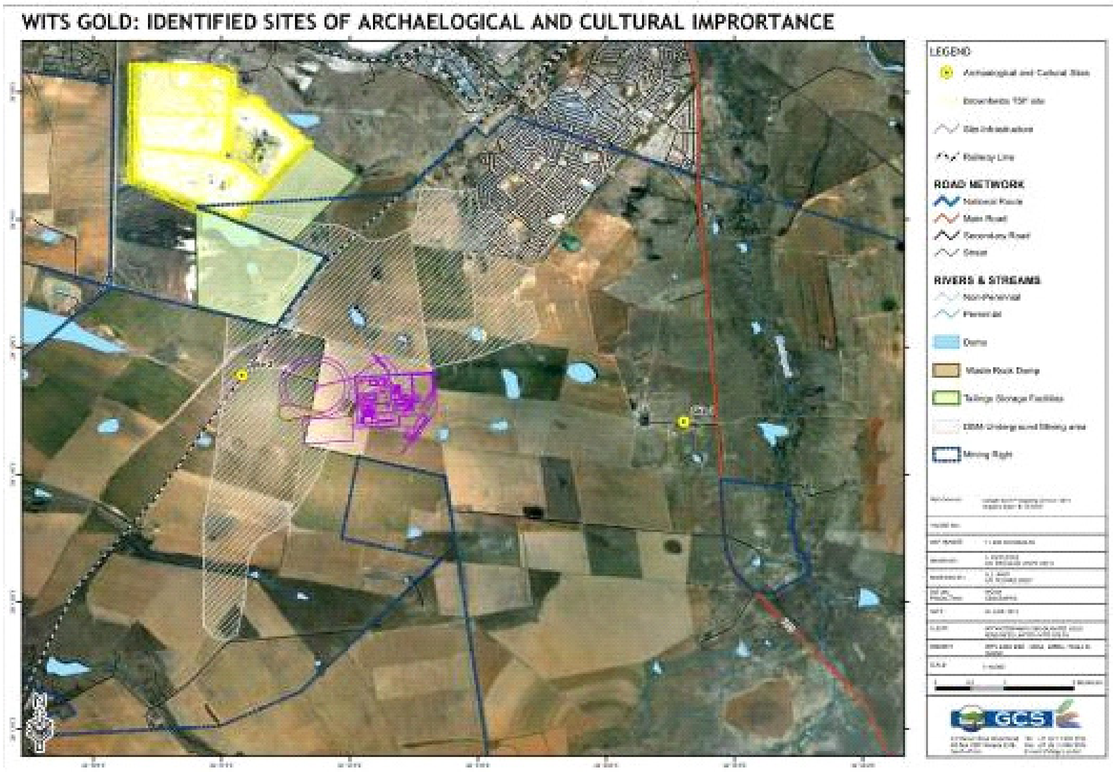
GPS: 28°10.223'S
26°51.161'E

The site falls to the west and just outside of the footprint area of the proposed mining development. Therefore there will not be a direct impact on the site, but there will be a secondary one. The buildings are regarded as having a **medium** cultural significance. It still is in a good condition, but is not very unique.

The buildings should remain intact and may even be reutilized. Any structural changes should be communicated with the Provincial Heritage Resources Agency (PHRA) of the Free State Province and a permit will be required to do so. The buildings should not be demolished.

Figure 4.7: Station buildings at site no. 2

Figure 4.8: Location of the sites indicated in the report



(Figure not to scale. Please refer to Appendix A for the A3 figure.)

Figure 4.9: Identified sites of archaeogical and cultural importance

4.13 Traffic

The updated traffic description was undertaken by ITS Engineers as part of the detailed Traffic Impact Assessment (Appendix D-9).

The finding of this investigation can be summarised as follows:

- Access to the proposed site will be provided from the S239 road. The access will be controlled by stop signs on the side road allowing free flow on the S239 and it is expected to operate at an acceptable LOS once the proposed development is fully operational.
- As mentioned above the operational phase is anticipated to be the critical period in terms of additional trips generation. The trips generation prediction for that period is in order of ± 30 and 23 vehicle trips during the AM and PM . The additional trips to be generated will not pose a significant on the external road network.
- The interaction (turning movements) between public transport and privates vehicles might pose some safety hazard. It is therefore recommended that the following measures be adopted to mitigate the impact:
    - Provision of lighting at sufficient standards at the intersection of the S239 and the access to the mining area.
- In terms of public transport provision as well as pedestrian safety:
    - No on-street pick up / drop offs at the intersection of the S239 and the access to the development should be allowed (drop-offs / pickup should be done on site).

4.14 Socio-Economic

The section below details the socio-economic description that was undertaken by GCS (Pty) Ltd as part of the detailed Social Impact Assessment (Appendix D-10).

Conceptualising a proposal to develop a greenfields gold mine, the anticipated social and environmental impacts are generally broad and not limited to one specific area or town. The proposed project falls within the Free State Province, Lejweleputswa District Municipality (DM), Matjhabeng Local Municipality (LM). A portion of the site falls within the Masilonyana LM, also within the district of Lejweleputswa.

In order to assess the potential impact of the proposed project, it is important to consider the particular Province, DMs, LMs as well as the nearby towns in a holistic way.

The baseline study will therefore include a brief overview of the socio-economic factors in the Free State Province and the Lejweleputswa DM with a thorough investigation into Matjhabeng and Masilonyana LMs as well as the towns of Virginia and Theunissen.

4.14.1 Regional context

The Free State Province represents 10.6% of the total land area of South Africa (Census 2001). The province covers an area of 129 464 km^2, and had a population of 2.7 million in 2001. The Free State Province is divided into 5 DMs. These are again subdivided into 20 LMs.

District Municipalities

- Fezile Dabi DM in the north;
- Thabo Mofutsanyane DM in the east;
- Motheo DM in the south-east;
- Xhariep DM in the south; and
- **Lejweleputswa DM** in the north-west.

The area of jurisdiction of Lejweleputswa DM is situated in the north western part of the Free State and borders the North West Province to the north and the Northern Cape Province to the west. The Lejweleputswa DM is divided into the following LM:

Local Municipalities

- **Masilonyana LM;**
- Tokologo LM;
- Tswelopele LM;
- Nala LM; and
- **Matjhabeng LM.**

The Matjhabeng LM, previously known as the Free State Goldfields, consists of the following towns:

Matjhabeng LM

- Welkom/Thabong/Bronville;
- Allanridge/Nyakallong;
- Odendaalsrus/Kutlwanong;
- Hennenman/Phomolong;
- Ventersburg/Mmamahabane; and
- **Virginia/Meloding.**

The Masilonyana LM consists of the following towns:

Masilonyana LM

- **Theunissen;**
- Masilo;
- Brandfort;
- Majwemasweu;
- Soutpan;
- Ikgomotseng;
- Verkeerdevlei;
- Tshepong;
- Winburg; and
- Makeleketla.

4.14.2 Local context

4.14.2.1 Demographic profile

Population and household profile

According to Statistics South Africa Census Data 2001 and the Community Survey 2007 (Stats SA, 2001, CS, 2007) the population size (persons) for the Matjhabeng LM decreased by 0.77% even though households grew by 9.42% (CS, 2007). The Masilonyana LM population size (persons) increased by 24.35%, whilst the household sizes increased by 59.66%.

Population group

Statistics SA data (2001) indicates that the Matjhabeng LM population are composed of mostly Black African persons (89.72%) followed by 8.66% White persons. Both females and males are evenly represented within the municipality, with slightly more Indian or Asian men (61.97%) than women (38.03%).

The Masilonyana LM population in comparison, are composed of 91.99% Black African persons, followed by 6.71% White persons. Opposite to the Matjhabeng LM, females are slightly outnumbered by males within the Masilonyana LM. This indicates that the traditional migrant nature of mining has dissipated in the area and that families are more integrated.

Language

Closely linked with population group demographics, is language. The majority of the Matjhabeng LM (63.54%) population speak Sesotho. Afrikaans is spoken by 11.53% of the population, with a very small percentage of 1.80% of the population speaking English. Within the Masilonyana LM, a similar pattern is noted, with 67.11% Sesotho speaking persons. Afrikaans (7.99%) and English (0.34%) is spoken less often.

Age

It is important to assess the age distribution of persons in order to determine both the current and future needs of an area. Age is an important indicator as it relates to education, skills and dependency. A young population may require an improved educational system, whereas an older society may need an accented focus on healthcare. The Matjhabeng LM population has a large adolescent population, steadily levelling off from 20 years of age. With 28.32% of the population being younger than 15 years of age, indicating that they do not form part of the Economically Active Population (EAP) of the area. Within the Masilonyana LM, the population younger than 15 years of age represents 29.78% of the population.

A relatively large portion of the Matjhabeng LM population falls among the 35 to 39 year age band. These persons normally form part of the economically active group, and since they have more work experience, usually fall within the higher skilled and higher salary bracket. One can clearly note that the Masilonyana LM starts decreasing from the age of 20 years, leaving fewer economically active individuals.

Education

The largest percentage (17.70%) of the Matjhabeng LM population aged 20 years and older (at the time of the 2001 census) had achieved an education at the standard of Grade

12/Standard 10/Form 5/NTCIII. A large percentage (12.14%), however, did not receive any schooling. Only 5.58% of the population achieved an academic level higher than Grade 12. In contrast, the largest percentage (18.56%) of the Masilonyana LM population aged 20 years and older (at the time of the 2001 census) had received no form of education. Only 12.12% had achieved an education at the standard of Grade 12/Standard 10/Form 5/NTCIII.

4.14.3 Economic profile

This section provides a delineation of the study area and a brief economic status quo pertaining to:

- Employment and labour profile; and
- Individual income level.

Employment and labour profile

The employment status of the population has a variety of important implications. Economically active and employed persons can contribute to the overall welfare of a specific community by paying their taxes, looking after the youth and aged and by stimulating the economy. However, should a community have a large number of economically inactive and / or unemployed persons, the burden on the EAP of that community are amplified.

Barker (2003) defines unemployment as a situation where members of the labour force are without work (not employed) and are currently available for work, and are seeking work.

According to the definition of unemployment, as used by Statistics SA, the unemployed are economically active people who:

- Do not currently work;
- Want to work and are available to start work; and
- Have taken active steps to look for work or to start some form of self-employment.

4.14.4 Services and infrastructure profile

Social service delivery centres on the provision of health, education and community development facilities and services. The concept of service delivery also comprises various elements such as affordability, quality, efficiency and access.

“Sustainable human settlements are settlements that work. They are settlements in which people live, in which they shop, seek entertainment, care for their children, and socialize and celebrate important holidays or events with their friends and neighbours. Sustainable human settlements are settlements in which people access social amenities such as healthcare clinics, libraries, schools, and so on. Sustainable human settlements are also settlements in which people vote and express their opinions freely; in which they work and pay taxes; and in which all of these things are possible without putting undue stress on the community, the family, the individual, the economy, or the environment." (Shisaka Development Management Services 2004, as cited in Ekurhuleni Integrated Development Plan 2007-2011).

According to the National Population Unit, South Africa's priorities are to meet the basic needs of all South Africans (in terms of water, sanitation, health services, education, housing and infrastructure). This is in order to redress disparities in wealth and access to resources, to create employment, to stimulate and sustain economic growth and to improve the quality of life of all South Africans. In addition, South Africa has committed itself to the Millennium Development Goals, which amongst other objectives is also aimed at the eradication of poverty and the provision of basic services to all.

The Millennium Declaration, which was adopted by the United Nations member states in the year 2000, contains eight Millennium Development Goals (MDG). These goals range from poverty reduction, health, and gender equality to education and environmental sustainability. South Africa's progress and challenges will be assessed with respect to its sustainable development, by examining trends in socio-economic development and policy-making. Cross cutting issues that can be discussed in the context of South African settlements are:

- Poverty eradication;
- Changing unsustainable patterns of production and consumption;
- Health and sustainable development;
- Means of implementation;
- Gender equality; and
- Sustainable development in a globalising world.

This indicator therefore examines the level of service provision in the study area. Services assessed include sanitation, water, housing, refuse facilities and electrification. According to Abrahams and Goldblatt (1997), there are three priority services (water, sanitation and electricity) for the promotion of health, convenience and quality of life.

In addition, the Free State Growth and Development Strategy for 2005 / 2014 identified specific development priorities, based on the social and economic development challenges of the province. The Free State Province has identified the following as primary development objectives:

Enhancing economic development and job creation

- Local economic development;
- Tourism growth; and
- Land reform.

Providing and facilitating sustainable infrastructure

- Infrastructure;
- Housing;
- Sport and recreation;
- Cemeteries; and
- Community facilities.

Investing in the development of people

- Education;
- Health and social welfare;
- Youth development; and
- Cross cutting issues: elderly / disabled / gender equity.

Ensure a safe and secure environment

- Safety and security.

Good / co-operative governance with sustainable use of resources and the environment

Housing

Housing is one of the basic human needs that have a profound impact on the health, welfare, social attitudes and economic productivity of the individual. It is also one of the best indications of a person's standard of living and of his or her place in society. In achieving the MDG, South African Government Policy is to ensure that its citizens live within good housing conditions. In order to achieve this goal, the government wants to eliminate all informal dwellings and bucket type toilets, and to ensure that all citizens have access to electricity for lighting, and access to clean, safe water within a reasonable distance (Statistics SA, 2007).

The Matjhabeng LM has been steadily formalising informal settlements within its municipal area. Persons residing within informal settlements have decreased by 18% between 2001 and 2007.

In terms of housing provision, the Matjhabeng LM has launched Operation Hlasela, which is focused on providing decent housing conditions in areas such as Meloding and Phomolong. Old two-roomed houses are being demolished and replaced with decent four-roomed houses. The Provincial Department of Human Settlements has committed subsidies to the approximate value of R 12.8 million towards this project. An added benefit of this project is that is has created local employment opportunities for the local residents (www.matjhabeng.co.za).

Land tenure describes the way in which people own land. Tenure reform aims to bring all people occupying land under one system of landholding. This system must provide the same rights for different forms of tenure such as private ownership and communal tenure. Land tenure is a contentious issue in the rural areas and a general lack of available data contributes to the municipality's inability to addressing ownership.

Community Survey 2007 results show that the percentage of households in the Matjhabeng LM who owned, whether fully paid off or had not yet paid off their dwellings, increased from 51.40% in 2001 to 60.30% in 2007.

The percentage of households who rented dwellings increased slightly from 21.5% in 2001 to 22.4% in 2007.

The promotion of security of tenure through the Discount Benefit Scheme has been launched in the Matjhabeng LM, whereby ownership of properties is being transferred from the Matjhabeng LM to beneficiaries. This scheme transfers old housing stock, kept under the 99-year leasehold to individuals. The progress is as follows:

Thabong

- 133 title deeds have been issued; and
- 500 transfers are lodged with the Deeds Office.

Meloding

- 87 title deeds have been registered.

Nyakallong

- 50 title deeds have been registered.

In addition, the Matjhabeng LM has formalised the following informal settlements:

Meloding

- Three informal settlements were formalised resulting in the establishment of 346 erven.

Kutlwanong

- The informal settlement near Kutlwanong Stadium was formalized and 214 erven established.

Mmamahabane

- A total of 32 erven were established during the process of formalisation.

The formalisation process required that each individual be allocated with a proper pegged site to ensure adherence to the layout plan.

Energy use

According to the Masilonyana LM IDP (2011/12), the bulk electrical network of the municipality is well established, with Eskom providing services to all mines and towns in the municipality. The IDP further states that there is sufficient infrastructure to service the whole municipal area.

The bulk electrical network within the Matjhabeng LM is well established since Eskom is servicing all the mines and townships within the municipal area. However, aging electrical infrastructure where the Matjhabeng LM is the service provider has posed challenges. In addition the Matjhabeng LM Integrated Development Plan (IDP) for 2010/11 (IDP, 2010/11) reports that, a change in Eskom's cost recovery and subsidisation policy has made it very expensive to electrify the rural areas (including farms and farming communities). The National Government has set a target of 100% electrification of all areas by the end of 2014.

The use of electricity for heating, cooking and lighting has increased substantially between 2001 and 2007, with a growth of 19.6% for heating and cooking respectively.

Water and sanitation

Water infrastructure within the Matjhabeng LM consists mainly of Sedibeng Water reservoirs and pipelines. Water supply mainly focuses on the Goldfields region, supplying the mines with water from the Vaal River near Bothaville and to a lesser extent from the Sand River.

Matjhabeng LM supply water to all formal towns and townships in its area of jurisdiction. These areas comprise of residential, business and industrial users that are serviced.

Main reservoirs within the Matjhabeng LM are located east of Allanridge, in Welkom, as well as north and south of Virginia. Pump stations are situated east of Allanridge and at Virginia where there is also purification plant (IDP, 2010/11).

According to the Matjhabeng LM IDP (2010/11), the municipality has 11 purification plants and is finding it difficult to keep all the purification plants and networks in good operational standard that conforms to National Standards. It has been estimated that, after the completion of the municipality's current projects, a remaining backlog of approximately 9 000 households will still exist. The municipality intends to address this backlog over a five year timeframe.

The Masilonyana LM IDP (2011/12) indicates that the municipality's water infrastructure comprises of the reservoir and pipelines of Sedibeng Water that supply the municipal area and the mines with water from the Vaal River and to lesser extent with water from the Sand River. All towns in the municipality are dependent on the ground water extraction and most of the rural areas have been provided with water (an estimated 80% of farm communities have clean, running water).

Water services delivery is performed by a vast number of Water Services Authorities, Water Boards and Service Providers across the country. The Department of Water Affairs' Blue Drop Certification programme of 2011 verified the status of drinking water quality and management of supply systems by municipalities via a supply infrastructure network of 914 systems. The Blue Drop Certification programme verifies the level of management proficiency, water quality and risk management in the municipal water services business.

The Blue Drop Report for 2011 has been designed with the objective to provide the sector and its stakeholders with current, accurate, verified and relevant information on three different levels:

System specific

- Data and information pertaining to the performance of each supply system on municipal level.

Province specific

- Figures and information to highlight the strengths, weaknesses and progress for the collective of municipalities within the province.

National overview

- Collate and elevate the detailed findings on system level to that of a provincial overview, which can then be compared and inculcated as a national view of drinking water quality management performance; and
- Comparative analyses amongst the provincial performances are useful indicators and benchmarks for the various role players.

The Matjhabeng LM obtained an overall score of 79.91%, placing them fourth among Free State Province Municipalities. The closest water supply system to the proposed site is the Virginia Water Supply System, which achieved an overall status of 79.80%, slightly less than the municipal average. This gives them an “Excellent Drinking Water Quality Compliance”.

The Masilonyana LM obtained an overall score of 6.49%, placing the fifteenth among Free State Province Municipalities. The closest water supply system the proposed site is the Theunissen Water Supply System, which achieved an overall status of 6.5%, resulting in a compliance warning.

Matjhabeng LM has incrementally increased the level of water supply and expanded household access to both a Reconstruction and Development Programme water standard and higher. Households with access to piped water inside their dwellings have increased by 15.4%, with household relying on water within an access point in their yard, simultaneously reducing by 14.1%. Households with access to piped water outside their yards declined significantly (18.4%).

<u>Healthcare</u>

HIV/AIDS in South Africa has increased rapidly over the past decade. The social and economic consequences of the disease are far reaching and affect every facet of life in South Africa. Despite South Africa creating a progressive and far-sighted policy and legislative environment for dealing with HIV/AIDS, the prevalence of HIV/AIDS continues to increase. This indicates that policies and laws have not been adequately implemented and have not impacted significantly on the ground.

HIV/AIDS policies integrate the following principles:

Non discrimination

- No employee shall be dismissed on the ground of his/her HIV status;
- No hiring decision based on HIV assessment;
- Training within the workplace not influenced by HIV status; and
- Advancement or promotion not dependent on HIV status.

Confidentiality and disclosure

- No employee required to disclose his/her status; and
- Should the employee want to disclose his/her status voluntarily, it cannot be disclosed to others without the employee's written consent.

Benefits applied equally to all employees

- Medical assistance is provided to an employee in accordance with the rules of the health care delivery system to which the employee is contracted; and
- Pension funds and provident funds are applied equally to all employees.

Ill-health retirement

- When an employee is deemed medically incapacitated the employee is provided with an ill health retirement package; and
- If however, the employee wishes, he/she can submit a dissenting opinion from a independent registered medical practitioner.

Five broad economic impact channels are usually used to assess the impact of HIV/AIDS on the South African economy (Chamber of Mines of South Africa, 2003):

- A lower overall population and labour force which affects both the production potential of the economy and the expenditure side of the economy;
- The direct costs, which include increased contributions to medical benefit schemes, disability cover, etc;
- The indirect costs (e.g. Increased absenteeism, reduced productivity and impact on training);

- An increased level of government expenditure as a result of higher demand for public health and social services; and
- Private households will bear the brunt of home care costs of family members living and suffering from AIDS, the cost of funerals, and the care of orphans which will reduce household savings and spending in other areas.

Independent of the above models, the industry recognises that HIV/AIDS has the following effects on labour, and therefore, on the economy of the company (Chamber of Mines of South Africa, 2003):

- Productivity is being affected by the increasing illness of the employees necessitating absenteeism and increasing sick leave;
- Training and replacement of labour once the employee becomes medically incapacitated or dies is required and productivity is reduced; and
- Staff morale – loss of colleagues, increased workloads, perceived and actual discrimination, uncertainty about HIV/AIDS and the fear of infection will undermine morale and productivity.

Socio-economic development is about more than just economic growth, and should include the following as well:

- Longevity;
- Standard of living;
- Infant, child and maternal mortality; and
- Distribution of income.

Some socio-economic development consequences of HIV/AIDS are summarised below.

- Life expectancy;
- Infant mortality rates;
- Child mortality rates; and
- Crude death rate.

The effects of AIDS reverses hard-won socio-economic development gains and makes further development attempts that much more difficult as the HIV/AIDS hurdle will have to be surmounted in addition to the other pressing developmental problems.

The number of HIV positive persons living within the Free State Province has increased by 5.78% since 1996. The number of HIV related deaths has however dramatically increased, and in 2005 surpassed the amount of deaths accredited to other causes. This indicates that HIV/AIDS is a real concern within the Free State Province.

The Matjhabeng LM aims to provide quality care and effective services based on the World Health Organisations definition of Primary Health Care within the policy framework of the:

- Department of National Health;
- Provincial Health Department; and
- Matjhabeng Municipality.

Clinics in Matjhabeng Municipality

Virginia

- Virginia Clinic
- OR Tambo Clinic
- Rearabetswe Clinic
- Meloding Clinic
- Khothalang clinic

Services that are provided by the Matjhabeng LM include:

- Ante Natal Care;
- Post Natal Care;
- Immunisations;
- Integrated management of childhood illnesses;
- Family planning;
- Mental Health Care;
- Management of Chronic conditions e.g. asthma;
- Minor Ailments;
- Tuberculosis management;
- Counselling for voluntary HIV testing Sexually Transmitted Infections;
- HIV/AIDS Care;
- Anti Retroviral Treatment;
- Health information; and
- Referral system.

The Masilonyana LM has a high rate of HIV/AIDS infection, which the IDP (2011/12) attributes to migrant labour from the mines and high employment rates. The municipality has mobile clinics that operate in the rural areas, but challenges such as far distances to travel leading to a low frequency of visits as well as overcrowding have been highlighted.

Roads and transport

The Matjhabeng LM has a well established road and transportation infrastructure, however, the issue of maintenance is providing the municipality with safety and financial challenges. The public transport system mainly consists of privately owned taxis, but there are, however, a rail network that links towns such as Hennenman and Virginia with other provinces, such as the Gauteng-, KwaZulu Natal-, Eastern Cape- and Western Cape Province. The transport infrastructure, however, does not extend to local rail network or bus service operations within the municipality (IDP, 2010/11).

The road networking within the Masilonyana LM is well developed but the road conditions are deteriorating at an increasing rate, with very little maintenance taking place. The maintenance of all primary roads has been identified as an urgent priority for the next five years in order to facilitate the flow of traffic through the municipality and to support local economic development. Similarly, there is a need to maintain the tertiary road system as it forms a lifeline for rural communities in terms of health, education and emergency services.

Public safety

The current level of crime within the Matjhabeng LM has caused concern, with an increase in housebreaking and violence against women and children. Both the Matjhabeng and Masilonyana LM IDPs (2010/11 and 2011/12) have highlighted the following as some contributing factors:

- High unemployment rate and migration from rural to urban areas;
- Lack of resources within the SA Police Service (transport, manpower);
- Ineffective functioning of Neighbourhood Watch Organisations and Community Policing Forums;
- Lack of visible policing; and
- Lack of accessibility to police stations.

The IPD (2010/11) highlights that more facilities such as mobile police stations, available transport and accessible communication systems are required to improve crime prevention and emergency response.

The social change processes shown below are expected to take place as a result of this project.

Demographic processes

- In-migration;
- Presence of temporary workers;
- Resettlement; and
- Displacement / dispossession.

Economic processes

- Waged labour; and
- Conversion and diversification of economy.

Geographic processes

- Conversion and diversification of land use;
- Enhanced transport and rural accessibility; and
- Physical splintering.

Institutional and legal processes

- No impacts are expected.

Emancipatory and empowerment processes

- Capacity building.

Socio-cultural processes

- Social behaviour.

It is important to pause here and clarify that the actual impacts experienced at a given project site will depend on a variety of factors, that range between the baseline conditions, the public participation process, engagement and capacity building that has taken place, the type of mining methods and minerals mined, the role of politics, most notably in local municipalities and the other processes of social change either already under way (e.g. due to exploration activities), or which may develop during the life of the mine.

5 PUBLIC PARTICIPATION

Public Participation is a vital component in the environmental process. GCS has invited various stakeholders to register as Interested and Affected Parties (I&APs) in order to have the opportunity to submit their comments regarding the proposed project. This section of the report documents the process, which was followed with respect to consultation of I&APs and other stakeholders.

5.1 Purpose of the Public Participation Process

Public participation is an essential and legislative requirement for any MRA and related environmental authorization. The principles that demand communication with society at large are best embodied in the principles of the NEMA, South Africa's overarching environmental law. In addition, Section 24(5), Regulation 54-57 of GNR 543 under the NEMA, guides the Public Participation Process (PPP) that is required for an EIA process as per an application for Environmental Authorisation. However, as this EIA has been conducted in terms of the MPRDA, the requirements, as set out in the DMR Acceptance Letter (attached with the cover letter), as well as all legal requirements as defined in Chapter 2, Part 3, Section 49(1)F of the MPRDA will be considered. The above reference section of the MPRDA states that the EIA should *"describe the process of engagement of identified interested and affected persons, including their views and concerns"*.

Furthermore it is the general objectives of the Public Participation Process, during the EIA are to:

- Assist the I&APs with identifying issues of concern, and providing suggestions for enhanced benefits and alternatives;
- Contribute their local knowledge and experience to be incorporated into the Environmental Assessment; and
- Verify that their issues have been considered and included in the EMP.

The PPP aims furthermore to ensure that all relevant I&APs are consulted and involved. The process ensures that all stakeholders have an opportunity to raise their comments as part of an open and transparent process, which in turn ensures for a complete comprehensive environmental study.
The specific/detailed purpose of consultation and the engagement therefore is to:

- Introduce the proposed project (which was completed during the Scoping Phase);
- Explain the EIA and PPP to be undertaken;

- Determine and record public issues and concerns;
- Provide opportunities for public input and gathering of local knowledge;
- Inform a broad range of stakeholders about the project and the environmental process to be followed;
- Establish lines of communication between stakeholders and the project team;
- Identify all the significant issues in the project; and
- Identify possible mitigation measures or environmental management programmes to minimise and/or prevent environmental impacts, associated with the project.

Once the concerns of I&APs have been established, the EIA/EMP Report will aim to address these concerns.

In order to achieve the above, general and specific objectives, a range of measures, as defined in the Public Participation Guidelines referred to above, are employed. These include the measures as per the sections below.

5.2 Identifying I&APs

Land owners and property occupiers were identified during the initial consultation conducted by GCS. As the on-the ground understanding of affected stakeholders improves through interaction with various stakeholders and GCS, the database is continually updated to include additional stakeholders.

The detailed list of I&APs consulted thus far is provided in Appendix F-1.

5.3 Notification

Announcement of the initial opportunity to become involved and to participate in the Application for a Mining right was announced in March 2012 during the EIA Phase. The initiation of the PPP was advertised as follows:

- Distribution of a Background Information Document (BID) containing details of the proposed project, including a map of the project area, and a registration sheet (March 2012);
- An advertisement was placed in the Volksblad (Vista) Newspaper 8 March 2012; and
- Site notice boards were positioned at prominent localities around the site on 5-9 March 2012.

Stakeholders have further been notified about the commencement of the EIA phase, explaining the process to be followed and opportunity of engagement. Announcement of the second public meeting (18 July 2012) and availability of the draft EIA/EMP for public review and comment period of 30 days (Wednesday, 4 July 2012 to Friday, 3 August 2012) were advertised as follows:

- Email and bulk sms sent to all I&APs on 4 July 2012; and
- An advertisement was placed in the Volksblad (Vista) Newspaper 29 June 2012.

Once the EIA/EMP Report has been completed (including the various specialist studies) and submitted to the DMR, I&APs will be afforded an opportunity to review and comment on the findings thereof.

5.3.1 Background Information Document

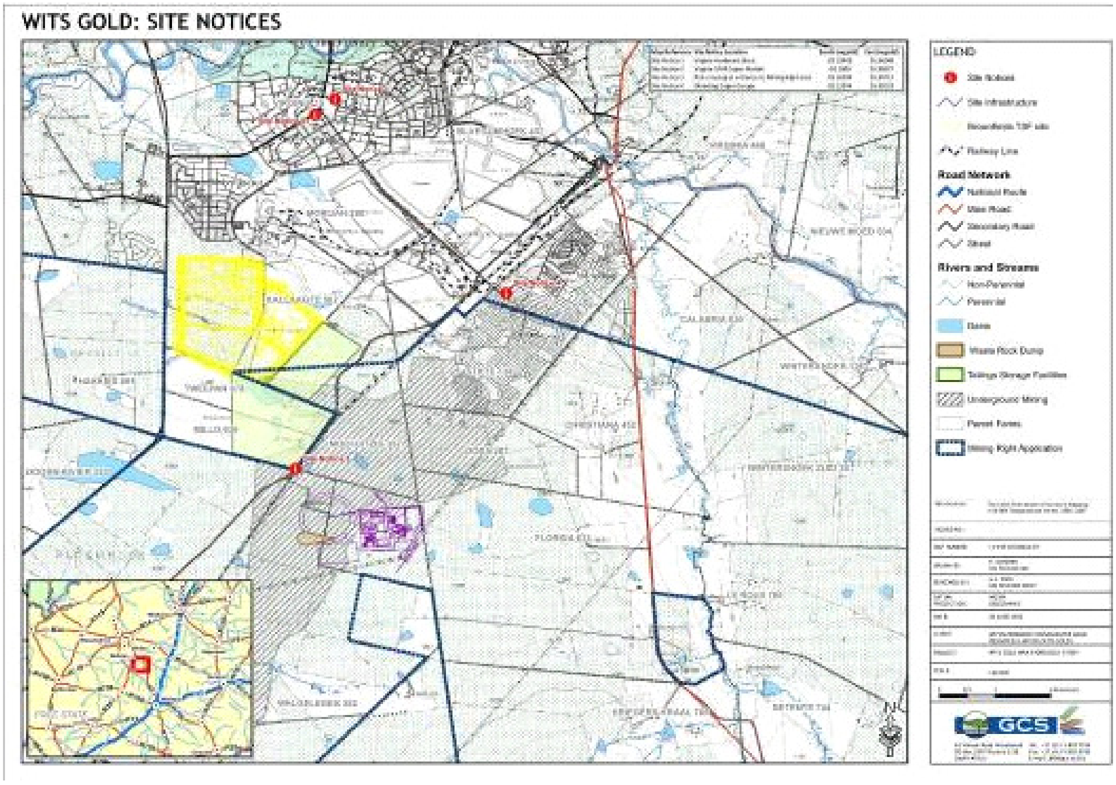
A BID (Appendix F-2) was distributed to identified stakeholders. The BID was compiled in English and Afrikaans and included details of the proposed project, the EIA and the MPRDA process. It included relevant contact details and a comment/registration sheet for I&APs to complete. I&APs were invited to register and send responses by fax, telephone or e-mail to GCS.

5.3.2 Site Notice

Four site notices (Appendix F-3) were erected at prominent locations (as pointed out by affected stakeholders) around the site on 5-9 March 2012 (**Table 5.1** and Figure 5.1). These notices were prepared in accordance to the guideline regulations and contained details of the proposed project and the EIA phase including requirements of the MPRDA. It clearly depicted the contact details of the project team.

Table 5.1: Location of site notices (5-9 March 2012)

Site	Coordinates	
	South	East
Virginia Hardware Store	-28.10408	026.86346
Virginia SPAR Super Market	-28.10660	026.86027
Rail-crossing at entrance to Mining Right area	-28.16394	026.85712
Meloding Engen Garage	-28.13554	026.89119



(Figure not to scale. Please refer to Appendix A for the A3 figure.)

Figure 5.1: Site Notice Locations

5.3.3 Advertisement

Advertisements were placed in Volksblad (Vista) Newspaper on 8 March 2012 and 29 June 2012 (Appendix F-4). The advert, which appeared in the main body of the newspaper, aimed to inform the general public, as well as any other affected parties about the MRA, public meeting (27 March 2012) and availability of the Scoping Report for public comment and review. It not only included a brief description of the project, but also the legal requirements and an invitation to any I&AP to register as such with GCS. An authority reference number was provided. An additional advert was placed in the Vista newspaper detailing the location and comment period of the draft EIA for public review and comment as well as notification of the second public meeting (18 July 2012).

5.4 Stakeholder Engagement

5.4.1 Consultation Meeting

Two consultation meetings have been held with some of the key stakeholders. At the first meeting (27 March 2012) the background to the project, as well as the environmental approach, was explained. The attendees were provided with an opportunity to raise issues, concerns, questions and their views. All of these were documented during the discussion session. Issues raised at these meetings have been included in the minutes of the meeting which is included in Appendix F-5.

The second meeting was held on 18 July 2012 to discuss the finding of the EIA and provide the I&APs another opportunity to raise issues, concerns, questions and their views. All of these were documented during the discussion session. Issues raised at these meetings have been included in the minutes of the meeting which is included in Appendix F-5.

5.4.2 Issues Raised during the Scoping Phase

This section of the report documents the concerns, comments, viewpoints and questions (collectively referred to as 'issues') raised by the I&APs during the consultation process. The following opportunities were available during the EIA Phase for contribution from the I&APs:

- Completing and returning the registration/comment sheets;
- Providing comment telephonically or by email/fax to GCS; and
- Attending stakeholder meetings.

All concerns and issues received thus far (during the EIA phase) were captured and documented in the Issues and Response Register (IRR) in such a way as to include:

- Contact details of all registered I&APs; and
- Issues raised linked to the related I&AP.

The IRR (See Appendix F-6) will continually be updated to include additional I&AP contributions that may be received as the application process proceeds. Further issues and concerns will be captured as mentioned above during additional public consultation.

5.5 EIA and EMP Report

The draft EIA/EMP Report was made available for public review on 4 July 2012 until 3 August 2012. One printed copy of the report was made available to I&APs by means of placing the document together with a CD containing the information in the Virginia Local Library. Electronic copies will be placed on the GCS website (www.gcs-sa.biz) as well as be provided to I&APs in electronic format (CD) upon request.

The final EIA/EMP Report will be made available for public review and comment on 7 August 2012 until 17 September 2012 whereby they will be afforded the opportunity to submit their comments directly to the DMR as well as to GCS. One printed copy of the report will be made available to I&APs by means of placing the document together with a CD containing the information in the Virginia Local Library. Electronic copies will be placed on the GCS website (www.gcs-sa.biz) as well as be provided to I&APs in electronic format (CD) upon request.

6 IDENTIFICATION OF IMPACTS AND ISSUES WITH MANAGEMENT MEASURES AND ACTION PLANS (EMP)

This chapter of the EIA/EMP report relates to the following sections of the MPRDA and Regulation 527 (GNR 527) of 23 April 2004 promulgated in terms of the MPRDA:

39(3) "An applicant who prepares an environmental management programme or an environmental management plan must –

(b) investigate, assess and evaluate the impact of his or her proposed prospecting or mining operations on –

(i) the environment;

(ii) the socio-economic conditions of any person who might be directly affected by the prospecting or mining operation; and

(iii) any national estate referred to in section 3(2) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999), with the exception of the national estate contemplated in section 3(2)(i) (vi) and (vii) of that Act."

"50(c) An assessment of the nature, extent, duration probability, and significance of the identified potential environmental, social and cultural impacts of the proposed mining operation, including cumulative environmental impacts".

This chapter of the EIA/EMP report describes and evaluates the potential impact Wits Gold's proposed mining and related activities, processes and actions, on the surrounding environment. It is the purpose of this part of the EIA/EMP report to indicate the impacts on the various aspects of the environment that are anticipated to be associated with the proposed activities, as required in terms of Sections 50 and 52 of the Government Notice (GN) R.527, dated March 2004, under the MPRDA, 2002.

This chapter of the EIA/EMP further provides the management measures and action plans recommended to manage the potential impacts rated in the EIA section. In addition the management measures provide the responsible person with compliance requirements (i.e. timeframes and guidelines) to ensure that these commitments are adhered to and implemented and the priority of these commitments.

6.1 Environmental Impact Significance Rating Methodology

To ensure uniformity, the assessment of potential impacts will be addressed in a standard manner so that a wide range of impacts is comparable. For this reason a clearly defined rating scale will be provided to the specialist to assess the impacts associated with their investigation.

Each impact identified will be assessed in terms of probability (likelihood of occurring), scale (spatial scale), magnitude (severity) and duration (temporal scale). To enable a scientific approach to the determination of the environmental significance (importance), a numerical value will be linked to each rating scale.

The following criteria will be applied to the impact assessment for the EIA/EMP:

Occurrence

- Probability of occurrence (how likely is it that the impact may occur?); and
- Duration of occurrence (how long may impact last?).

Severity

- Magnitude (severity) of impact (will the impact be of high, moderate or low severity?); and
- Scale/extent of impact (will the impact affect the national, regional or local environment, or only that of the site?).

Status of Impact

- +: Positive impact
- -: Negative impact
- N: Neutral (no impact)

In order to assess each of these factors for each impact, the following ranking scales were used:

Probability:=P	*Duration:=D*
5 – Definite/don't know	5 – Permanent
4 – Highly probable	4 - Long-term (ceases with the operational life)
3 – Medium probability	3 - Medium-term (5-15 years)
2 – Low probability	2 - Short-term (0-5 years)
1 – Improbable	1 – Immediate
0 – None	
Scale:=S	*Magnitude:=M*
5 – International	10 - Very high/don't know
4 – National	8 – High
3 – Regional	6 – Moderate
2 – Local	4 – Low
1 – Site only	2 – Minor
0 – None	
Status of Impact	
+: Positive	
-: Negative	
N: Neutral	

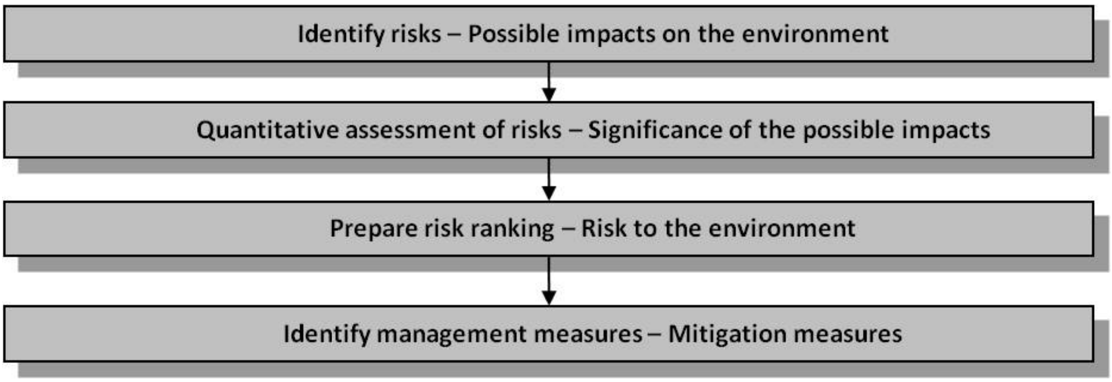
Once the above factors have been ranked for each impact, the environmental significance of each was assessed using the following formula:

SP = (magnitude + duration + scale) x probability

The maximum value that can be achieved is 100 Significance Points (SP). Environmental effects were rated as follows:

Significance	*Environmental Significance Points*	*Colour Code*
High (positive)	>60	H
Medium (positive)	30 to 60	M
Low (positive)	<30	L
Neutral	0	N
Low (negative)	>-30	L
Medium (negative)	-30 to -60	M
High (negative)	<-60	H

The following process will be followed:



No specialist findings have been modified by the EAP. The information provided within this report reflects the opinion of the specialists, in agreement with the EAP. The applicant has reviewed all the conditions.

6.2 Pre-Construction Phase

Wits Gold commits to obtain all necessary environmental authorisations from the relevant government departments, before undertaking any construction activities. Wits Gold also commits to obtain rezoning classification before any construction or operational activities commence.

Table 6.1 details the identified impacts and management measures for the pre-construction activities.

Table 6.1: Impacts and Management Measures for Pre-Construction Activities

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
PRE-CONSTRUCTION PHASE: ACTIVITIES REQUIRING MANAGEMENT MEASURES																				
Issues Relating to PERMITTING																				
Construction and Mining Related Activities will only commence upon approval of the rezoning application from agricultural to mining. This may cause a delay with regards to the planned operational schedule of the DBM Project.	Rezoning of Land	0	0	0	0	0	N	N	Construction and mining related activities will only commence upon approval of the rezoning application from agricultural to mining.	0	0	0	0	0	N	N	Apply for the rezoning of the area from agricultural to mining.	Prior to Construction	Project Manager/Applicant	Once off
Construction and Mining Related Activities will only commence upon approval of all environmental authorisations as required by environmental legislation. This may cause a delay with regards to the planned operational schedule of the DBM Project.	Timeframe Delays	0	0	0	0	0	N	N	Construction and mining related activities will only be commenced upon approval of the MPRDA EIA/EMP by the DMR.	0	0	0	0	0	N	N	Compile MPRDA EIA/EMP and obtain record of decision from the DMR.	Prior to Construction	Project Manager/Applicant	Once off
									Construction and mining related activities will only be commenced upon approval of the MPRDA SLP by the DMR.								Compile MPRDA SLP and obtain record of decision from the DMR.	Prior to Construction	Project Manager/Applicant	Once off
									Construction and mining related activities will only be commenced upon approval of the NEMA EIA/EMP by the DEA.								Compile NEMA EIA/EMP and obtain record of decision from the DEA.	Prior to Construction	Project Manager/Applicant	Once off
									Construction and mining related activities that trigger water uses in accordance with Section 21 of the NWA will only be commenced with upon approval of the NWA IWUL by the DWA.								Compile NWA IWUL and obtain record of decision from the DWA.	Prior to Construction	Project Manager/Applicant	Once off
Construction and Mining Related Activities will only commence upon approval of all environmental authorisations as required by environmental legislation. This may cause a delay with regards to the planned operational schedule of the DBM Project.	Access to Electricity	0	0	0	0	0	N	N	Construction and mining related activities will only commence once an electricity source has been confirmed with the electricity provider and the necessary record of decision provided to the relevant authorities (i.e. DMR and DEA).	0	0	0	0	0	N	N	Consult with Eskom regarding the opportunity to utilise power from the Theseus sub-station located close to the site.	Prior to Construction	Project Manager/Applicant	Once off
																	Ensure that the power lines established on site will not be impacted on by future mining operations and/or infrastructure expansions.	Prior to Construction	Project Manager/Applicant	Once off
Issues related to GEOLOGY																				
No significant pre-construction impacts are envisaged.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TOPOGRAPHY																				
Issues related to the blasting and vibration associated with shaft development on the surrounding land owners houses and other existing infrastructure on/around site.	Blasting and vibration	6	4	2	5	60	-	M	Undertake a blast and vibration assessment and crack survey on site and within a 2 km radius prior to the commencement of any construction activities.	4	4	2	4	40	-	M	Undertake a blast and vibration assessment prior to any blasting activities taking place on site.	Prior to Construction	Project Manager/Applicant/Geotechnical Specialist	Once off (R 165 000.00)
																	Undertake a crack survey of neighbouring properties to establish a baseline prior to undertaking any blasting activities on site. Undertake a follow-up crack survey after any blasting activities to confirm damage, if applicable, together with a photographic record.	Prior to Construction	Project Manager/Applicant/Geotechnical Specialist	R 95 000.00
Issues related to GEOHYDROLOGY																				
Baseline information is required for water quality and quantity monitoring purposes.	Baseline Monitoring	6	4	2	4	48	+	M	Groundwater quality monitoring networks must be set up prior to the construction phase so that any groundwater quality and quantity issues can be addressed accordingly.	8	4	2	5	70	+	H	Groundwater quality sampling will be undertaken on a monthly basis and analysed according to the prescribed monitoring programme contained in the EIA/EMP.	Monthly	Environmental Coordinator	R 91 000.00
																	Determining potentiometric water level and aquifer potential of Witwatersrand aquifer.	Quarterly	Environmental Coordinator/Water Quality Specialist	Included in Operational Costs
																	Quarterly groundwater monitoring	Quarterly	Environmental	R 42 000.00

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
PRE-CONSTRUCTION PHASE: ACTIVITIES REQUIRING MANAGEMENT MEASURES																				
																	reports will be generated by the mine or through a qualified water quality specialist.		Coordinator/Water Quality Specialist	
																	In the event that water quality or quantity issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental Coordinator/Water Quality Specialist	To be determined - depending on severity of incident
Issues related to HYDROLOGY																				
Baseline information is required for water quality monitoring purposes.	Baseline Monitoring	6	4	2	4	48	+	M	Surface water quality monitoring networks must be set up prior to the construction phase so that any surface water quality issues can be addressed accordingly.	8	4	2	5	70	+	H	Surface water quality sampling will be undertaken on a monthly basis and analysed according to the prescribed monitoring programme contained in the EIA/EMP.	Monthly	Environmental Coordinator	R 91 000.00
																	Quarterly surface water monitoring reports will be generated by the mine or through a qualified water quality specialist.	Quarterly	Environmental Coordinator/Water Quality Specialist	R 42 000.00
																	In the event that water quality issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental Coordinator/Water Quality Specialist	To be determined - depending on severity of incident
Clean water runoff from areas outside the dirty water footprint area of the mine could flow into this area and potentially become polluted.	SWMP development	6	4	3	4	52	-	M	Seperation of clean and dirty water areas.	4	2	2	2	16	-	L	Indentify dirty water footprint area and separate clean and dirty water using a system of berms and drains.	Prior to Construction	Environmental Coordinator/Water Quality Specialist	R 150 000.00
Issues related to SOIL, LAND USE AND LAND CAPABILITY																				
Crop production and grazing on land will cease	Fencing-off of mine areas, potential resettlement of farmers	1	5	8	5	70	-	H	No mitigation measures possible until closure and decommissioning phase	1	5	8	5	70	-	H	No mitigation measures possible until closure and decommissioning phase	N/A	N/A	N/A
Issues related to FAUNA AND FLORA																				
No significant pre-construction impacts are envisaged.		0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to AIR QUALITY																				
Baseline information is required in order to determine dust dispersion on site as a result of pre-mining activities as well as for ongoing air quality monitoring purposes.	Baseline Monitoring	6	4	2	4	48	+	M	A dust monitoring network must be set up prior to the construction phase so that any air quality or dust issues can be addressed accordingly.	8	4	2	5	70	+	H	Dust sampling will be undertaken on a monthly basis and analysed according to the prescribed monitoring programme contained in the EIA/EMP.	Monthly	Environmental Coordinator	R 92 000.00
																	Monthly monitoring reports will be generated by the mine or through a suitably qualified air quality specialist.	Monthly	Environmental Coordinator/Air Quality Specialist	R 42 000.00
																	In the event that air quality or dust issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental Coordinator/Air Quality Specialist	To be determined - depending on severity of incident
Issues related to NOISE																				
No significant pre-construction impacts are envisaged.		0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TRAFFIC																				
No significant pre-construction impacts are envisaged.		0	0	0	0	0	N	L	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to VISUAL																				
No significant pre-construction		0	0	0	0	0	N	L	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
PRE-CONSTRUCTION PHASE: ACTIVITIES REQUIRING MANAGEMENT MEASURES																				
impacts are envisaged.																				
Issues related to SOCIAL																				
Increase in population size	Population	10	4	3	4	68	-	H	Implement according to proposed action plan.	8	4	4	3	48	-	M	• Employment criteria should be communicated to the community in advance (e.g. in newspapers, community forum notice boards, etc); • Local labour should be employed as far as possible; • Verify the details of potential employees in order to ensure that local labour is employed; • Accommodation for members of the workforce, other than security personnel, must not be permitted on site; The only semi-permanent structures that should be allowed on site is guard houses for security personnel; • Camp followers / informal traders must not be allowed to congregate outside the construction site; • Temporary staff should be housed in the surrounding communities, i.e. Bed and Breakfast establishments, etc. to prevent the establishment of construction camps; and • The AgriSA protocol for access to farms should be followed at all times.	Ongoing	Environmental Control Officer	Included in Construction and Operational Costs
Resettlement	Job Creation	10	2	1	3	39	-	M	Implement according to proposed action plan.	10	2	1	2	26	-	L	• Full disclosure and consultation with affected landowners; and • Develop a relocation plan to address impacts of resettlement, which will address issues of compensation, etc.; and • Establish communication with affected landowners to ensure that their needs and preferences are taken into consideration.	Ongoing	Environmental Control Officer	Included in Construction and Operational Costs
Waged labour	Job Creation	6	3	3	4	48	+	M	Implement according to proposed action plan.	8	4	3	4	60	+	M	• Unskilled and unemployed labour should be sourced from the surrounding local communities as far as possible; • Skills development opportunities should be granted to community members and local job seekers, where needed; • Maximise employment opportunities for the local communities and reduce the influx of a foreign labour force whilst ensuring an effective construction and operational phase; • Capture all project relevant skills in the project area with the aim to ensure maximum local employment; • Make use of any existing skills databases and include the local councillors and other representative community structures in the process; • Develop a Recruitment Manual to include a list of employment opportunities that will become available during the project planning, construction and post-construction phases and provide guidelines on	Ongoing	Environmental Control Officer	Included in Construction and Operational Costs

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
PRE-CONSTRUCTION PHASE: ACTIVITIES REQUIRING MANAGEMENT MEASURES																				
																	procedures to be followed by aspiring employment seekers; • Establish an employment information desk to assist with the day to day management of project related labour issues; • Identify and maximise on appropriate training and skills transfer opportunities that will enhance the skills level of the local labour force during the pre-construction, during construction and during full operation. It is recommended that training and skills development activities start during the construction period; • Project contracts between Wits Gold and the main contractor should stipulate the use of local labour for unskilled and semi-skilled positions and tasks; • Ensure that local businesses, especially those of Historically Disadvantaged Individuals (HDI), women and of Small, Micro and Medium Enterprises (SMMEs) get allocated the maximum appropriate share of project related business opportunities; and • Ensure that the Labour Relations Amendment Act, 2002 (Act No. 12 of 2002) as well as the necessary policies and procedures are taken into consideration to ensure the correct procurement procedures.			
Increase in standard of living (broader community)	N/A	4	2	3	3	27	+	L		8	4	3	3	45	+	M	• To increase the standard of living locally, the contractors employed should aim to ensure that local or surrounding people are employed where possible. It is furthermore suggested that all the employees should be motivated to spend their earned income locally. This can be achieved by ensuring that the goods and services required by the employees are provided for locally (if possible). The onus will lie on local shop owners to ensure that the demanded for goods and services are met; and • The employment of local residents during operation (as far as practically possible) would increase the standard of living, since they would have a higher disposable income and less transportation costs.	Ongoing	Environmental Control Officer	Included in Construction and Operational Costs
Increase in standard of living (local farmers)	Job Creation	8	4	2	3	42	-	M		6	3	1	3	30	-	M	• The reduced standard of living of affected landowners should be taken into consideration when determining the appropriate compensation of landowners.	Ongoing	Environmental Control Officer	Included in Construction and Operational Costs
Actual health	Health	8	4	2	4	56	-	M	Implement according to proposed action plan.	4	4	3	3	33	-	M	• In order to reduce the impact on the local community it is important to maximise the use of local labour as	Ongoing	Environmental Control Officer	Included in Construction and Operational Costs

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
PRE-CONSTRUCTION PHASE: ACTIVITIES REQUIRING MANAGEMENT MEASURES																				
																	far as possible; • Local labour should be employed as far as possible to avoid additional pressure on the existing services; • HIV / Aids awareness campaigns should be initiated by Wits Gold and provided to all its mine employees on a regular basis; • Wits Gold should investigate how they could assist in implementing a community health awareness programme in liaison with the LM; • Environmental pollution must be limited as far as possible and the requirements of the EMP be implemented to reduce the impact on surrounding landowners; • Environmental pollution must be limited as far as possible and the requirements of the EMP be implemented to reduce the impact on surrounding landowners; • The necessary safety precautions should be taken and first aid supplies should be made available on site; • All mine employees (including contractors) should undergo health and safety training on a regular basis; • The general health of employees should be monitored on an on-going basis and employees should be given free access to clinic services; • It is advised that Wits Gold, through consultation with the LM investigate ways in which their LED programmes and infrastructure development component of their SLP can assist in improving the overall health services within the communities; and • The required safety equipment should be provided to employees as well as on site and should be in a good working order.			
Perceived health (prior to construction)	Health	8	4	2	4	56	-	M	Implement according to proposed action plan.	2	4	2	3	24	-	L	• Dust generation from surface stockpiles should be monitored and dust suppression measures be implemented; • Sufficient safety precautions should be put in place to limit the exposure of dust to mine workers; and • Continuous communication with affected landowners and community members should take place, informing them of the various mitigation measures put in place to limit the impact of dust on them.	Ongoing	Environmental Control Officer	Included in Construction and Operational Costs
Feelings in relation to the project	N/A	6	3	2	3	33	-	M	Implement according to proposed action plan.	6	2	2	2	20	-	L	• A comprehensive PPP should be implemented to effectively consult and involve the affected landowners and communities; • Continuous consultation with the affected communities should take place to keep them informed; • Consultation with the surrounding	Ongoing	Environmental Control Officer	Included in Construction and Operational Costs

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
PRE-CONSTRUCTION PHASE: ACTIVITIES REQUIRING MANAGEMENT MEASURES																				
																	residents should take place on a continuous basis to understand, assess and mitigate their concerns where appropriate; • Wits Gold must be transparent about the areas they intend mining and the proposed mining method and technology; and • Information about the proposed mining methods should be made available to stakeholders to educate them about mining in general as well as the proposed mining methods.			
Aspirations for the future (local landowners)	N/A	10	3	1	3	42	-	M	Implement according to proposed action plan.	8	3	1	3	36	-	M	• It is critical that Wits Gold maintain an open and trusting relationship with the affected communities subsequent to the granting of the Mining Right.	Ongoing	Environmental Control Officer	Included in Construction and Operational Costs
Aspirations for the future (broader community)	N/A	4	2	2	3	24	+	L	Implement according to proposed action plan.	10	4	3	4	68	+	H	• Wits Gold must be honest and transparent about the potential economic benefits and employment opportunities that the proposed mine is likely to effect in these communities, in order to manage any undue expectations.	Ongoing	Environmental Control Officer	Included in Construction and Operational Costs
Physical quality of the living environment	N/A	10	4	2	4	64	-	H	Implement according to proposed action plan.	8	4	2	3	42	-	M	• Existing community forums must serve as liaison between the affected stakeholders and Wits Gold and can discuss traffic, dust, noise and construction related concerns with them; • Suppress dust by spraying water or non-contaminating palliative liquids on roads, crusher and screening plant, mills and vehicles; • Prevent dust blowing off transported materials by washing vehicles, wheels and covering loads; • Rehabilitate behind production with adequate top soiling, fertilisation, irrigation and correct choice of grasses to ensure year-round cover; • Prepare a noise reduction plan to cover all significant impacts at source and implement noise reduction and screening to limit exposure. Drilling and blasting is generally intermittent and should be limited to daylight hours when ambient noise levels are highest. A hearing conservation programme must be implemented where noise exceeds 85dB(A) in the mine or must not be more than 7dB(A) above ambient residual noise levels beyond mine boundary or nearest residential community; • The maximum acceptable night time noise levels should not be exceeded; • Traffic calming measures should be put in place to minimise traffic noise; • Adequate monitoring of the biophysical impacts should occur in order to address any unnecessary inconveniences to stakeholders;	Ongoing	Environmental Control Officer	Included in Construction and Operational Costs

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
PRE-CONSTRUCTION PHASE: ACTIVITIES REQUIRING MANAGEMENT MEASURES																				
																	• Mitigation and monitoring as recommended by the Water Quality Impact Assessments should be implemented; • Plant tall trees as barriers in gardens or in road reserve to reduce the visual and light intrusion, as well as noise impacts; • Recommendations made in the EIA/EMP and EMPr should be adhered to. • Rehabilitate behind production with adequate top soiling, fertilisation, irrigation and correct choice of grasses to ensure year-round cover; • Prepare a noise reduction plan to cover all significant impacts at source and implement noise reduction and screening to limit exposure. Drilling and blasting is generally intermittent and should be limited to daylight hours when ambient noise levels are highest. A hearing conservation programme must be implemented where noise exceeds 85dB(A) in the mine or must not be more than 7dB(A) above ambient residual noise levels beyond mine boundary or nearest residential community; • The maximum acceptable night time noise levels should not be exceeded; • Traffic calming measures should be put in place to minimise traffic noise; • Adequate monitoring of the biophysical impacts should occur in order to address any unnecessary inconveniences to stakeholders; • Mitigation and monitoring as recommended by the Water Quality Impact Assessments should be implemented; • Plant tall trees as barriers in gardens or in road reserve to reduce the visual and light intrusion, as well as noise impacts; and • Recommendations made in the EIA/EMP and EMPr should be adhered to.			
Aesthetic quality of the living environment	N/A	6	4	2	4	48	-	M	Implement according to proposed action plan.	4	4	2	4	40	-	M	• The design and specific positioning of the infrastructure should aim to minimise the possible negative visual impact of the mine on the surrounding property owners; • The design of the mine buildings should blend in with surrounding environment; • Implement re-vegetation as levels are abandoned to break the form, reduce colour contrast, dust generation or contaminated runoff; and • Recycle dumps or use as backfill with appropriate permission.	Ongoing	Environmental Control Officer	Included in Construction and Operational Costs

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
PRE-CONSTRUCTION PHASE: ACTIVITIES REQUIRING MANAGEMENT MEASURES																				
Availability and quality of housing	N/A	2	3	2	3	21	-	L	Implement according to proposed action plan.	8	4	3	3	45	+	M	• Employees should be educated with regards to their accommodation options; • Housing needs should be monitored and addressed in consultation and cooperation with the applicable LMs; and • Maximise the employment of locals to limit the need for any additional housing infrastructure, as far as possible. • In consultation with the municipality and other mines operating in the area, ensure that the necessary planning for upgrades of social infrastructure, where lacking due to the proposed mine, take place; • Involvement in upliftment programmes should be done according to the priority needs and projects identified as part of the LMs IDP, as well as in consultation with other stakeholders such as the local community representatives, ward committees and youth organisations;	Ongoing	Environmental Control Officer	Included in Construction and Operational Costs
Adequacy and access to social infrastructure	N/A	6	3	2	2	22	-	L	Implement according to proposed action plan.	8	4	2	4	56	+	M	• Continuous involvement of the mine would be necessary and should be undertaken in a transparent and supportive manner; • Implement a regular and formalised consultation process with local government to ensure synergy between the mine's social development and LED focus; • Communication of the projects that Wits Gold would be involved in should filter through to all community levels to ensure maximum benefit to the community; and • Community development projects initiated by Wits Gold should avoid benefiting only a selected few but should follow a broad based approach, whilst also taking budgeting constraints into consideration.	Ongoing	Environmental Control Officer	Included in Construction and Operational Costs
Personal safety and hazard exposure	N/A	6	4	2	4	48	-	M	Implement according to proposed action plan.	4	3	2	3	27	-	L	• Local, unemployed labour should be employed as far as possible; • Accommodation for members of the workforce, other than security personnel, must not be permitted on site; • The only semi-permanent structures that should be allowed on site is guard houses for security personnel; • Camp followers / informal traders must not be allowed to congregate outside the construction site; • Strict security measures should be put in place. Security personnel should be on site on a permanent basis;	Ongoing	Environmental Control Officer	Included in Construction and Operational Costs

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
PRE-CONSTRUCTION PHASE: ACTIVITIES REQUIRING MANAGEMENT MEASURES																				
																	• Construction workers should be confined to the construction area and should wear uniforms or identity tags to be easily identified; • The mining area should be fenced to avoid unauthorised entry by humans or animals onto the mining area; • The contractor should communicate the construction schedule and vehicle movements to the neighbouring property owners in advance; • Workers must not be allowed to overnight on the premises and must be transported to their places of residence by bus on a daily basis; • Workers must not be allowed to leave the designated mining areas without permission; • A Health and Safety Plan should be implemented and it must be ensured that all managers are trained in First Aid and other relevant safety courses; • Implement safety measures to limit fire hazards and implement fire breaks if possible; • Wits Gold should, in conjunction with the property owners, develop and implement emergency procedures; • Operational safety risks should be addressed as part of the OHS Act; • A Fire/Emergency Management Plan should be developed and implemented. It is important that this management plan and associated communication channels are developed at the outset of the construction phase. It would be important to regularly review the functionality and efficiency of such a plan in conjunction with the local emergency teams, mine management and neighbouring landowners; • Open fires for cooking and related purposes should not be allowed on site; • Appropriate fire fighting equipment should be on site and construction workers should be appropriately trained for fire fighting; • The construction sites should be clearly marked and "danger" and "no entry" signs should be erected; • Speed limits on the local roads surrounding the construction sites should be enforced; and • Speeding of construction vehicles must be strictly monitored.			
Crime and violence	N/A	4	3	3	2	20	-	L		4	2	3	2	18	-	L	• Local, unemployed labour should be employed as far as possible; • Wits Gold must liaise with the LMs and labour unions to establish a protocol for ensuring community	Ongoing	Environmental Control Officer	Included in Construction and Operational Costs

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
PRE-CONSTRUCTION PHASE: ACTIVITIES REQUIRING MANAGEMENT MEASURES																				
																	safety; • Mine workers should be clearly identifiable by ensuring they wear uniforms and identification cards that should be exhibited in a visible place on their body; and • The AgriSA protocol for access to farms should be followed in all instances where access to farmers' land is required.			
Loss of natural and cultural heritage	N/A	8	5	1	3	42	-	M		8	2	1	1	11	-	L	• The recommendations of the HIA should be implemented; • Local residents and farmers should be consulted to determine any possible heritage sites not identified by the HIA; and • Local residents and farmers should inform mitigation measures when addressing any potential impact on cultural heritage sites or graves.	Ongoing	Environmental Control Officer	Included in Construction and Operational Costs
Social networks	N/A	6	3	2	3	33	-	M	Implement according to proposed action plan.	6	3	2	2	22	-	L	• Employ local residents as far as possible; • Make use of credible SMME's for the provision of goods and services; and • Embark on regular communication efforts towards the community with regards to the mine's involvement in the communities. This could be done through an already established community forum.	Ongoing	Environmental Control Officer	Included in Construction and Operational Costs
Functioning of government agencies	N/A	8	3	3	4	56	-	M	Implement according to proposed action plan.	6	4	3	3	39	-	M	• Assist the LM with the diversification of the local economy; • Emphasise the use of local service providers and SMMEs and focus on the development of LED programmes; and • Institute a joint municipal coordinating and implementing committee to support the municipality's local economic and social develop needs and requirements, where feasible.	Ongoing	Environmental Control Officer	Included in Construction and Operational Costs
Impact equity (affected landowners)	N/A	8	4	1	3	39	-	M	Implement according to proposed action plan.	6	3	1	2	20	-	L	• Negative impacts on the local property owners should be limited as far as possible such as intrusion impacts (dust, noise, and air pollution). Mitigation measures from the specialist studies dealing with these issues should thus be strictly implemented; • Safety and security measures are critical to avoid any increase in criminal activities within the local study area; and • The use of local labour must be maximised as far as possible.	Ongoing	Environmental Control Officer	Included in Construction and Operational Costs
Impact equity (community members)	N/A	4	2	3	3	27	+	L	Implement according to proposed action plan.	8	4	3	3	45	+	M	• Skills training and development should be maximised to benefit as many local employees as possible; and • The use of local labour must be maximised as far as possible.	Ongoing	Environmental Control Officer	Included in Construction and Operational Costs
Gendered division of labour	N/A	4	3	3	2	20	+	L	Implement according to proposed action plan.	6	4	3	3	39	+	M	• Women must have equal employment opportunities;	Ongoing	Environmental Control Officer	Included in Construction and

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
PRE-CONSTRUCTION PHASE: ACTIVITIES REQUIRING MANAGEMENT MEASURES																				
																	• Training and skills development should take place for women; • Salaries of women should be equal to that of men when undertaking the same job; • Commitments made in the SLP with regard to the employment of women should be adhered to; and • Institute a well designed gender equality strategy on the mine.			Operational Costs
Issues related to safety and security of surrounding land owners must be addressed.	Access	10	4	2	5	80	-	H	Access to the plant area, TSF and equipment will be of limits to the public at all times during all phases of the project.	6	4	1	4	44	-	M	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing with any work. If proved insufficient for control, these shall be replaced by fencing.	Prior to construction	Health and Safety Officer	To be determined
																	Security will be established at access points of the project area which will record entry and exit of vehicles.	Prior to construction	Health and Safety Officer	To be determined
									Safety and security impacts associated with the inflow of a workforce are sensitive issues which should be thoroughly addressed to limit any possible negative impacts on the surrounding landowners. A baseline of current criminal activity and safety/security risks must be established with input for the local municipality and the SAPS.	6	4	1	3	33	-	M	A community forum consisting of representatives of the project proponent, contractors, local leaders such as councillors, the Environmental Coordinator and the property owners should be established. The aim of such a forum would be to set up local safety and security measures to deal with the inflow of workers and possible jobseekers and to adapt the measures if and when required.	Prior to construction	Health and Safety Officer/Project Manager/ Environmental Coordinator	As required
Mining projects often attract jobseekers from within the study area or even from other areas even prior to construction commencing. This situation is usually worsened by exaggerated rumours of possible employment opportunities.	Influx of jobseekers	8	2	2	5	60	-	M	Develop a strategy to minimise the influx of outsiders to the area. The establishment of a labour desk to deal with jobseekers is critical.	6	2	2	4	40	-	M	Prior to construction commencing, community meetings and the local newspaper could be used to communicate details of the project (actual skills and number of workers required) to minimise the influx of unqualified jobseekers to the project area.	Prior to construction	Health and Safety Officer/HR Manager	As required
Inflow of temporary workers from outside the local community and the potential for conflict between locals and these "outsiders".	Inflow of temporary workers	8	2	2	5	60	-	M	Maximise the use of local labour and contractors where possible by developing a strategy to involve local labour in the construction process e.g. communicate the construction requirements through the local leaderships such as the ward committees, ward councillors and representatives of the local and , and advertise in the local newspapers in the local languages.	6	2	2	4	40	-	M	Before construction commences, representatives from the local municipality, local leaders (e.g. councillors), community-based organisations, as well as neighbouring residents should be informed of the details of the construction company, size of the workforce and construction schedules.	Prior to construction	Project Manager/ Environmental Coordinator/HR Manager	As required
For the duration of the construction period, non-local and/or temporary contract workers forming part of the construction team of the main contractor will require accommodation.	Housing of workforce	8	3	3	5	70	-	H	Ensure that non-local and/or temporary contract workers are provided with accommodation for the duration of the construction period.	6	2	1	4	36	-	M	Before construction commences, representatives from the local municipality, local leaders (e.g. councillors), community-based organisations, as well as affected property owners should be consulted regarding accommodation options for non-local and/or temporary workers. Construction activities and schedules, as well as the location of construction camps, if applicable, should be discussed and finalised with these	Prior to construction	Project Manager/ Environmental Coordinator	As required

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
PRE-CONSTRUCTION PHASE: ACTIVITIES REQUIRING MANAGEMENT MEASURES																				
																	representatives.			
									Ensure that non-local and/or temporary contract workers and other jobseekers do not "squat" within local settlements or on private properties.	4	2	1	4	28	-	L	Undertake regular inspections of the project area and surrounding properties to determine if squatting is taking place. If squatting is observed, contact the local municipality and police immediately for assistance in addressing the situation.	On-going	Health and Safety Officer/Project Manager/ Environmental Coordinator	As required
Mining developments are usually perceived as a positive injection to the economic standard of an area as it could lead to further developments in the area. The proposed DBM project would thus contribute to the economy due to the possible expenditure during the construction phase which could result in business opportunities for the local and regional economy, especially with regards to the local service industry. It is further anticipated that a large proportion of the wage bill earned by construction workers would be spent within the local municipal area resulting in local economic benefits with subsequent indirect spin-offs for local businesses.	Local Economic Contribution	8	2	3	4	52	+	M	Involve local companies in the procurement process as much as possible in order to ensure further indirect economic spin-offs and benefits to the local economy.	10	4	2	5	80	+	H	Wits Gold should develop a database of local companies, including credible SMMEs that could qualify as potential service providers prior to the initiation of the tender process, to enable these local companies and SMMEs to be involved with the tender process. DBM should liaise with local stakeholders, as well as with representatives of the local municipality.	Already commenced	Procurement Manager/Project Manager/ HR Manager	To be determined
The effect the mining operation will have on property values of surrounding land owners.	Property values	10	4	2	5	80	-	H	Minimise the impact of the mining operation on the surrounding land owners.	8	3	1	4	48	-	M	Undertake a property evaluation of the surrounding properties prior to the initiation of construction activities so that a baseline value can be identified and recorded.	Negotiations already commenced	Project Manager/Applicant	Once off
																	Develop a strategy to address issues raised by surrounding land owners pertaining to impacts on property values that addresses how such issues will be addressed and managed, as well as potential compensation rates.	Prior to construction	Project Manager/Applicant	Ongoing
Issues related to HERITAGE																				
Evidence of 2 sites of archaeological/cultural importance occur within the greater project area. Potential impacts on these must be minimised.	N/A	6	3	2	4	44	-	M	Fence the identified areas off.	4	4	2	4	40	-	M	Ensure that the identified sites are fenced off and the sites are not disturbed by pre-construction and/or mining activities.	N/A	N/A	N/A
Issues related to WETLANDS																				
No significant pre-construction impacts are envisaged.	N/A	0	0	0	0	0	N	L	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to RADIATION																				
No significant pre-construction impacts are envisaged.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A

6.3 Construction Phase

After the Pre-Construction Phase has been completed and finalised, Wits Gold will commence with the construction phase for their mining activities and project related infrastructure in line with their approved environmental authorisations.

During the construction phase the following activities will take place on site:

- Construction of service roads;
- Construction of power lines where necessary;
- Construction of access roads where necessary;
- Water pollution control structures;
- Construction of shaft access;
- Construction of ancillary infrastructure; and
- Clean and dirty water infrastructure.

The main construction activities for the infrastructure mentioned above that will have an impact on the bio-physical environment will be:

- Footprint clearance:
    - The removal of vegetation/agriculture material from the area;
    - The removal/stripping and stockpiling of topsoil and subsoil;
    - The movement of vehicles on site, and on regional road;
    - An increase of workers for construction activities;
    - Start of visual impact;
    - Noise generation;
    - Fugitive dust generation; and
    - Change in surface water run-off and drainage patterns.
- Establishment of infrastructure:
    - Construction of ancillary infrastructure relating to the mining area (ventilation shafts; offices; workshops; diesel storage; and power lines);
    - Movement of vehicles on site, and on regional road;
    - Increase of workers for construction activities and informal job-seekers;
    - Start of visual impact;
    - Noise generation;
    - Fugitive dust generation; and
    - Change in surface water run-off and drainage patterns.
- Establishment of Box-cut if applicable (Incline Shaft):
    - Movement of vehicles on site;
    - Noise generation;

  - Fugitive dust generation; and
  - Change in surface water run-off and drainage patterns.
- Waste Handling:
  - Domestic and construction waste generation;
  - Waste storage;
  - Movement of vehicles on site to storage facilities;
  - Diesel storage for construction activities; and
  - Establishment and upgrade of the pollution control dams, the slit traps and the clean and dirty water systems.
- Cumulative Impacts resulting from construction activities.

6.3.1 Geohydrology

The Karoo aquifer within a 1000 m radius of the shafts and/or decline area could be dewatered, especially during the construction phase of these facilities. The only supply borehole that could be affected by the aquifer dewatering will be MO_2 on Moedersdrift, belonging to Mr. A.B. Pienaar. However, this risk can be mitigated by grouting the sidewalls, which will prevent inflows causing aquifer dewatering.

6.3.2 Hydrology

It is anticipated that most risks posed to local surface water resources could be effectively managed by an appropriate storm-water management plan.

- Deep seepage from the TSF facilities into local watercourses is unlikely due to the location of discard facilities far from rivers and streams. It is possible that a TSF located towards the east of the planned discard area could allow seepage into deep and well-drained sandy soils that will eventually seep into local river systems. The design of TSFs will take into consideration seepage risks and, if needed, make allowance for sealing or lining of the base of a tailings dam.
- Other seepage will be collected by means of return water drains and transferred to return water dams. In this case, where stormwater will be treated and discharged, water from return water dams should be considered as a first priority water supply to processing and treatment plants.
- A concern that needs to be addressed is the dust created in TSFs that could add to local atmospheric pollution. Dust from the tailings dams of other mines in the vicinity of the town of Virginia is widely claimed to pose health risks to local inhabitants. Dust suppression on the TSFs constructed for this mine is considered to be important.

- Dirty water runoff conveyance and storage systems at the mine will be controlled by structures and control measures as prescribed in the Storm-water Management Plan.

6.3.3 Soils, Land Use and Land Capability

For the impact assessment, all the following phases of the project cycle were considered for potential impacts on soil and land capability. Below is a description of each of the activities per construction phase that may result in soil impacts:

- Establishment of box cuts in the portal area and shaft area for underground mining access;
- Establishment of haul roads;
- Establishment of water management infrastructure;
- Clearing of vegetation in areas designated for surface infrastructure;
- Stripping and stockpiling of topsoil and sub-soil;
- Digging of foundations and trenches;
- Preparation of residue disposal areas (waste dumps);
- Delivery of materials (steel and equipment) as well as transport of construction personnel; and
- General building/construction activities.

6.3.4 Fauna & Flora

No impacts were identified that could lead to a beneficial impact on the ecological environment of the study area since the proposed development is largely destructive. The following impacts were identified that are relevant to the proposed development:

- Direct impacts:
    - Direct impacts on flora species of conservation importance;
    - Direct impacts on fauna species of conservation importance;
    - Loss, or disruption of mammal migration routes on a local scale;
    - Direct impacts on sensitive/ pristine habitat types of the study area; and
    - Direct impacts on common fauna species occurring on the study area.
- Indirect Impacts:
    - Faunal interactions with structures, servitudes and personnel; and
    - Impacts on surrounding habitat/ species, including ecosystem functioning.

It could reasonably be expected, and was confirmed in the Impact Assessment, that surface impacts on the natural environment constitute the most significant impact on biodiversity attributes of the study area. The decimation of remaining areas of natural habitat during the construction phase will not only completely destroy the existing habitat within areas of high ecological sensitivity, but will also destroy the potential of other area to be inhabited by a relative diverse and natural composition of plants and animals. Most of the area comprises agricultural fields where extremely little natural attributes occur and consequently moderate and low ecological sensitivities were ascribed. The loss of these areas is unlikely to affect the local or regional biodiversity attributes to a significant level or the conservation status of animals that are likely to inhabit these parts.

Small portions of the study area are considered ecologically important on a local scale; attributes that contribute to this sensitivity include the presence of conservation important animals and plants, a high diversity of species noted and a relative pristine status. Impacts within these areas are expected to be significant and severe. The endorheic pans, whilst not currently in a prime condition due to the absence of water, are likely to be inhabited by a diverse composition of animals when inundated for a prolonged period. It is also likely that conservation important species will utilise these features during specific periods (for example the Marsh Sylph during flowering periods of the grass *Leersia hexandra*). Similarly, the remaining portion of natural grassland in the eastern part of the study area is regarded sensitive in terms of biodiversity attributes. Not only was a diverse composition of plants and animals noted within this area, the presence of plants and animals of conservation importance were noted, reflecting the relative pristine nature of this portion of grassland, in spite of relative high grazing pressure.

The only manner in which these portions of habitat can be conserved is by excluding them from the proposed development, the natural grassland in particular. In contrast, it is only reasonable to expect that it is impossible to conserve all the endorheic pans, as it will affect the proposed development significantly. However, every effort should be made to conserve as much of this habitat type as possible. The exclusion of these areas from the proposed development is likely to reduce the probability of impacts to an acceptable level. Included in this statement is the understanding that all site specific and generic mitigation measures are implemented in order to prevent impacts from spilling into adjacent sensitive areas.

6.3.5 Wetlands

The following impacts are expected to occur as a result of the proposed project activities:

Construction Phase:

- Loss of wetland habitat;

- Increased sediment movement into adjacent wetlands;
- Altered run-off characteristics of the landscape leading to changes in hydrology supporting the wetlands on site; and
- Water quality deterioration due to storage, handling, leaks and spills of a variety of polluting substances on site.

6.3.6 Air Quality

The proposed activities will result in dust emissions, both from mining activities and fugitive emissions from the large areas of previously vegetated land that will now be exposed. Provided sufficient mitigation measures are instigated, it is unlikely that these emissions resulting from mining activity will result in the exceedence of South Africa's guidelines for particulate emissions.

The dump is an area of concern, although it is impossible to determine whether the emissions that result from Wits Gold DBM's activities will increase or decrease the fugitive dust emissions from the dump in question. It is recommended that care be taken in the design and structure of the dump, and that the existing dust fall out monitoring network be redesigned to centre around the dump, with monitors in the sensitive reception areas of Virginia and Meloding.

6.3.7 Traffic

It is evident that the traffic generated by the proposed development does not have a significant impact on the external road network. In terms of the intersection and road link capacity, no improvements are recommended since the intersections under investigation are expected to operate at acceptable level of service.

The interaction (turning movements) between construction vehicles, public transport and privates vehicles might impose some safety hazardous to the vehicles drivers. It is therefore recommended that the following measures be adopted to mitigate the impact:

- Surfacing of S239 Road between Virginia Way and the S239 / Access Road intersection.
- Construction of an exclusive right turn lane, on the northbound approach as indicated in Drawing 2984/GL/01.The exclusive right turn lane should be constructed with a 60 m length and a 60 m tapper.

- Provision of lighting at sufficient standards at the intersection of the S239 (Theunissen Street), S1279 and Jan Hofmeyer Street routes and the access to the development.
- No on-street pick up/drop offs at the intersection of the S239 (Theunissen Street) S1279 and Jan Hofmeyer Street routes and the access to the development (drop-offs/pickup should be done on site).

6.3.8 Social

The social change processes shown in are expected to take place as a result of this project.

Demographic processes	Economic processes	Geographic processes
• In-migration; • Presence of temporary workers; • Resettlement; and • Displacement / dispossession.	• Waged labour; and • Conversion and diversification of economy.	• Conversion and diversification of land use; • Enhanced transport and rural accessibility; and • Physical splintering.
Institutional and legal processes	**Emancipatory and empowerment processes**	**Socio-cultural processes**
• No impacts are expected.	• Capacity building.	• Social behaviour.

It is important to pause here and clarify that the actual impacts experienced at a given project site will depend on a variety of factors, that range between the baseline conditions, the public participation process, engagement and capacity building that has taken place, the type of mining methods and minerals mined, the role of politics, most notably in local municipalities and the other processes of social change either already under way (e.g. due to exploration activities), or which may develop during the life of the mine.

6.3.9 Heritage

6.3.9.1 Site 1

The development will have a direct impact on site 1. The exact nature thereof is however not known at this stage and will be confirmed by the client when the exact footprint has been finalised. Due to the sensitivity of this issue, graves are always regarded as having a high cultural significance.

With graves it usually is best to incorporate them into the development plan for the site. Should this be possible, the graveyard should then be fenced off and kept intact. Access to any descendants should also be allowed. A management plan needs to be drafted and implemented and it should also be monitored once a year by a heritage expert.

Should the above not be possible the graves will have to be exhumed and the bodies reburied. This is a lengthy process including social consultation for 60 days in order to find families of the deceased and to obtain their permission.

In the case of graves older than 60 years and those with an unknown date of death (as in this case) an archaeologist as well as an undertaker will have to be part of the team involved. For graves with a date of death of younger than 60 years, only an undertaker is involved.

6.3.9.2 Site 2

Site 2 falls to the west and just outside of the footprint area of the proposed mining development. Therefore there will not be a direct impact on the site, but there will be a secondary one. The buildings are regarded as having a medium cultural significance. It still is in a good condition, but is not very unique.

The buildings should remain intact and may even be reutilized. Any structural changes should be communicated with the Provincial Heritage Resources Agency (PHRA) of the Free State Province and a permit will be required to do so. The buildings should not be demolished.

6.3.10 Radiation

Impact on public safety as a result of exposure to radioactivity.

Table 6.2 - **Table 6.5** details the identified impacts and management measures for the construction activities.

Table 6.2: Impacts and Management Measures for Construction Phase Activities: Footprint Clearance and road establishment

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CONSTRUCTION PHASE ACTIVITY 1: FOOTPRINT CLEARANCE AND ROAD ESTABLISHMENT																				
Issues related to GEOLOGY																				
No significant construction impacts are envisaged.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TOPOGRAPHY																				
Removal of vegetation and the associated shaping of the area to prepare footprint for construction will allow for increased surface water runoff, which may lead to change in topographical characteristics of the area.	Vegetation clearance	6	4	2	4	48	-	M	Construction areas must be clearly demarcated to control movement of personnel and vehicles, providing clear boundaries for construction sites in order to limit the spread of impacts.	4	4	1	3	27	-	L	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
									Removal of vegetation must be undertaken in a phased approach to limit surface exposure.								The contractor will ensure that all activities, material and equipment storage and personnel movement take place within the designated area.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
									Erosion control measures must be implemented early in the construction phase.								Employees and contractors will complete induction on the EMP, Environmental Awareness Plan and Emergency Response Plan prior to construction activities being undertaken. All workers will be made aware of the penalty systems for non compliance.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
									Clean and dirty water separation must be implemented early in the construction phase, especially down-gradient of construction areas.								Draw up a procedure clearly reflecting the method and phases of clearance of vegetation only in areas where construction will take place.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
									Linear infrastructure must follow for as far as practically possible the natural contours of the area.								The topsoil material will be stockpiled in a designated area for rehabilitation at closure/decommissioning.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
																	Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the National Water Act, 1998.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
																	Maintain and monitor the implementation of dirty water separation.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
Issues related to GEOHYDROLOGY																				
Clearing topsoil for footprint areas can increase infiltration rates of water to the groundwater system and decrease buffering capacity of soils to absorb contaminants from spills on surface. This can increase the risk of contamination of the groundwater system (increases aquifer vulnerability).	Footprint clearance	8	2	2	5	60	-	M	Mitigation is not possible, but water quality monitoring is essential.	8	2	2	5	60	-	M	Groundwater quality sampling will be undertaken on a monthly basis and analysed according to the prescribed monitoring programme contained in the EIA/EMP.	Monthly	Environmental control officer	R 91 000.00
																	Quarterly groundwater monitoring reports will be generated by the mine or through a qualified water quality specialist.	Quarterly	Environmental control officer/Water Quality Specialist	R 42 000.00
																	In the event that water quality or quantity issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental control officer/Water Quality Specialist	To be determined - depending on severity of incident
Issues related to HYDROLOGY																				
Baseline information is required for water quality monitoring purposes.	Baseline Monitoring	6	4	2	4	48	+	M	Surface water quality monitoring networks must be set up prior to the construction phase so that any	8	4	2	5	70	+	H	Surface water quality sampling will be undertaken on a monthly basis and analysed according to the prescribed	Monthly	Environmental Coordinator	R 91 000.00

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CONSTRUCTION PHASE ACTIVITY 1: FOOTPRINT CLEARANCE AND ROAD ESTABLISHMENT																				
									surface water quality issues can be addressed accordingly.								monitoring programme contained in the EIA/EMP.			
																	Quarterly surface water monitoring reports will be generated by the mine or through a qualified water quality specialist.	Quarterly	Environmental Coordinator/Water Quality Specialist	R 42 000.00
																	In the event that water quality issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental Coordinator/Water Quality Specialist	To be determined - depending on severity of incident
Footprint clearance activities will cause soil erosion to occur, and subsequent sediment transport and siltation of water courses or could obstruct natural runoff patterns.	Vegetation clearance	8	3	2	5	65	-	H	Temporary attenuation dams must be constructed downstream of the proposed area if construction will occur during the wet season. This measure is required to mitigate the sediment transport and erosion impact.	4	3	2	3	27	-	L	Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the National Water Act, 1998.	Prior to construction	Environmental Control Officer/ Project Manager	Included in construction costs.
																	Maintain and monitor the implementation of dirty water separation infrastructure.	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.
																	Construct the required erosion protection measures.	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.
Spillages on site may lead to surface water pollution.	Heavy vehicle movement	8	4	2	4	56	-	M	Employees and contractors will be educated to make them aware of the necessity to prevent spillages through the implementation of good housekeeping practices.	4	4	2	3	30	-	M	Employees and contractors will complete induction on the EMP, Environmental Awareness Plan and Emergency Response Plan prior to construction activities being undertaken. All workers will be made aware of the penalty systems for non compliance.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
									The management of chemicals and hydrocarbons must form part of the emergency preparedness and response programme.								Employees and contractors will complete induction prior to construction activities being undertaken and the Environmental Awareness Plan and Emergency Response Plan must be implemented.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
Vegetation and topsoil cleared from building sites and roadways could obstruct natural drainage, divert clean water into dirty water areas, cause waterlogging of adjacent areas or pollute water resources.	Footprint clearance	4	4	2	3	30	-	M	Rehabilitate taking into account natural drainage paths.	4	2	1	1	7	-	L	Overburden that is removed should be spread at a suitable location and immediately rehabilitated, taking into account natural drainage paths, in accordance with appropriate drainage plans.	During construction phase	Environmental Control Officer	Included in construction costs.
Runoff water that is trapped and passes through culverts and drains could cause local soil erosion.	Drainage pathways	4	4	3	3	33	-	M	Control and manage water release.	4	2	2	1	8	-	L	All water releases shall be controlled and flow channels shall be designed to an acceptable standard.	During construction phase	Environmental Control Officer	Included in construction costs.
Issues related to SOIL, LAND USE AND LAND CAPABILITY																				
Dilution of fertile topsoil component	Vegetation removal	**1**	**5**	**8**	**5**	70	-	H	Keep as much original landcover/topsoil as possible					0	-	L	Implement mitigation in accordance with the mitigation measures proposed.	**During construction phase**	Environmental Control Officer	Included in construction costs.
Loss of topsoil stabilisation	Vegetation removal	**1**	**5**	**8**	**5**	70	-	H	Keep as much original landcover/topsoil as possible					0	-	L	Implement mitigation in accordance with the mitigation measures proposed.	**During construction phase**	Environmental Control Officer	Included in construction costs.
Loss of grazing land capability	Vegetation removal	**1**	**5**	**8**	**5**	70	-	H	Rehabilitate land as close to the original land-use as possible					0	-	L	Implement mitigation in accordance with the mitigation measures proposed.	**During construction phase**	Environmental Control Officer	Included in construction costs.
Soil compaction	Movement of vehicles over soil surface	**2**	**4**	**6**	**4**	48	-	M	Keep infrastructure localized to reduce footprint					0	-	L	Implement mitigation in accordance with the mitigation measures proposed.	**During construction phase**	Environmental Control Officer	Included in construction costs.
Removal and stripping of soil will allow for increased surface water runoff, which may lead to an increased erosion potential.	Removal and stockpiling of soil	10	2	1	5	65	-	H	Soils of significantly different soil groups based on characteristics like clay content should be stockpiled separately. This is to ensure that	6	2	1	3	27	-	L	The top 500 mm of topsoil will be removed from the area where surface infrastructure is to be developed. The topsoil will be stored in berms	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CONSTRUCTION PHASE ACTIVITY 1: FOOTPRINT CLEARANCE AND ROAD ESTABLISHMENT																				
									their characteristics are suitable for the drainage conditions once replaced. Soils should be separated into categories based on clay content, and into topsoil and subsoil horizons. The topsoil will be re-used during the rehabilitation phase.								along the perimeter of the site. Care will be taken to ensure that the berm is not located within any surface water channels. The berms will not exceed 5 m in height.			
Removal of vegetation will expose soils and allow for increased surface water runoff, which may lead to an increased erosion potential.	Vegetation clearance	10	2	1	5	65	-	H	Areas must not be stripped of vegetation before the area will be needed for construction. Use phased approach in clearance activities.	6	2	1	3	27	-	L	Draw up a procedure clearly reflecting the method and phases of clearance of vegetation only in areas where construction will take place.	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.
									Re-establishment of vegetation will be encouraged after construction. If area is exposed for longer than 18 months and no self-succession has taken place, other options must be investigated.								Develop a monitoring programme for vegetation in the construction area. After 18 months assess area and determine if it is necessary to implement a re-vegetation plan for the area.	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.
									Effective dust management must be employed during the construction phase.								Draw up a dust management plan in consultation with the environmental manager and include dust suppression as part of the contractor's responsibility. Establish barriers/berms to limit runoff.	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.
Soil physical and chemical degradation will occur as a result of soil stripping and stockpiling, will lead to the loss of soil resource and will impact on soil characteristics.	Removal and stockpiling of soil	10	2	1	4	52	-	M	Topsoil and subsoil stripping will be conducted up to a suitable depth for construction purposes, at least 400 mm. Different soils must be stockpiled separately in designated areas.	6	2	1	2	18	-	L	Designate specific areas for the stockpiling of topsoil and subsoil. Develop a soil stripping plan for immediate implementation and monitor the area post stripping.	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.
									Topsoil and subsoil stockpiles must be vegetated.								Develop a monitoring programme for vegetation in the construction area. After 18 months assess area and determine if it is necessary to implement a re-vegetation plan for the area.	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.
									The topsoil that is collected will be stockpiled in such a way that dust and water erosion is limited. Stockpiles will be constructed in such a way to ensure stability and thereby preventing the possibility of wash down. Soils which are stripped could be used in the construction of berms or other storm water management measures.								Draw up a dust management plan in consultation with the environmental manager and include dust suppression as part of the contractor's responsibility.	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.
									Erosion control measures must be implemented where height exceeds 1.5 m. A soil conservation guide should be developed and implemented. No vehicle movement will be permitted over any of the stockpile areas.								Ensure the required erosion protection measures are maintained, monitored and corrected where necessary.	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.
The use of heavy machinery during the construction process will result in the compaction of soil, resulting in decreased infiltration of rain water and increased surface run-off volumes and velocities leading to a greater erosion risk.	Heavy vehicle movement	8	2	2	4	48	-	M	All areas not directly within the proposed infrastructure footprint area where the soil has been compacted will need to be ripped to break up the compacted soil surface. This will aid infiltration and decrease run-off.	4	2	1	2	14	-	L	Develop a plan clearly defining the construction area. After construction activities determine which areas must be ripped and potentially re-vegetated. Implement the plan with proper measures in place not to compact new areas.	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.
									All ripped areas need to be re-vegetated with a suitable mix of plant species as determined by a qualified specialist. All re-vegetated areas								Develop a monitoring programme for vegetation in the construction area. After 18 months assess area and determine if it is necessary to	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
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CONSTRUCTION PHASE ACTIVITY 1: FOOTPRINT CLEARANCE AND ROAD ESTABLISHMENT																				
									should be monitored to ensure successful re-establishment of natural vegetation and to prevent invasion by alien species.								implement a re-vegetation plan for the area.			
Soil pollution due to the spillages of hydrocarbons along construction routes.	Heavy vehicle movement	8	2	2	4	48	-	M	Employees and contractors will be educated by means of training to make them aware of the necessity to prevent spillages through the implementation of good housekeeping practices. The management of chemicals and hydrocarbons should form part of the emergency response programme. No activities associated with hydrocarbons and or chemicals (i.e. wash bays etc.) may be undertaken outside of an effectively designed contained area.	4	2	1	2	14	-	L	Employees and contractors will complete induction on the EMP, Environmental Awareness Plan and Emergency Response Plan prior to construction activities being undertaken. All workers will be made aware of the penalty systems for non compliance.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
																	Employees and contractors will complete induction prior to construction activities being undertaken and the Environmental Awareness Plan and Emergency Response Plan must be implemented.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
General disturbance of the area.	Footprint clearance	6	2	2	4	40	-	M	A combination of mining and agriculture should be considered as part of the land use plan .	4	2	1	3	21	-	L	Implement the rehabilitation plan as developed and required.	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.
Loss of agricultural and grazing land capability.	Land Capability Change	6	2	2	4	40	-	M	The grazing and wilderness land capability of the proposed site will be lost once the topsoil has been stripped.	2	2	1	2	10	-	L	Implement the rehabilitation plan as developed and required to restore grazing and wilderness land capability	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.
Issues related to FAUNA AND FLORA																				
Direct impacts on flora species of conservation importance.	Vegetation clearance	8	5	4	5	85	-	H	Exclude sensitive areas and provide protection for nearby sensitive areas.	8	5	4	1	17	-	L	Develop environmental monitoring plans that identify and address issues of concern as well as include relevant aspects in awareness training.	Seasonal/Bi-annual	Environmental control officer/Ecologist/Proponent	Included in construction costs.
Direct impacts on fauna species of conservation importance.	Vegetation clearance	8	5	4	5	85	-	H	Exclude sensitive areas and provide protection for nearby sensitive areas.	8	5	4	1	17	-	L	Develop environmental monitoring plans that identify and address issues of concern as well as include relevant aspects in awareness training.	Seasonal/Bi-annual	Environmental control officer/Ecologist/Proponent	Included in construction costs.
Loss or disruption of mammal migration routes.	Vegetation clearance	6	5	2	5	65	-	H	Ensure minimal footprint clearance; ensure minimal human/animal conflict potential; implement awareness programmes; allow for natural crossings where possible; control movement of personnel; and limit speeds of vehicles.	6	4	2	3	36	-	M	Develop and implement awareness programmes aimed at ensuring that persistent and deliberate impacts on animals in nearby natural habitat are prevented.	Ongoing	Environmental control officer/Health & Safety Officer/Contractor/Site Manager	Included in construction costs.
Direct impacts on sensitive/pristine habitat types.	Vegetation clearance	8	5	3	3	48	-	M	Exclude sensitive areas and provide protection for nearby sensitive areas; limit the spread of impacts to nearby sensitive areas.	8	5	3	2	32	-	M	Develop environmental monitoring plans that identify and address issues of concern as well as include relevant aspects in awareness training.	Seasonal/Bi-annual	Environmental control officer	Included in construction costs.
Direct impacts on common fauna species of the study area.	Vegetation clearance	4	4	2	5	50	-	M	Ensure minimal footprint clearance; ensure minimal human/animal conflict potential; implement awareness programmes; control movement of personnel; and limit speeds of vehicles.	4	4	2	4	40	-	M	Develop and implement awareness programmes aimed at ensuring that persistent and deliberate impacts on animals in nearby natural habitat are prevented.	Ongoing	Environmental control officer/Health & Safety Officer/Contractor/Site Manager	Included in construction costs.
Faunal interaction with structures, servitudes and/or personnel.	Vegetation clearance	4	5	3	4	48	-	M	Ensure minimal footprint clearance; ensure minimal human/animal conflict potential; implement awareness programmes; control movement of personnel; and limit speeds of vehicles.	4	4	2	3	30	-	M	Develop and implement awareness programmes aimed at ensuring that persistent and deliberate impacts on animals in nearby natural habitat are prevented.	Ongoing	Environmental control officer/Health & Safety Officer/Contractor/Site Manager	Included in construction costs.
Impacts on surrounding habitat/species, including ecosystem functioning.	Vegetation clearance	6	4	2	3	36	-	M	Limit spread of impacts to adjacent areas and provide adequate protection for nearby sensitive areas.	6	4	2	2	24	-	L	Develop environmental monitoring plans that identify and address issues of concern as well as include relevant aspects in awareness training.	Seasonal/Bi-annual	Environmental control officer/Health & Safety Officer	Included in construction costs.
Issues related to AIR QUALITY																				
Fugitive dust emissions as a result of	Heavy vehicle	6	2	2	4	40	-	M	The impact during construction phase	2	2	2	3	18	-	L	Establish a dust management plan in	Daily	Environmental Control	Included in

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CONSTRUCTION PHASE ACTIVITY 1: FOOTPRINT CLEARANCE AND ROAD ESTABLISHMENT																				
the movement of vehicles and removal of material for construction purposes will have a negative impact in terms of visual characteristics/air quality.	movement								is limited to a short period only. All mine haul roads will be treated with dust suppressant chemicals or watered in order to reduce the impact of dust on the aesthetics of the surrounding area.								consultation with the environmental manager and include dust suppression as part of the contractor's responsibility.		Officer	construction costs.
Generation of windblown dust	Exposure of underlying soil	4	2	2	3	24	-	L	Recover exposed land promptly, where possible.	2	2	2	3	18	-	L	Establish a dust management plan in consultation with the environmental manager and include dust suppression as part of the contractor's responsibility.	Daily	Environmental Control Officer	Included in construction costs.
Issues related to NOISE																				
Noise will be generated as a result of the removal of vegetation, transportation and stockpiling of topsoil and subsoil's.	Heavy vehicle movement	6	2	2	4	40	-	M	At this stage construction activities are planned to take place during daytime period only. This may change to a 24 hour 7 day a week approach depending on the outcome of the BFS.	4	2	2	3	24	-	L	Where noise becomes a nuisance, management measures will be investigated and implemented to address these.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
									The use of noise barriers or earth berms and screening of noise at individual source where an activity can be clearly heard at the boundary will be implemented.								Machinery with low noise levels and maintained in a good order to be used and to comply with the IFC's Health and Safety Regulations.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
																	Use mufflers on engine exhausts and compressor components, and vibration isolation for mechanical equipment.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
Issues related to TRAFFIC																				
Potential access road S239	Heavy vehicle movement	6	5	3	5	70	-	H	Geometry and surfacing of access road.	2	4	3	2	18	-	L	Construct road and surfacing.	Once plus maintenance	Project Manager	R100 000 - R4 000 000 every 5 - 10 years
Mine access	Heavy vehicle movement	2	4	2	4	32	-	M	Geometry and surfacing of mine access road.	2	4	2	2	16	-	L	Construct access.	Once plus maintenance	Project Manager	R10 000 - R1 000 000 every 5 - 10 years
Railway line level crossing	Heavy vehicle movement	8	5	3	5	80	-	H	Provide alternative access from R73.	3	4	1	2	16	-	L	Provide and construct alternative access.	Once plus maintenance	Project Manager	R10 000 - R1 000 000 every 5 - 10 years
									Provide road signs, flash lights, control booms & height restriction.	3	4	3	2	20	-	L	Provide road signs, flash lights, control booms & height restriction.	Once plus maintenance	Project Manager	R10 000 - R500 000 every 20 - 30 years
Public transport facility	Heavy vehicle movement	2	4	2	3	24	-	L	Provision of public transport facility	2	4	3	2	18	-	L	Construction of public transport facility.	Once plus maintenance	Project Manager	R10 000 - R500 000 every 10 - 15 years
Street lights at access intersection	Heavy vehicle movement	2	4	2	3	24	-	L	Provision of street lights	2	4	1	2	14	-	L	Provision of street lights.	Once plus maintenance	Project Manager	R10 000 - R500 000 every 10 - 15 years
Increase in vehicular movement on site will impact traffic volumes in the project area.	Heavy vehicle movement	8	4	4	5	80	-	H	As part of the construction requirements access roads will have to be established and/or upgraded.	6	4	3	3	39	-	M	Ensure that road construction meets the requirements of the operation.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
									Enforce speed limit restrictions on all vehicles.								Speed enforcement must be implemented (40 km/hr for heavy vehicles and 60 km/hr for light vehicles on gravel roads). Implement a strict penalty system for non-compliance.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
									Do not allow pedestrian pick-ups on any roads.								Implement a strict penalty system for non-compliance .	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
An informal intersection is in place at the S239 Road/access point.	Heavy vehicle movement	6	5	3	5	70	-	H	Upgrading of intersection at the S239 Road/access point.	4	5	2	3	33	+	M	Upgrade the intersection of the S239 Road/access point.	Once off	Project Manager/Applicant	Included in construction costs.
Impacts on vehicle safety (i.e. access spacing, road alignment, lighting, etc).	Heavy vehicle movement	6	4	2	4	48	-	M	Provision of light at sufficient standards at the intersection of the S239 Road/access point. Do not allow on-street pick up/drop offs at the intersection of the S239/access road	2	5	2	4	36	+	M	Provide sufficient light at the S239 Road/access point intersection.	Once off	Project Manager/Applicant	Included in construction costs.

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CONSTRUCTION PHASE ACTIVITY 1: FOOTPRINT CLEARANCE AND ROAD ESTABLISHMENT																				
									to the development (drop-offs/pickup should be done on site).											
Issues related to VISUAL																				
Fugitive dust emissions as a result of vegetation clearance and associated bare areas may have a negative impact in terms of air quality and visual characteristics.	Heavy vehicle movement	8	2	2	5	60	-	M	Effective dust management must be employed during the construction phase.	4	2	1	3	21	-	L	Draw up a dust management plan in consultation with the environmental manager and include dust suppression as part of the contractor's responsibility.	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.
Issues related to SOCIAL																				
Increase in population size		10	4	3	4	68	-	H	Implement according to proposed action plan.	8	4	4	3	48	-	M	• Employment criteria should be communicated to the community in advance (e.g. in newspapers, community forum notice boards, etc); • Local labour should be employed as far as possible; • Verify the details of potential employees in order to ensure that local labour is employed; • Accommodation for members of the workforce, other than security personnel, must not be permitted on site; The only semi-permanent structures that should be allowed on site is guard houses for security personnel; • Camp followers / informal traders must not be allowed to congregate outside the construction site; • Temporary staff should be housed in the surrounding communities, i.e. Bed and Breakfast establishments, etc. to prevent the establishment of construction camps; and • The AgriSA protocol for access to farms should be followed at all times.	Ongoing	Environmental Control Officer	Included in construction and operational costs.
Effect of temporary workers on social dynamics		8	4	3	3	45	-	M	Implement according to proposed action plan.	4	3	3	3	30	-	M	• Chemical latrines or ablution facilities must be provided to workers in close proximity to the site; • Employ local labour as far as possible (within a 20 km radius); • Avoid the establishment of camps, hostels or temporary accommodation for workers. Accommodation should be provided at suitable locations in Virginia and Welkom and surrounds; and • Ensure that during the project construction process and the operational phase of the project, employees receive adequate health support from the project team for work-related health problems.	Ongoing	Environmental Control Officer	Included in construction and operational costs.
Waged labour		6	3	3	4	48	-	M	Implement according to proposed action plan.	8	4	3	4	60	-	M	• Unskilled and unemployed labour should be sourced from the surrounding local communities as far as possible; • Skills development opportunities should be granted to community members and local job seekers, where needed; • Maximise employment opportunities for the local communities and reduce the influx of a foreign labour force	Ongoing	Environmental Control Officer	Included in construction and operational costs.

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CONSTRUCTION PHASE ACTIVITY 1: FOOTPRINT CLEARANCE AND ROAD ESTABLISHMENT																				
																	whilst ensuring an effective construction and operational phase; • Capture all project relevant skills in the project area with the aim to ensure maximum local employment; • Make use of any existing skills databases and include the local councillors and other representative community structures in the process; • Develop a Recruitment Manual to include a list of employment opportunities that will become available during the project planning, construction and post-construction phases and provide guidelines on procedures to be followed by aspiring employment seekers; • Establish an employment information desk to assist with the day to day management of project related labour issues; • Identify and maximise on appropriate training and skills transfer opportunities that will enhance the skills level of the local labour force during the pre-construction, during construction and during full operation. It is recommended that training and skills development activities start during the construction period; • Project contracts between Wits Gold and the main contractor should stipulate the use of local labour for unskilled and semi-skilled positions and tasks; • Ensure that local businesses, especially those of Historically Disadvantaged Individuals (HDI), women and of Small, Micro and Medium Enterprises (SMMEs) get allocated the maximum appropriate share of project related business opportunities; and • Ensure that the Labour Relations Amendment Act, 2002 (Act No. 12 of 2002) as well as the necessary policies and procedures are taken into consideration to ensure the correct procurement procedures.			
Conversion and diversification of economic activities (local economy)		4	3	3	3	30	+	M	Implement according to proposed action plan.	6	3	3	3	36	+	M	• Consideration should be given to the fact that agricultural practises will be compromised and that it may become impractical, as well as uneconomical to continue; • Affected landowners must be consulted to establish means to continue farming practises, i.e. as part of a Local Economic Development project to supply the mine with produce; • Economic development should take place in line with the Local Municipality's IDP, as well as their	Ongoing	Environmental Control Officer	Included in construction and operational costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
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CONSTRUCTION PHASE ACTIVITY 1: FOOTPRINT CLEARANCE AND ROAD ESTABLISHMENT																				
																	Spatial Development Framework; and • The establishment of new businesses should comply with zoning and local by-law requirements.			
Conversion and diversification of economic activities (farmers)		10	4	2	3	48	-	M	Implement according to proposed action plan.	8	3	1	3	36	-	M	• The placement of mine infrastructure should avoid splintering farms, and should be done in consultation with affected landowners; • Consideration should be given to buying out properties in its entirety to reduce the risk of dissolving the economic unit of the farm; • Consideration should be given to the fact that agricultural practises will be compromised and that it may become impractical, as well as uneconomical to continue; and • Affected landowners must be consulted to establish means to continue farming practises, i.e. as part of a Local Economic Development project to supply the mine with produce.	Ongoing	Environmental Control Officer	Included in construction and operational costs.
Increase in standard of living (broader community)		4	2	3	3	27	-	L	Implement according to proposed action plan.	8	4	3	3	45	-	M	• To increase the standard of living locally, the contractors employed should aim to ensure that local or surrounding people are employed where possible. It is furthermore suggested that all the employees should be motivated to spend their earned income locally. This can be achieved by ensuring that the goods and services required by the employees are provided for locally (if possible). The onus will lie on local shop owners to ensure that the demanded for goods and services are met; and • The employment of local residents during operation (as far as practically possible) would increase the standard of living, since they would have a higher disposable income and less transportation costs.	Ongoing	Environmental Control Officer	Included in construction and operational costs.
Increase in standard of living (local farmers)		8	4	2	3	42	-	M	Implement according to proposed action plan.	6	3	1	3	30	-	M	• The reduced standard of living of affected landowners should be taken into consideration when determining the appropriate compensation of landowners.	Ongoing	Environmental Control Officer	Included in construction and operational costs.
Employment creation and decrease in unemployment		4	3	3	3	30	+	M	Implement according to proposed action plan.	6	4	3	3	39	+	M	• It is suggested that non-locals should only be hired when specialist skills, which are not available locally, are required and local business providing such skills cannot be created. The following aspects in this regard should receive priority: o Labour based construction methods should be used whenever practically possible; o Local residents and communities should be employed, wherever possible; o Local construction companies	Ongoing	Environmental Control Officer	Included in construction and operational costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
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CONSTRUCTION PHASE ACTIVITY 1: FOOTPRINT CLEARANCE AND ROAD ESTABLISHMENT																				
																	should be used whenever possible, especially for subcontracting work; and o Local suppliers should be used as far as possible.			
Conversion and diversification of land use		6	4	3	4	52	-	M	Implement according to proposed action plan.	4	4	3	4	44	-	M	• Educate landowners in terms of their rights and responsibilities prior to the project going ahead; • Assist landowners in identifying ways to adapt their land uses; • Plan to avoid splitting agricultural land and natural habitats; • Integrate the mining area with regional land use planning objectives where possible; and • Take into account surrounding land uses and design post-mining land use options to support and enhance long-term development options.	Ongoing	Environmental Control Officer	Included in construction and operational costs.
Transportation and rural accessibility		4	4	3	2	22	-	L	Implement according to proposed action plan.	6	4	3	4	52	+	M	• Employ local labour as far as possible to limit the negative impacts on the infrastructure and services within the area (e.g. roads); • Wits Gold should, in liaison with the relevant Roads and Traffic Department, assist with the regular maintenance of the roads frequently used by construction and mine traffic; • Speed limits on the local roads surrounding the mining site should be enforced; • Appropriate traffic management measures should be planned for and implemented, especially during the construction phase with the expected increase in heavy vehicle traffic; and • The mitigation measures proposed by the TIA should be implemented, where relevant.	Ongoing	Environmental Control Officer	Included in construction and operational costs.
Capacity building (skills transfer)		6	2	3	4	44	+	M	Implement according to proposed action plan.	10	3	3	4	64	+	H	• Recruit and train local residents to supply unskilled labour during the construction and operational phase; • The use of diverse activities should be stimulated, allied with, but not reliant on, construction related activities such as outsourcing catering activities to local businesses. The local municipality could assist local residents and business owners to garner the benefit associated with the spin-offs emanating from the proposed mine; • Stakeholders should be mutually accountable for increased opportunities regarding skills and competency development (general education and technical training). This will enable active participation, not only in the construction sector, but also in other spheres of the economy, as well as providing opportunities for career enhancement;	Ongoing	Environmental Control Officer	Included in construction and operational costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
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CONSTRUCTION PHASE ACTIVITY 1: FOOTPRINT CLEARANCE AND ROAD ESTABLISHMENT																				
																	• Training should be concentrated on skills that can be readily transferred to other employment opportunities in the local area to avoid persons with trained skills leaving the area for work elsewhere; • The project implementers and/or the contractors should identify the required jobs to be undertaken prior to the construction phase to enable local recruitment and/or some form of basic training; • It is recommended that a comprehensive program for recruiting, hiring, training, orienting and counselling be established. The nature of the training provided does not need to be limited to specific project related tasks and can include financial planning, bookkeeping, general arithmetic etc; • The principles of the Expanded Public Works Programme must be adhered to and effective labour-based construction technologies must be used to increase the positive effects of job creation; • Ensure that stakeholders have knowledge of the support of legislation and regulations; • The implementation of the SLP should be monitored on an annual basis; • Ensure compliance to the BBSEC and MPRDA; and • Ensure that the employment and training of HDSA and women meet the requirements of the BBSEC.			
Social behaviour		6	4	2	3	36	-	M	Implement according to proposed action plan.	6	2	2	3	30	-	M	• Establish a code of conduct for construction and mine workers with strict control measures; • Require mine personnel to wear identification badges to distinguish them from trespassers or unwanted loiterers; • Liaise with the SAPD in order to implement effective crime prevention strategies; and • Liaise with existing forums in the community to communicate information to the community and to assist in the monitoring of compliance.	Ongoing	Environmental Control Officer	Included in construction and operational costs.
Nutrition		8	4	4	4	64	-	H	Implement according to proposed action plan.	6	3	3	4	48	-	M	• In relation to exposures from any particular source of mining, protection and safety shall be optimised in order that the magnitude of individual doses, the number of people exposed and the likelihood of incurring exposures all be kept as low as reasonably achievable, economic and social factors being taken into account, within the restriction that the doses	Ongoing	Environmental Control Officer	Included in construction and operational costs.

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CONSTRUCTION PHASE ACTIVITY 1: FOOTPRINT CLEARANCE AND ROAD ESTABLISHMENT																				
																	to individuals delivered by the source be subject to dose constraints; • Implement a radiation monitoring programme and establish means of isolating radiogenic materials; • Implement the recommendations from the Radiological Study; • Preparation of radiation management plan; • Establish and maintain a safety culture to encourage a questioning and learning attitude to protection and safety and to discourage complacency; • Establish policies and procedures that identify protection and safety and makes it of highest priority; • Promptly identify and correct problems affecting protection and safety; • Safety assessments related to protection and safety measures for sources of radiation associated with mining shall be made at different stages; • All employees on site, as well as surrounding landowners, should receive general radiation safety training to maintain a safe working and living environment for all; and • Establish procedures that ensure there is as little exposure as possible of the workforce and of the public to dust contaminated with radioactive material during mining.			
Actual health		8	4	2	4	56	-	M	Implement according to proposed action plan.	4	4	3	3	33	-	M	• In order to reduce the impact on the local community it is important to maximise the use of local labour as far as possible; • Local labour should be employed as far as possible to avoid additional pressure on the existing services; • HIV / Aids awareness campaigns should be initiated by Wits Gold and provided to all its mine employees on a regular basis; • Wits Gold is to investigate how they could assist in implementing a community health awareness programme in liaison with the LM; • Environmental pollution must be limited as far as possible and the requirements of the EMP be implemented to reduce the impact on surrounding landowners; • Environmental pollution must be limited as far as possible and the requirements of the EMP be implemented to reduce the impact on surrounding landowners; • The necessary safety precautions should be taken and first aid supplies should be made available on site; • All mine employees (including	Ongoing	Environmental Control Officer	Included in construction and operational costs.

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																	contractors) should undergo health and safety training on a regular basis; • The general health of employees should be monitored on an on-going basis and employees should be given free access to clinic services; • It is advised that Wits Gold, through consultation with the LM investigate ways in which their LED programmes and infrastructure development component of their SLP can assist in improving the overall health services within the communities; and • The required safety equipment should be provided to employees as well as on site and should be in a good working order.			
Feelings in relation to the project		6	3	2	3	33	-	M	Implement according to proposed action plan.	6	2	2	2	20	-	L	• A comprehensive PPP should be implemented to effectively consult and involve the affected landowners and communities; • Continuous consultation with the affected communities should take place to keep them informed; • Consultation with the surrounding residents should take place on a continuous basis to understand, assess and mitigate their concerns where appropriate; • Wits Gold must be transparent about the areas they intend mining and the proposed mining method and technology; and • Information about the proposed mining methods should be made available to stakeholders to educate them about mining in general as well as the proposed mining methods.	Ongoing	Environmental Control Officer	Included in construction and operational costs.
Aspirations for the future (local landowners)		10	3	1	3	42	-	M	Implement according to proposed action plan.	8	3	1	3	36	-	M	• It is critical that Wits Gold maintain an open and trusting relationship with the affected communities prior and subsequent to the granting of the Mining Right.	Ongoing	Environmental Control Officer	Included in construction and operational costs.
Aspirations for the future (broader community)		4	2	2	3	24	+	L	Implement according to proposed action plan.	10	4	3	4	68	+	H	• Wits Gold must be honest and transparent about the potential economic benefits and employment opportunities that the proposed mine is likely to effect in these communities, in order to manage any undue expectations.	Ongoing	Environmental Control Officer	Included in construction and operational costs.
Physical quality of the living environment		10	4	2	4	64	-	H	Implement according to proposed action plan.	8	4	2	3	42	-	M	• Existing community forums must serve as liaison between the affected stakeholders and Wits Gold and can discuss traffic, dust, noise and construction related concerns with them; • Suppress dust by spraying water or non-contaminating palliative liquids on roads, crusher and screening plant, mills and vehicles; • Prevent dust blowing off transported materials by washing vehicles, wheels and covering loads; • Rehabilitate behind production with	Ongoing	Environmental Control Officer	Included in construction and operational costs.

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																	adequate top soiling, fertilisation, irrigation and correct choice of grasses to ensure year-round cover of the open pit; • Prepare a noise reduction plan to cover all significant impacts at source and implement noise reduction and screening to limit exposure. Drilling and blasting is generally intermittent and should be limited to daylight hours when ambient noise levels are highest. A hearing conservation programme must be implemented where noise exceeds 85dB(A) in the mine or must not be more than 7dB(A) above ambient residual noise levels beyond mine boundary or nearest residential community; • The maximum acceptable night time noise levels should not be exceeded; • Traffic calming measures should be put in place to minimise traffic noise; • Adequate monitoring of the biophysical impacts should occur in order to address any unnecessary inconveniences to stakeholders; • Mitigation and monitoring as recommended by the Water Quality Impact Assessments should be implemented; • Plant tall trees as barriers in gardens or in road reserve to reduce the visual and light intrusion, as well as noise impacts; • Recommendations made in the EMP and EMPr should be adhered to. • Rehabilitate behind production with adequate top soiling, fertilisation, irrigation and correct choice of grasses to ensure year-round cover; • Prepare a noise reduction plan to cover all significant impacts at source and implement noise reduction and screening to limit exposure. Drilling and blasting is generally intermittent and should be limited to daylight hours when ambient noise levels are highest. A hearing conservation programme must be implemented where noise exceeds 85dB(A) in the mine or must not be more than 7dB(A) above ambient residual noise levels beyond mine boundary or nearest residential community; • The maximum acceptable night time noise levels should not be exceeded; • Traffic calming measures should be put in place to minimise traffic noise; • Adequate monitoring of the biophysical impacts should occur in order to address any unnecessary inconveniences to stakeholders;			

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																	• Mitigation and monitoring as recommended by the Water Quality Impact Assessments should be implemented; • Plant tall trees as barriers in gardens or in road reserve to reduce the visual and light intrusion, as well as noise impacts; and • Recommendations made in the EMP and EMPr should be adhered to.			
Aesthetic quality of the living environment		6	4	2	4	48	-	M	Implement according to proposed action plan.	4	4	2	4	40	-	M	• The design and specific positioning of the infrastructure should aim to minimise the possible negative visual impact of the mine on the surrounding property owners; • The design of the mine buildings should blend in with surrounding environment; • Implement re-vegetation as levels are abandoned to break the form, reduce colour contrast, dust generation or contaminated runoff; and • Recycle dumps or use as backfill with appropriate permission.	Ongoing	Environmental Control Officer	Included in construction and operational costs.
Availability and quality of housing		2	3	2	3	21	-	L	Implement according to proposed action plan.	8	4	3	3	45	+	M	• Employees should be educated with regards to their accommodation options; • Housing needs should be monitored and addressed in consultation and cooperation with the applicable LMs; and • Maximise the employment of locals to limit the need for any additional housing infrastructure, as far as possible.	Ongoing	Environmental Control Officer	Included in construction and operational costs.
Adequacy of physical infrastructure		10	4	3	4	68	-	H	Implement according to proposed action plan.	8	4	3	3	45	+	M	• Ensure that the needed public services and capital facilities are in place before the peak construction occurs. This will ensure that demand for these services do not exceed supply; • The provision of infrastructural services must be integrated with the economic needs of the community; • Wits Gold, in liaison with the LM should proactively plan for enough infrastructure and services to meet the maximum potential of the mine in terms of service and infrastructure demand; • Measures must be taken to address infrastructure development as part of future planning; • The relevant authorities, and bodies involved in the supply of bulk services should be informed about the proposed project to ensure that it gets incorporated into their demand projections; • Promote local procurement of suppliers and contractors for the transport system.	Ongoing	Environmental Control Officer	Included in construction and operational costs.
Adequacy and access to social		6	3	2	2	22	-	L	Implement according to proposed	8	4	2	4	56	+	M	• In consultation with the	Ongoing	Environmental Control	Included in

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infrastructure									action plan.								municipality and other mines operating in the area, ensure that the necessary planning for upgrades of social infrastructure, where lacking due to the proposed mine, take place; • Involvement in upliftment programmes should be done according to the priority needs and projects identified as part of the LMs IDP, as well as in consultation with other stakeholders such as the local community representatives, ward committees and youth organisations; • Continuous involvement of the mine would be necessary and should be undertaken in a transparent and supportive manner; • Implement a regular and formalised consultation process with local government to ensure synergy between the mine's social development and LED focus; • Communication of the projects that Wits Gold would be involved in should filter through to all community levels to ensure maximum benefit to the community; and • Community development projects initiated by Wits Gold should avoid benefiting only a selected few but should follow a broad based approach, whilst also taking budgeting constraints into consideration.		Officer	construction and operational costs.
Personal safety and hazard exposure		6	4	2	4	48	-	M	Implement according to proposed action plan.	4	3	2	3	27	-	L	• Local, unemployed labour should be employed as far as possible; • Accommodation for members of the workforce, other than security personnel, must not be permitted on site; • The only semi-permanent structures that should be allowed on site is guard houses for security personnel; • Camp followers / informal traders must not be allowed to congregate outside the construction site; • Strict security measures should be put in place. Security personnel should be on site on a permanent basis; • Construction workers should be confined to the construction area and should wear uniforms or identity tags to be easily identified; • The mining area should be fenced to avoid unauthorised entry by humans or animals onto the mining area; • The contractor should communicate the construction schedule and vehicle movements to the neighbouring property owners in advance; • Workers must not be allowed to	Ongoing	Environmental Control Officer	Included in construction and operational costs.

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																	overnight on the premises and must be transported to their places of residence by bus on a daily basis; • Workers must not be allowed to leave the designated mining areas without permission; • A Health and Safety Plan should be implemented and it must be ensured that all managers are trained in First Aid and other relevant safety courses; • Implement safety measures to limit fire hazards and implement fire breaks if possible; • Wits Gold should, in conjunction with the property owners, develop and implement emergency procedures; • Operational safety risks should be addressed as part of the OHS Act; • A Fire/Emergency Management Plan should be developed and implemented. It is important that this management plan and associated communication channels are developed at the outset of the construction phase. It would be important to regularly review the functionality and efficiency of such a plan in conjunction with the local emergency teams, mine management and neighbouring landowners; • Open fires for cooking and related purposes should not be allowed on site; • Appropriate fire fighting equipment should be on site and construction workers should be appropriately trained for fire fighting; • The construction sites should be clearly marked and “danger” and “no entry” signs should be erected; • Speed limits on the local roads surrounding the construction sites should be enforced; and • Speeding of construction vehicles must be strictly monitored.			
Crime and violence		4	3	3	2	20	-	L	Implement according to proposed action plan.	4	2	3	2	18	-	L	• Local, unemployed labour should be employed as far as possible; • Wits Gold must liaise with the LMs and labour unions to establish a protocol for ensuring community safety; • Mine workers should be clearly identifiable by ensuring they wear uniforms and identification cards that should be exhibited in a visible place on their body; and • The AgriSA protocol for access to farms should be followed in all instances where access to farmers’ land is required.	Ongoing	Environmental Control Officer	Included in construction and operational costs.
Loss of natural and cultural heritage		8	5	1	3	42	-	M	Implement according to proposed action plan.	8	2	1	1	11	-	L	• The recommendations of the HIA should be implemented; • Local residents and farmers should	Ongoing	Environmental Control Officer	Included in construction and operational costs.

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																	be consulted to determine any possible heritage sites not identified by the HIA; and • Local residents and farmers should inform mitigation measures when addressing any potential impact on cultural heritage sites or graves.			
Social networks		6	3	2	3	33	-	M	Implement according to proposed action plan.	6	3	2	2	22	-	L	• Employ local residents as far as possible; • Make use of credible SMME's for the provision of goods and services; and • Embark on regular communication efforts towards the community with regards to the mine's involvement in the communities. This could be done through an already established community forum.	Ongoing	Environmental Control Officer	Included in construction and operational costs.
Functioning of government agencies		8	3	3	4	56	-	M	Implement according to proposed action plan.	6	4	3	3	39	-	M	• Assist the LM with the diversification of the local economy; • Emphasise the use of local service providers and SMMEs and focus on the development of LED programmes; and • Institute a joint municipal coordinating and implementing committee to support the municipality's local economic and social develop needs and requirements, where feasible.	Ongoing	Environmental Control Officer	Included in construction and operational costs.
Impact equity (affected landowners)		8	4	1	3	39	-	M	Implement according to proposed action plan.	6	3	1	2	20	-	L	• Negative impacts on the local property owners should be limited as far as possible such as intrusion impacts (dust, noise, and air pollution). Mitigation measures from the specialist studies dealing with these issues should thus be strictly implemented; • Safety and security measures are critical to avoid any increase in criminal activities within the local study area; and • The use of local labour must be maximised as far as possible.	Ongoing	Environmental Control Officer	Included in construction and operational costs.
Impact equity (community members)		4	2	3	3	27	+	L	Implement according to proposed action plan.	8	4	3	3	45	+	M	• Skills training and development should be maximised to benefit as many local employees as possible; and • The use of local labour must be maximised as far as possible.	Ongoing	Environmental Control Officer	Included in construction and operational costs.
Gendered division of labour		4	3	3	2	20	+	L	Implement according to proposed action plan.	6	4	3	3	39	+	M	• Women must have equal employment opportunities; • Training and skills development should take place for women; • Salaries of women should be equal to that of men when undertaking the same job; • Commitments made in the SLP with regard to the employment of women should be adhered to; and • Institute a well designed gender equality strategy on the mine.	Ongoing	Environmental Control Officer	Included in construction and operational costs.
Surrounding farm owners have indicated that they are not all in favour of the mine being established	Construction activities	10	4	1	5	75	-	H	An issues and complaints register containing contact details of the complainant and a description of the	6	4	1	4	44	-	M	Continually update the issues and response register as and when complaints/issues are received.	During construction phase	Environmental Control Officer/ Project Manager/HR Manager	Included in construction costs.

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due to the potential impacts it may have on their lives.									issue/complaint received will be established and kept on site.											
The possible discrepancies between locally available skills and the requirements of the project within the more skilled levels could be responsive to training and skills development prior to the construction phase.	Employment Opportunities and Skills Inequities	8	2	3	4	52	-	M	Maximise the use of local labour and Employees and contractors where possible by developing a strategy to involve local labour in the construction process.	4	2	2	3	24	-	L	It is recommended that local individuals applying for work should submit their Curriculum Vitae (CV's) directly to the mine. Some proof of residence should be attached.	During construction phase	Environmental Control Officer/ Project Manager/HR Manager	Included in construction costs.
																	Make use of any existing databases of available workers and include the local councillor and other representative community structures in the process.	During construction phase	Environmental Control Officer/ Project Manager/HR Manager	Included in construction costs.
																	Project contracts between the developer and the main contractor should stipulate the use of local labour for unskilled and semi-skilled positions and tasks.	During construction phase	Environmental Control Officer/ Project Manager/HR Manager	Included in construction costs.
																	Enhance on a capacity building and skills development strategy to lessen any possible skills disparity between the local skills available and the requirements of the project.	During construction phase	Environmental Control Officer/ Project Manager/HR Manager	Included in construction costs.
																	Project requirements should be discussed with community representatives to avoid unrealistic expectations among local community members.	During construction phase	Environmental Control Officer/ Project Manager/HR Manager	Included in construction costs.
																	Remuneration packages should take cognisance of existing remuneration provided to local labourers and skills/experience of labourers.	During construction phase	Environmental Control Officer/ Project Manager/HR Manager	Included in construction costs.
																	Farm workers should be informed of the possible negative impacts of discarding their long term employment positions as farm workers for short term positions that could possibly have some short term financial benefits, without long term guarantees.	During construction phase	Environmental Control Officer/ Project Manager/HR Manager	Included in construction costs.
Construction related projects often attract jobseekers from within the study area or even from other provinces even prior to construction commencing. This situation is usually worsened by exaggerated rumours of possible employment opportunities. The impact of in-migration as a direct result of the proposed project is, expected to occur both prior and during the construction phases of the proposed development.	Influx of jobseekers	8	4	3	4	60	-	M	Develop a strategy to minimise the influx of outsiders to the area. The establishment of a labour desk to deal with jobseekers is critical. The existing HR policy can be amended to address this aspect.	6	4	3	3	39	-	M	No temporary workers should be employed from jobseekers gathering at the construction site.	During construction phase	Environmental Control Officer/ Project Manager/HR Manager	Included in construction costs.
																	The unskilled and semi-skilled positions should be filled by permanent residents from the surrounding areas where possible. Proof of residence should be provided when applying for jobs.	During construction phase	Environmental Control Officer/ Project Manager/HR Manager	Included in construction costs.
																	The applicant and Employees and contractors should ensure a fair and transparent recruiting process to limit the potential for conflict between locals in search of employment.	During construction phase	Environmental Control Officer/ Project Manager/HR Manager	Included in construction costs.
																	Focused communication efforts to the local communities are critical so that unrealistic expectations regarding the number of temporary workers required are not created.	During construction phase	Environmental Control Officer/ Project Manager/HR Manager	Included in construction costs.
																	Informal vendors at the construction site should be strictly managed to avoid conflict, as well as environmental pollution. The provision of formal stalls for vendors	During construction phase	Environmental Control Officer/ Project Manager/HR Manager	Included in construction costs.

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																	would assist in minimising this impact.			
Issues related to safety and security of surrounding land owners must be addressed.	Access	10	4	2	5	80	-	H	Access to the plant area, TSF and equipment will be of limits to the public at all times during all phases of the project.	4	3	2	4	36	-	M	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing with any work. If proved insufficient for control, these shall be replaced by fencing.	During construction phase	Environmental Control Officer/ Project Manager/HR Manager	Included in construction costs.
																	Security will be established at access points of the project area which will record entry and exit of vehicles.	During construction phase	Environmental Control Officer/ Project Manager/HR Manager	Included in construction costs.
									Safety and security impacts associated with the inflow of a workforce are sensitive issues which should be thoroughly addressed to limit any possible negative impacts on the surrounding landowners. A baseline of current criminal activity and safety/security risks must be established with input for the local municipality and the SAPS.								A community forum consisting of representatives of the Company, Employees and contractors, local leaders such as councillors, the Environmental Control Officer and the property owners should be established. The aim of such a forum would be to set up local safety and security measures to deal with the inflow of workers and possible jobseekers and to adapt the measures if and when required.	During construction phase	Health and Safety Officer/Project Manager/ Environmental Control Officer	Included in construction costs.
Mining projects often attract jobseekers from within the study area or even from other areas even prior to construction commencing. This situation is usually worsened by exaggerated rumours of possible employment opportunities.	Influx of jobseekers	10	3	3	5	80	-	H	Develop a strategy to minimise the influx of outsiders to the area. The establishment of a labour desk to deal with jobseekers is critical.	6	3	2	3	33	-	M	Prior to construction commencing, community meetings and the local newspaper could be used to communicate details of the project (actual skills and number of workers required) to minimise the influx of unqualified jobseekers to the project area.	During construction phase	Health and Safety Officer/HR	Included in construction costs.
Inflow of temporary workers from outside the local community and the potential for conflict between locals and these "outsiders".	Inflow of temporary workers	10	3	2	5	75	-	H	Maximise the use of local labour and Employees and contractors where possible by developing a strategy to involve local labour in the construction process e.g. communicate the construction requirements through the local leaderships such as the ward committees, ward councillors and representatives of the local and , and advertise in the local newspapers in the local languages.	6	3	2	4	44	-	M	Before construction commences, representatives from the local municipality, local leaders (e.g. councillors), community-based organisations, as well as neighbouring residents should be informed of the details of the construction company, size of the workforce and construction schedules. A community forum should also be actively involved in this process.	During construction phase	Project Manager/ Environmental Control Officer/HR	Included in construction costs.
The potential in-migration of workers is likely to result in other cumulative impacts, such as conflict with existing community members, social inconveniences and / or problems and pressures on existing infrastructure. This process of potential in-migration is anticipated to have a major effect on the farmers in close proximity to the proposed mine.	Effect of temporary workers on social dynamics	6	4	3	3	39	-	M	Ensure that non-local and/or temporary contract workers are provided with accommodation for the duration of the construction period. Employ local labour as far as possible (within a 20 km radius);. Avoid the establishment of camps, hostels or temporary accommodation for workers. Accommodation should be provided at suitable locations in Virginia, Theunissen, Welkom and surrounds	4	3	2	3	27	-	L	Before construction commences, representatives from the local municipality, local leaders (e.g. councillors), community-based organisations, as well as affected property owners should be consulted regarding accommodation options for non-local and/or temporary workers. Construction activities and schedules, as well as the location of construction camps, if applicable, should be discussed and finalised with these representatives.	During construction phase	Project Manager/ Environmental Control Officer	Included in construction costs.
									Chemical latrines or ablution facilities must be provided to workers in close proximity to the site								Undertake regular inspections of the project area and surrounding properties to determine if squatting is taking place. If squatting is observed, contact the local municipality and police immediately	On-going	Health and Safety Officer/Project Manager/ Environmental Control Officer	Included in construction costs.
									Ensure that during the project construction process and the operational phase of the project,											

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CONSTRUCTION PHASE ACTIVITY 1: FOOTPRINT CLEARANCE AND ROAD ESTABLISHMENT																				
									Employees and Employees and contractors receive adequate health support from the project team for work-related health problems.								for assistance in addressing the situation.			
Mining developments are usually perceived as a positive injection to the economic standard of an area as it could lead to further developments in the area. The proposed DBM project would thus contribute to the economy due to the possible expenditure during the construction phase which could result in business opportunities for the local and regional economy, especially with regards to the local service industry. It is further anticipated that a large proportion of the wage bill earned by construction workers would be spent within the local municipal area resulting in local economic benefits with subsequent indirect spin-offs for local businesses.	Local Economic Contribution	6	4	2	4	48	+	M	Involve local companies in the procurement process as much as possible in order to ensure further indirect economic spin-offs and benefits to the local economy.	8	4	3	4	60	+	M	Wits Gold should develop a database of local companies, including credible SMMEs that could qualify as potential service providers prior to the initiation of the tender process, to enable these local companies and SMMEs to be involved with the tender process. DBM should liaise with local stakeholders, as well as with representatives of the local municipality.	During construction phase	Procurement Manager/Project Manager/HR Manager	Included in construction costs.
Even though the area is not known for various tourist facilities and the study area is not situated within a tourist node, it is still expected that the local hospitality industry could benefit through the provision of accommodation and meals to a large part of the professional construction team members (e.g. engineers, managers, consultants and product representatives) who would stay in the area for the duration of the construction phase.	Local Tourism Industry					0	+	L	The local hospitality industry should receive preference should accommodation facilities be required.					0	-	L	Implement contractual requirement for Employees and contractors to procure goods and services locally as far as possible.	During construction phase	Procurement Manager/Project Manager/HR Manager	Included in construction costs.
The majority of property owners consulted indicated that they cultivate crops on their properties. These activities falling within the footprint area would be severely negatively affected due to the development footprint and would have to come to a halt. The cultivation of crops in close proximity to the site could also be negatively affected by dust creation due to the use of the gravel roads on site, possible blasting and the initial site earthworks (especially during harvesting times).	Construction activities	8	2	2	4	48	+	M	A dust monitoring network must be set up prior to the construction phase so that any air quality or dust issues can be addressed accordingly.	8	4	2	5	70	+	H	Dust sampling will be undertaken on a monthly basis and analysed according to the prescribed monitoring programme contained in the EIA/EMP.	Monthly	Environmental Control Officer	R 92 000.00
																	Monthly monitoring reports will be generated by the mine or through a suitably qualified air quality specialist.	Monthly	Environmental Control Officer/Air Quality Specialist	R 42 000.00
																	In the event that air quality or dust issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental Control Officer/Air Quality Specialist	To be determined - depending on severity of incident
The possibility of crop and equipment losses due to theft as well as potential damage to farming infrastructure during the construction phase is a grave concern.	Construction activities	6	3	2	3	33	-	M	Strict security measures should be put in place to prevent crop theft, equipment theft and infrastructure damage. Security personnel should be on site on a permanent basis.	2	2	2	3	18	-	L	A community forum consisting of representatives of the project proponent, Employees and contractors, local leaders such as councillors, the Environmental Control Officer and the property owners should be established. The aim of such a forum would be to set up local safety and security measures to deal with the potential for crop theft, equipment theft and infrastructure damage and to adapt	During construction phase	Health and Safety Officer/Project Manager/ Environmental Control Officer	Included in construction costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CONSTRUCTION PHASE ACTIVITY 1: FOOTPRINT CLEARANCE AND ROAD ESTABLISHMENT																				
																	the measures if and when required.			
																	Personnel at the mine need to be informed of protocols for reporting suspicious activities.	During construction phase	Health and Safety Officer/Project Manager/ Environmental Control Officer	Included in construction costs.
																	The construction schedule should be available to any local policing forum as well as the South African Police Force.	During construction phase	Health and Safety Officer/Project Manager/ Environmental Control Officer	Included in construction costs.
Access to the mine would increase the risk of vehicle and pedestrian accidents in the vicinity of the access point. Movement of construction vehicles and possible speeding by these vehicles have been raised as a concern. Large numbers of construction related traffic could thus have negative impacts on the daily living and movement patterns of the farmers especially where these vehicles would pass in close proximity to their dwellings or access internal roads on their properties.	Heavy vehicle movement	4	2	2	3	24	-	L	Construction material to be transported with road-worthy vehicles that are well maintained and a speed limit of 40 km/h to be maintained.	2	2	2	3	18	-	L	The contractor should communicate the construction schedule and vehicle movements to the neighbouring property owners. Implement a strict penalty fine system for speeding incidents .	During construction phase	Health and Safety Officer/Project Manager/ Environmental Control Officer	Included in construction costs.
The development of the proposed mine could increase the crime levels within the surrounding area thereby severely affected the quality of life of current property owners.	Safety and Security Risks	6	3	2	3	33	-	M	Strict security measures should be developed and implemented. Security personnel should be on site on a permanent basis.	2	2	2	3	18	-	L	As far as possible, the movement of construction workers should be confined to the work site to avoid any increased safety and security risks.	During construction phase	Health and Safety Officer/Project Manager/ Environmental Control Officer	Included in construction costs.
																	Before construction commences, representatives from the local municipality and community-based organisations, as well as neighbouring residents should be informed of the details of the construction company, size of the workforce and construction schedules.	During construction phase	Health and Safety Officer/Project Manager/ Environmental Control Officer	Included in construction costs.
																	Construction workers should be easily identified as part of the construction team by e.g. wearing specific clothing and/or identity tags.	During construction phase	Health and Safety Officer/Project Manager/ Environmental Control Officer	Included in construction costs.
																	Ensure adequate housing facilities for outside workers and transportation to and from the construction site.	During construction phase	Health and Safety Officer/Project Manager/ Environmental Control Officer	Included in construction costs.
																	Criminal incidents should be communicated to the workforce and mine Employees and Employees and contractors to ensure a general awareness of the safety situation in the area.	During construction phase	Health and Safety Officer/Project Manager/ Environmental Control Officer	Included in construction costs.
																	Operational safety risks should be addressed as part of the Occupational Health and Safety Act (1993).	During construction phase	Health and Safety Officer/Project Manager/ Environmental Control Officer	Included in construction costs.
A major concern in terms of public health is HIV/Aids as it is known that the disease spreads with the influx of outside workers to an area. Young	Health Impacts	6	4	3	4	52	-	M	The general health of construction workers should be monitoring on an on-going basis.	4	3	2	3	27	-	L	Local labour should be employed as far as possible to avoid additional pressure of outsiders on the existing services.	During construction phase	Health and Safety Officer/Project Manager/ Environmental Control	Included in construction costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION M	D	S	P	TOTAL	STATUS	SP	RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION M	D	S	P	TOTAL	STATUS	SP	ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
CONSTRUCTION PHASE ACTIVITY 1: FOOTPRINT CLEARANCE AND ROAD ESTABLISHMENT																				
male mineworkers could be classified as those in the "high risk" categories. If a significant proportion of the construction workforce are affected by HIV/Aids, it can lead to lower productivity, increased health related expenses and negative implications to replace workers.																			Officer	
									Develop an HIV/AIDS awareness and support programme, with specific focus on those in and nearby the construction site.								HIV/Aids awareness campaigns should be focused on contract workers.	During construction phase	Health and Safety Officer/Project Manager/ Environmental Control Officer	Included in construction costs.
																	First aid supplies should be available at various points at the construction site.	During construction phase	Health and Safety Officer/Project Manager/ Environmental Control Officer	Included in construction costs.
																	Emergency and health services should be notified of the construction schedule and peak construction periods.	During construction phase	Health and Safety Officer/Project Manager/ Environmental Control Officer	Included in construction costs.
The impact on the sense of place relates to the change in the landscape character and visual impact of the proposed mine during the construction phase.	Sense of Place	8	3	2	4	52	-	M	Visual impacts of the construction site, however, are temporary and should respond to mitigation.	4	2	2	3	24	-	L	The construction site should be kept litter free.	During construction phase	Health and Safety Officer/Project Manager/ Environmental Control Officer	Included in construction costs.
																	Site rehabilitation on certain sections of the site should occur as soon as the construction process allows.	During construction phase	Health and Safety Officer/Project Manager/ Environmental Control Officer	Included in construction costs.
During the construction phase, general construction activities create different types of noise, such as noise associated with the movement of construction vehicles, the reverse indicator of trucks, the loading or movement of material and activities of workers at a construction site such as shouting, loud music (especially after hours) and so forth. These types of noises would have different nuisance impacts on those within the construction site and on nearby dwellings.	Noise	8	2	2	4	48	-	M	At this stage construction activities are planned to take place during daytime period only. This may change to a 24 hour 7 day a week approach depending on the outcome of the BFS.	4	2	1	2	14	-	L	Where noise becomes a nuisance, management measures will be investigated and implemented to address these.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
									The use of noise barriers or earth berms and screening of noise at individual source where an activity can be clearly heard at the boundary will be implemented.								Machinery with low noise levels and maintained in a good order to be used and to comply with the IFC's Health and Safety Regulations.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
																	Use mufflers on engine exhausts and compressor components, and vibration isolation for mechanical equipment.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
Damage to property as a result of blast and vibration.	Blasting and vibration	10	2	2	4	56	-	M	Undertake a detailed blast and vibration assessment and crack survey prior to each blasting event.	4	2	1	2	14	-	L	Notify neighbouring land owners of a blasting event prior to such an event taking place (at least 2 days prior).	During construction phase	Environmental Control Officer	Included in construction costs.
																	Undertake a crack survey before and after a blasting event.	During construction phase	Environmental Control Officer	Included in construction costs.
Issues related to HERITAGE																				
Evidence of 2 sites of archaeological/cultural importance occur within the greater project area. Potential impacts on these must be minimised.	Graves/ grave yards	8	4	2	3	42	-	M	Should it be directly impacted on by the mine the graves may be exhumed and the human remains reburied. Before this may happen the necessary advertising, possible social consultation and permitting applications should be implemented. Should the graves however not be impacted on directly, there will definitely be a secondary impact. The graves should then be fenced in a management plan for the preservation and maintenance thereof be written.	4	4	2	2	20	-	L	It is possible that more cultural sites may be present. Also the subterranean presence of archaeological and/or historical sites, features or artefacts are always a distinct possibility. Care should also be taken when development work commences that if any more artefacts are uncovered, a qualified archaeologist be called in to investigate.	Ongoing	Environmental Control Officer	N/A
Issues related to WETLANDS																				
Two hillslope seepage wetlands will be directly impacted by the proposed	Site Clearance	6	1	5	5	60	-	M	The impact could be avoided by adjusting the surface infrastructure	4	5	1	5	50	-	M	Implement mitigation in accordance with the mitigation measures	Ongoing	Environmental Control Officer	Included in construction costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CONSTRUCTION PHASE ACTIVITY 1: FOOTPRINT CLEARANCE AND ROAD ESTABLISHMENT																				
surface infrastructure layout and will likely be completely and permanently destroyed during site clearing activities preceding construction. The affected wetlands are wetland units 3 and 4 (Figure 13). In addition, the existing gravel road crossing over wetland unit 2 will be upgraded as the main access road to the mine shaft. Upgrading and widening of this road will result in further wetland loss.All of the affected wetlands have been significantly impacted by agricultural activities, especially wetland unit 4 which has been completely cultivated, limiting the associated loss of biodiversity. The affected wetlands are also all isolated systems that are not directly linked to any drainage network. The impact will thus be restricted to the wetlands in question.									layout to exclude all wetland areas from the development footprint. However, this is considered unlikely. Alternatively, the loss of these wetlands could be offset through the implementation of a wetland management and rehabilitation plan for the remaining wetlands within the study area that aims to improve the condition of these wetlands and the role they play in especially biodiversity support, which is considered to be the most important function of the wetlands on site.								proposed.			
Disturbances to the soils within the wetland catchments during vegetation clearing and site preparation could result in increased sediment movement off the site and into downslope wetland areas. However, as most of the site is already cultivated and the soils are regularly disturbed through ploughing activities, the construction activities are unlikely to significantly increase sediment movement unless undertaken during the rainy season	Site Clearance	6	5	1	3	36	-	M	Earthworks and vegetation clearing activities on site should ideally be undertaken during the dry season to minimize sediment transport during surface runoff following rainfall events. Earthworks and vegetation clearing activities should also be phased to minimize the extent of disturbed areas at any one time. Temporary toe berms should be installed on the downslope side of large bare soils areas and any soil stockpiles to trap sediments eroded odd these areas. The site should be monitored for erosion and sediment movement during and after rainfall events and suitable interventions put in place to repair any erosion damage and to prevent further sediment movement off the site. Following completion of construction activities, bare soil areas should be ripped, scarified, landscaped and re-vegetated as soon as possible. Re-vegetated areas should be monitored to ensure successful re-establishment of vegetation. Ideally, 70 % cover should be obtained after 3 months. A mixture of indigenous grass species should be used.	4	5	1	2	20	-	L	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental Control Officer	Included in construction costs.
Clearing of vegetation and soil disturbance could lead to mobilisation of sediments and dust which may be blown or washed into receiving water bodies (wetlands and pans) within the vicinity. This would lead to increased turbidity (decreased water quality) which may have a negative impact on aquatic fauna. When the suspended solids (soil particles) settle out on the substrates in the wetlands, it leads to further deterioration in habitat	Site Clearance	6	4	2	4	48	-	M	Implementation of all mitigation measures listed above for erosion control and water quality management will reduce the severity of impacts. An emergency preparedness plan should be compiled and implemented in the event of major spills (e.g. fuel, mine water or sewage spill). Dust suppression measures should be used. A biomonitoring plan should be compiled and implemented and	6	4	1	2	22	-	L	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental Control Officer	Included in construction costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CONSTRUCTION PHASE ACTIVITY 1: FOOTPRINT CLEARANCE AND ROAD ESTABLISHMENT																				
quality. Sediments are colonised by *Typha* reeds or alien weeds, causing a decline in habitats during the wet season. This may result in a decline in overall biodiversity. Water quality impacts, resulting from spills, leaks, dust or dirty stormwater, will result in the loss of taxa that may be sensitive to water quality. In addition, altered hydrology, in terms of timing, duration and quantity of water will affect habitat availability. Reduced flows or shorter periods of inundation may reduce both the availability and suitability of habitats and will have an impact on aquatic fauna.									should include assessments of water quality, habitats and aquatic macroinvertebrates. Sampling sites further down in the Doring River catchment should be included to assess impacts on downstream ecosystems. All mitigation measures relating to water quality should be audited with prompt follow-up action taken in the event of non-compliances											
The existing gravel road crossing over wetland unit 2 will be upgraded as the assumed main access road to the mine shaft. Upgrading and widening of this road will result in further wetland loss. Two hillslope seepage wetlands will be directly impacted by the proposed surface infrastructure layout and will likely be completely and permanently destroyed during site clearing activities preceding construction. The affected wetlands are wetland units 3 and 4	Loss of wetland habitat	6	5	1	5	60	-	M	The loss of these wetlands could be offset through the implementation of a wetland management and rehabilitation plan for the remaining wetlands within the study area that aims to improve the condition of these wetlands and the role they play in especially biodiversity support, which is considered to be the most important function of the wetlands on site.	4	5	1	5	50	-	M	Develop a wetland management and rehabilitation plan, and implement throughout the construction, operation and closure phases of the mine.	Ongoing	Environmental control officer	N/A
Disturbances to the soils within the wetland catchments during vegetation clearing and site preparation could result in increased sediment movement off the site and into down slope wetland areas. However, as most of the site is already cultivated and the soils are regularly disturbed through ploughing activities, the construction activities are unlikely to significantly increase sediment movement unless undertaken during the rainy season.	Increased sediment movement	6	5	1	3	36	-	M	Earthworks and vegetation clearing activities on site should ideally be undertaken during the dry season to minimize sediment transport during surface runoff following rainfall events.	4	5	1	1	10	-	L	Develop a wetland management and rehabilitation plan, and implement throughout the construction, operation and closure phases of the mine.	Ongoing	Environmental control officer	N/A
																	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
									Earthworks and vegetation clearing activities should also be phased to minimize the extent of disturbed areas at any one time.								The contractor will ensure that all activities, material and equipment storage and personnel movement take place within the designated area.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
																	Employees and contractors will complete induction on the EMP, Environmental Awareness Plan and Emergency Response Plan prior to construction activities being undertaken. All workers will be made aware of the penalty systems for non compliance.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
																	Draw up a procedure clearly reflecting the method and phases of clearance of vegetation only in areas where construction will take place.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
									Temporary toe berms should be installed on the down slope side of large bare soils areas and any soil stockpiles to trap sediments eroded								The topsoil material will be stockpiled in a designated area for rehabilitation at closure/decommissioning.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CONSTRUCTION PHASE ACTIVITY 1: FOOTPRINT CLEARANCE AND ROAD ESTABLISHMENT																				
									odd these areas.								Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the National Water Act, 1998.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
																	The site should be monitored for erosion and sediment movement during and after rainfall events and suitable interventions put in place to repair any erosion damage and to prevent further sediment movement off the site.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
During construction of the surface infrastructure large areas will be covered with impermeable surfaces such as buildings, roads, paving etc., significantly increasing the generation of surface run-off from these areas, as well as the velocity of surface runoff. Infiltration and recharge of the shallow perched water table within the soil profile will decrease as a result. These changes within the runoff characteristics of the landscape will translate into changes to the supporting hydrology of the wetlands and lead to further degradation of receiving wetlands through increasing flood peaks and decreasing low flows, resulting in changed seasonality of the affected wetlands. Wetland units 5 and a further pan immediately to the north of the infrastructure area (but outside the study area) are likely to be most affected.	Altered Hydrology	6	2	2	5	50	-	M	To minimize the changes to the runoff characteristics of the landscape, the extent of hardened surfaces on site should be kept as small as possible. In addition, connectivity between areas of hardened surfaces should be minimized and such areas should ideally be separated by vegetated strips that encourage infiltration of rainwater into the soil. Care should however be taken to only allow clean water to infiltrate the soils. Dirty water areas should ideally be bunded and all runoff from these areas should be captured and used within the mining operations, with zero discharge of dirty water.	6	2	1	3	27	-	L	Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the National Water Act, 1998.	Prior to construction	Environmental Control Officer/ Project Manager	Included in construction costs.
																	Maintain and monitor the implementation of dirty water separation infrastructure.	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.
																	Construct the required erosion protection measures.	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.
Clearing of vegetation and soil disturbance could lead to mobilisation of sediments and dust which may be blown or washed into receiving water bodies (wetlands and pans) within the vicinity. This would lead to increased turbidity (decreased water quality) which may have a negative impact on aquatic fauna. When the suspended solids (soil particles) settle out on the substrates in the wetlands, it leads to further deterioration in habitat quality. Sediments are colonised by Typha reeds or alien weeds, causing a decline in habitats during the wet season. This may result in a decline in overall biodiversity. Water quality impacts, resulting from spills, leaks, dust or dirty storm water, will result in the loss of taxa that may be sensitive to water quality. In addition, altered hydrology, in terms of timing, duration and quantity of water will affect habitat availability. Reduced flows or shorter periods of inundation may reduce both the availability and suitability of habitats and will have an impact on aquatic fauna.	Decline in habitats and biota	6	4	2	4	48	-	M	The loss of these wetlands could be offset through the implementation of a wetland management and rehabilitation plan for the remaining wetlands within the study area that aims to improve the condition of these wetlands and the role they play in especially biodiversity support, which is considered to be the most important function of the wetlands on site.	6	4	1	2	22	-	L	Develop a wetland management and rehabilitation plan, and implement throughout the construction, operation and closure phases of the mine.	Ongoing	Environmental control officer	N/A

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CONSTRUCTION PHASE ACTIVITY 1: FOOTPRINT CLEARANCE AND ROAD ESTABLISHMENT																				
Issues related to RADIATION																				
Impact on public safety as a result of exposure to radioactivity.	Radioactive elements	10	4	2	5	80	-	H	Develop a Radiation Management Plan.	6	4	1	4	44	-	M	Implement the Radiation Management Plan throughout the life of mine and monitor exposure of the public to radioactivity in accordance therewith.	Ongoing	Environmental control officer/Health & Safety officer	Included in Construction and Operational Costs

Table 6.3: Impacts and Management Measures for Construction Phase Activities: Establishment of Infrastructure.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CONSTRUCTION PHASE ACTIVITY 2: ESTABLISHMENT OF INFRASTRUCTURE																				
Issues related to GEOLOGY																				
No significant construction impacts are envisaged.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TOPOGRAPHY																				
No significant construction impacts are envisaged.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to GEOHYDROLOGY																				
Small volumes of groundwater inflow, some dewatering of Karoo aquifer	Infrastructure establishment	6	2	2	4	40	-	M	Grouting of shafts and decline will minimise inflows and consequent aquifer dewatering	6	2	2	1	10	-	L	Grout side walls of all shafts and decline as construction proceeds downward, monitor water levels	Ongoing	Civil/Construction Engineer	Included in construction costs.
Issues related to HYDROLOGY																				
Spillages on site may lead to surface water pollution.	Heavy vehicle movement	8	4	2	4	56	-	M	Employees and contractors will be educated to make them aware of the necessity to prevent spillages through the implementation of good housekeeping practices.	4	4	2	3	30	-	M	Employees and contractors will complete induction on the EMP, Environmental Awareness Plan and Emergency Response Plan prior to construction activities being undertaken. All workers will be made aware of the penalty systems for non compliance.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
									The management of chemicals and hydrocarbons must form part of the emergency preparedness and response programme.								Employees and contractors will complete induction prior to construction activities being undertaken and the Environmental Awareness Plan and Emergency Response Plan must be implemented.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
Construction activities will influence the natural drainage patterns.	Drainage patterns	8	2	2	4	48	-	M	Reassessment of the placement of clean and dirty water systems as implemented during the footprint clearance phase of construction. Should it be necessary new clean and dirty water systems must be put in place where others are not functioning properly.	4	3	1	2	16	-	L	Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the National Water Act, 1998. Implement a management and maintenance programme for clean and dirty water systems to stay fully operational. Dirty water runoff conveyance and storage systems at the mine will be controlled by structures and control measures prescribed in the Stormwater Management Plan.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
Issues related to SOIL, LAND USE AND LAND CAPABILITY																				
Loss of fertile topsoil layer	Construction of power station and associated infrastructure	1	5	8	5	70	-	H	Preserve as large a area as possible/strip if possible	1	5	6	4	48	-	M	Implement mitigation in accordance with the mitigation measures proposed.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
Soil compaction	Construction of infrastructure	2	4	6	4	48	-	M	Keep infrastructure localized to reduce footprint	2	4	4	4	40	-	M	Implement mitigation in accordance with the mitigation measures proposed.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
Soil erosion	Vegetation removal during construction and operations	1	5	8	4	56	-	M	Keep as much original landcover/topsoil as possible	1	3	4	4	32	-	M	Implement mitigation in accordance with the mitigation measures proposed.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
Chemical soil pollution	Spillage and seepage of wastewater	2	5	8	5	75	-	H	Proper chemical waste management	1	3	4	4	32	-	M	Implement mitigation in accordance with the mitigation measures proposed.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
Change in natural landscape	Ground clearance and waste disposal	1	5	6	5	60	-	M	Keep infrastructure to a minimum to reduce footprint	1	5	4	4	40	-	M	Implement mitigation in accordance with the mitigation measures proposed.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
The construction of infrastructure will alter the land use land capability of the area.	Infrastructure establishment	6	2	2	4	40	-	M	Construction activities should be limited to designated areas. No related activities may be undertaken	2	2	1	2	10	-	L	Develop a plan clearly defining the construction area. Workers should complete induction prior to	During construction	Environmental Control Officer/ Project Manager/Health &	Included in construction costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CONSTRUCTION PHASE ACTIVITY 2: ESTABLISHMENT OF INFRASTRUCTURE																				
									outside of the designated areas. The boundaries will be fenced off to prevent unnecessary impacts on surrounding land capabilities. All fences will be routinely inspected and maintained. The surrounding land (not used for mining or operational purposes) will be kept in the state it was prior to the mining related construction activities.								construction activities being undertaken.		Safety Officer	
Issues related to FAUNA AND FLORA																				
Direct impacts on flora species of conservation importance.	Infrastructure establishment	8	5	4	5	85	-	H	Exclude sensitive areas and provide protection for nearby sensitive areas.	8	5	4	1	17	-	L	Develop environmental monitoring plans that identify and address issues of concern as well as include relevant aspects in awareness training.	Seasonal/Bi-annual	Environmental control officer/Ecologist/Proponent	Included in construction costs.
Direct impacts on fauna species of conservation importance.	Infrastructure establishment	8	5	4	5	85	-	H	Exclude sensitive areas and provide protection for nearby sensitive areas.	8	5	4	1	17	-	L	Develop environmental monitoring plans that identify and address issues of concern as well as include relevant aspects in awareness training.	Seasonal/Bi-annual	Environmental control officer/Ecologist/Proponent	Included in construction costs.
Loss or disruption of mammal migration routes.	Infrastructure establishment	6	5	2	5	65	-	H	Ensure minimal footprint clearance; ensure minimal human/animal conflict potential; implement awareness programmes; allow for natural crossings where possible; control movement of personnel; and limit speeds of vehicles.	6	5	2	3	39	-	M	Develop and implement awareness programmes aimed at ensuring that persistent and deliberate impacts on animals in nearby natural habitat are prevented.	Ongoing	Environmental control officer/Health & Safety Officer/Contractor/Site Manager	Included in construction costs.
Direct impacts on sensitive/pristine habitat types.	Infrastructure establishment	8	5	3	2	32	-	M	Exclude sensitive areas and provide protection for nearby sensitive areas; limit the spread of impacts to nearby sensitive areas.	8	5	3	1	16	-	L	Develop environmental monitoring plans that identify and address issues of concern as well as include relevant aspects in awareness training.	Seasonal/Bi-annual	Environmental control officer	Included in construction costs.
Direct impacts on common fauna species of the study area.	Infrastructure establishment	4	4	2	4	40	-	M	Ensure minimal footprint clearance; ensure minimal human/animal conflict potential; implement awareness programmes; control movement of personnel; and limit speeds of vehicles.	4	4	2	3	30	-	M	Develop and implement awareness programmes aimed at ensuring that persistent and deliberate impacts on animals in nearby natural habitat are prevented.	Ongoing	Environmental control officer/Health & Safety Officer/Contractor/Site Manager	Included in construction costs.
Faunal interaction with structures, servitudes and/or personnel.	Infrastructure establishment	4	4	3	4	44	-	M	Ensure minimal footprint clearance; ensure minimal human/animal conflict potential; implement awareness programmes; control movement of personnel; and limit speeds of vehicles.	4	4	2	4	40	-	M	Develop and implement awareness programmes aimed at ensuring that persistent and deliberate impacts on animals in nearby natural habitat are prevented.	Ongoing	Environmental control officer/Health & Safety Officer/Contractor/Site Manager	Included in construction costs.
Impacts on surrounding habitat/species, including ecosystem functioning.	Infrastructure establishment	6	4	2	3	36	-	M	Limit spread of impacts to adjacent areas and provide adequate protection for nearby sensitive areas.	6	4	2	2	24	-	L	Develop environmental monitoring plans that identify and address issues of concern as well as include relevant aspects in awareness training.	Seasonal/Bi-annual	Environmental control officer/Health & Safety Officer	Included in construction costs.
Issues related to AIR QUALITY																				
Fugitive dust emissions as a result of the movement of vehicles and removal of material for construction purposes will have a negative impact in terms of visual characteristics/air quality.	Heavy vehicle movement	6	2	2	4	40	-	M	The impact during construction phase is limited to a short period only. All mine haul roads will be treated with dust suppressant chemicals or watered in order to reduce the impact of dust on the aesthetics of the surrounding area.	2	2	2	3	18	-	L	Establish a dust management plan in consultation with the environmental manager and include dust suppression as part of the contractor's responsibility.	Ongoing	Environmental Control Officer	Included in construction costs.
Generation of windblown dust	Exposure of underlying soil	4	2	2	3	24	-	L	Recover exposed land promptly, where possible.	2	2	2	3	18	-	L	Establish a dust management plan in consultation with the environmental manager and include dust suppression as part of the contractor's responsibility.	Daily	Environmental Control Officer	Included in construction costs.
Issues related to NOISE																				
Noise will be generated as a result of the removal of vegetation, transportation and stockpiling of topsoil and subsoil's.	Heavy vehicle movement	6	2	2	4	40	-	M	Construction activities will take place 24 hours a day.	4	2	2	3	24	-	L	Where noise becomes a nuisance, management measures will be investigated and implemented to address these.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CONSTRUCTION PHASE ACTIVITY 2: ESTABLISHMENT OF INFRASTRUCTURE																				
									The use of noise barriers or earth berms and screening of noise at individual source where an activity can be clearly heard at the boundary will be implemented.								Machinery with low noise levels and maintained in a good order to be used and to comply with the International Finance Corporation (IFC's) Health and Safety Regulations.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
																	Use mufflers on engine exhausts and compressor components, and vibration isolation for mechanical equipment.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
Issues related to TRAFFIC																				
Potential access road S239	Heavy vehicle movement	6	5	3	5	70	-	H	Geometry and surfacing of access road.	2	4	3	2	18	-	L	Construct road and surfacing.	Once plus maintenance	Project Manager	R100 000 - R4 000 000 every 5 - 10 years
Mine access	Heavy vehicle movement	2	4	2	4	32	-	M	Geometry and surfacing of mine access road.	2	4	2	2	16	-	L	Construct access.	Once plus maintenance	Project Manager	R10 000 - R1 000 000 every 5 - 10 years
Railway line level crossing	Heavy vehicle movement	8	5	3	5	80	-	H	Provide alternative access from R73.	3	4	1	2	16	-	L	Provide and construct alternative access.	Once plus maintenance	Project Manager	R10 000 - R1 000 000 every 5 - 10 years
									Provide road signs, flash lights, control booms & height restriction.	3	4	3	2	20	-	L	Provide road signs, flash lights, control booms & height restriction.	Once plus maintenance	Project Manager	R10 000 - R500 000 every 20 - 30 years
Public transport facility	Heavy vehicle movement	2	4	2	3	24	-	L	Provision of public transport facility	2	4	3	2	18	-	L	Construction of public transport facility.	Once plus maintenance	Project Manager	R10 000 - R500 000 every 10 - 15 years
Street lights at access intersection	Heavy vehicle movement	2	4	2	3	24	-	L	Provision of street lights	2	4	1	2	14	-	L	Provision of street lights.	Once plus maintenance	Project Manager	R10 000 - R500 000 every 10 - 15 years
Increase in vehicular movement on site will impact traffic volumes in the project area.	Heavy vehicle movement	8	4	4	5	80	-	H	As part of the construction requirements access roads will have to be established and/or upgraded.	6	4	3	3	39	-	M	Ensure that road construction meets the requirements of the operation.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
									Enforce speed limit restrictions on all vehicles.								Speed enforcement must be implemented (40 km/hr for heavy vehicles and 60 km/hr for light vehicles on gravel roads). Implement a strict penalty system for non-compliance.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
									Do not allow pedestrian pick-ups on any roads.								Implement a strict penalty system for non-compliance .	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
Issues related to VISUAL																				
Fugitive dust emissions as a result of vegetation clearance and associated bare areas may have a negative impact in terms of air quality and visual characteristics.	Heavy vehicle movement	8	2	2	5	60	-	M	Effective dust management must be employed during the construction phase.	4	2	1	3	21	-	L	Draw up a dust management plan in consultation with the environmental manager and include dust suppression as part of the contractor's responsibility.	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.
Visual impact of new infrastructure and influence on surrounding land owners.	All Infrastructure construction	8	3	2	4	52	-	M	Topsoil and subsoil stockpiles including soft spoils must be constructed in such a way as to serve as visual barriers for the surrounding landowners.	4	2	2	3	24	-	L	The top 500 mm of topsoil will be removed from the area where surface infrastructure is to be developed. The topsoil will be stored in berms along the perimeter of the site. Care will be taken to ensure that the berm is not located within any surface water channels. The berms will not exceed 5 m in height.	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.
									Structures that are required to be built form steel or concrete may be painted a dark natural tone fitting in with the surrounding environment.								Paint colours such as olive greens and tans can be used at base of buildings and top parts be lighter grey to blend in with skyline. Pure whites, blacks and bright colours should be avoided. Avoid shiny and bare metal.	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.
									An ecological approach to rehabilitation and vegetative screening measures, as opposed a								A registered landscape architect should be consulted for this purpose. Trees and shrubs can be used to screen	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CONSTRUCTION PHASE ACTIVITY 2: ESTABLISHMENT OF INFRASTRUCTURE																				
									horticultural approach to landscaping should be adopted. For example communities of indigenous plants enhance bio-diversity and blend well with existing vegetation. This ecological approach to landscaping costs significantly less to maintain than conventional landscaping methods and is more sustainable.								structures and break stark contrasting lines if carefully planned and positioned.			
Issues related to SOCIAL																				
No further impacts envisaged - impacts on social aspects are addressed in footprint clearance.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to HERITAGE																				
Evidence of 2 sites of archaeological/cultural importance occur within the greater project area. Potential impacts on these must be minimised.	Graves/ grave yards	8	4	2	3	42	-	M	Should it be directly impacted on by the mine the graves may be exhumed and the human remains reburied. Before this may happen the necessary advertising, possible social consultation and permitting applications should be implemented. Should the graves however not be impacted on directly, there will definitely be a secondary impact. The graves should then be fenced in a management plan for the preservation and maintenance thereof be written.	4	4	2	2	20	-	L	It is possible that more cultural sites may be present. Also the subterranean presence of archaeological and/or historical sites, features or artefacts are always a distinct possibility. Care should also be taken when development work commences that if any more artefacts are uncovered, a qualified archaeologist be called in to investigate.	Ongoing	Environmental control officer	N/A
Issues related to WETLANDS																				
Two hillslope seepage wetlands will be directly impacted by the proposed surface infrastructure layout and will likely be completely and permanently destroyed during site clearing activities preceding construction. The affected wetlands are wetland units 3 and 4.	Loss of wetland habitat	6	5	1	5	60	-	M	The loss of these wetlands could be offset through the implementation of a wetland management and rehabilitation plan for the remaining wetlands within the study area that aims to improve the condition of these wetlands and the role they play in especially biodiversity support, which is considered to be the most important function of the wetlands on site.	4	5	1	5	50	-	M	Develop a wetland management and rehabilitation plan, and implement throughout the construction, operation and closure phases of the mine.	Ongoing	Environmental control officer	N/A
During construction of the surface infrastructure large areas will be covered with impermeable surfaces such as buildings, roads, paving etc., significantly increasing the generation of surface run-off from these areas, as well as the velocity of surface runoff. Infiltration and recharge of the shallow perched water table within the soil profile will decrease as a result. These changes within the runoff characteristics of the landscape will translate into changes to the supporting hydrology of the wetlands and lead to further degradation of receiving wetlands through increasing flood peaks and decreasing low flows, resulting in changed seasonality of the affected wetlands. Wetland units 5 and a further pan immediately to the north of the infrastructure area (but outside the study area) are likely to be most	Altered Hydrology	6	2	2	5	50	-	M	To minimize the changes to the runoff characteristics of the landscape, the extent of hardened surfaces on site should be kept as small as possible. In addition, connectivity between areas of hardened surfaces should be minimized and such areas should ideally be separated by vegetated strips that encourage infiltration of rainwater into the soil. Care should however be taken to only allow clean water to infiltrate the soils. Dirty water areas should ideally be bunded and all runoff from these areas should be captured and used within the mining operations, with zero discharge of dirty water.	6	2	1	3	27	-	L	Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the National Water Act, 1998.	Prior to construction	Environmental Control Officer/ Project Manager	Included in construction costs.
																	Maintain and monitor the implementation of dirty water separation infrastructure.	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.
																	Construct the required erosion protection measures.	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CONSTRUCTION PHASE ACTIVITY 2: ESTABLISHMENT OF INFRASTRUCTURE																				
affected.																				
Clearing of vegetation and soil disturbance could lead to mobilisation of sediments and dust which may be blown or washed into receiving water bodies (wetlands and pans) within the vicinity. This would lead to increased turbidity (decreased water quality) which may have a negative impact on aquatic fauna. When the suspended solids (soil particles) settle out on the substrates in the wetlands, it leads to further deterioration in habitat quality. Sediments are colonised by Typha reeds or alien weeds, causing a decline in habitats during the wet season. This may result in a decline in overall biodiversity. Water quality impacts, resulting from spills, leaks, dust or dirty storm water, will result in the loss of taxa that may be sensitive to water quality. In addition, altered hydrology, in terms of timing, duration and quantity of water will affect habitat availability. Reduced flows or shorter periods of inundation may reduce both the availability and suitability of habitats and will have an impact on aquatic fauna.	Decline in habitats and biota	6	4	2	4	48	-	M	The loss of these wetlands could be offset through the implementation of a wetland management and rehabilitation plan for the remaining wetlands within the study area that aims to improve the condition of these wetlands and the role they play in especially biodiversity support, which is considered to be the most important function of the wetlands on site.	6	4	1	2	22	-	L	Develop a wetland management and rehabilitation plan, and implement throughout the construction, operation and closure phases of the mine.	Ongoing	Environmental control officer	N/A
Issues related to RADIATION																				
Impact on public safety as a result of exposure to radioactivity.	Radioactive elements	10	4	2	5	80	-	H	Develop a Radiation Management Plan.	6	4	1	4	44	-	M	Implement the Radiation Management Plan throughout the life of mine and monitor exposure of the public to radioactivity in accordance therewith.	Ongoing	Environmental control officer/Health & Safety officer	Included in Construction and Operational Costs

Table 6.4: Impacts and Management Measures for Construction Phase Activities: Plant Construction

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CONSTRUCTION PHASE ACTIVITY 3: PLANT CONSTRUCTION																				
Issues related to GEOLOGY																				
No significant construction impacts are envisaged.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TOPOGRAPHY																				
The different structures such as the plants, and related activities, office buildings, and workshops, resulted in a substantial alteration to the natural topography of the area. The primary impact is an aesthetic one and will be dealt with in the visual impact section.	Plant establishment	6	5	2	5	65	-	H	As far as practically possible the designs will ensure that the infrastructure blends into the surrounding environment where possible. The necessary clean and dirty water systems will be implemented and maintained to limit the impact on the topography.	2	4	1	3	21	-	L	Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the National Water Act, 1998.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
																	Maintain and monitor the implementation of dirty water separation.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
The possible development of subsidence and associated sinkholes due to the presence of dolomites.	Plant establishment	6	5	2	3	39	-	M	The mine will ensure that the necessary geotechnical investigations are undertaken to ensure that all infrastructure is constructed on stable foundations.	4	5	2	3	33	-	M	Emergency preparedness measures will be produced and available that deals specifically with possible subsidence.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
																	Continuous monitoring of the surrounding area will be undertaken (weekly is proposed) to investigate the status of the area.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
																	Should sinkholes occur, sinkholes will be filled up as soon as possible.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
																	The surface area will be re-vegetated with an appropriate species.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
Issues related to GEOHYDROLOGY																				
The flow model indicates inflow volumes that could be expected in the order of 150 M^3/day per shaft and for the decline in the order of 200 M^3/day. The cumulative inflow volumes for the Construction Phase could be approximately 500 M^3/day. However, it should not affect groundwater users, as this is water from the deeper, fractured Witwatersrand aquifer.	Aquifer dewatering	6	2	2	4	40	-	M	The mine will have to include this in their future water balance planning. The quality of the mine water would not allow for direct discharge in the environment. Grouting of shafts and decline will stop inflows to occur and subsequent aquifer dewatering It is important to identify water-bearing zones well in advance rather than mining into them. For this reason a suitable cover drilling program is advised for all development into virgin ground. It is also important that cover drilling consist of both percussion and diamond drilling. An assessment of the fracturing in the core, even if no water is intersected, is important as it will provide data on the fracture densities associated with potential water zones	6	2	2	2	20	-	L	Maintain and monitor the implementation of dirty water separation infrastructure.	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.
Small/negligible groundwater contamination	Plant establishment	2	2	1	2	10	-	L	Care must be taken to prevent oil/grease spillages, use only dedicated workshops	2	2	1	1	5	-	L	Use only dedicated working areas	During construction and operational phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction and operational costs.
Issues related to HYDROLOGY																				
Plant establishment activities will cause soil erosion to occur, and subsequent sediment transport and siltation of water courses.	Erosion	8	2	1	5	55	-	M	Temporary attenuation dams must be constructed downstream of the proposed area if construction will occur during the wet season. This measure is required to mitigate the sediment transport and erosion	4	2	1	3	21	-	L	Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the National Water Act, 1998.	Prior to construction	Environmental Control Officer/ Project Manager	Included in construction costs.
																	Maintain and monitor the implementation of dirty water	During construction phase	Environmental Control Officer/ Project	Included in construction costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CONSTRUCTION PHASE ACTIVITY 3: PLANT CONSTRUCTION																				
									impact.								separation infrastructure.		Manager	
																	Construct the required erosion protection measures.	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.
Spillages of construction materials on site may lead to surface water pollution.	Heavy vehicle movement	8	4	2	4	56	-	M	Employees and contractors will be educated to make them aware of the necessity to prevent spillages through the implementation of good housekeeping practices.	4	4	2	3	30	-	M	Employees and contractors will complete induction on the EMP, Environmental Awareness Plan and Emergency Response Plan prior to construction activities being undertaken. All workers will be made aware of the penalty systems for non compliance.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
									The management of chemicals and hydrocarbons must form part of the emergency preparedness and response programme.								Employees and contractors will complete induction prior to construction activities being undertaken and the Environmental Awareness Plan and Emergency Response Plan must be implemented.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
Construction activities will influence the natural drainage patterns.	Drainage patterns	8	2	2	4	48	-	M	Reassessment of the placement of clean and dirty water systems as implemented during the footprint clearance phase of construction. Should it be necessary new clean and dirty water systems must be put in place where others are not functioning properly.	4	3	1	2	16	-	L	Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the National Water Act, 1998. Implement a management and maintenance programme for clean and dirty water systems to stay fully operational.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
Issues related to SOIL, LAND USE AND LAND CAPABILITY																				
Loss of fertile topsoil layer	Construction of power station and associated infrastructure	1	5	8	5	70	-	H	Preserve as large a area as possible/strip if possible	1	5	6	4	48	-	M	Implement mitigation in accordance with the mitigation measures proposed.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
Soil compaction	Construction of infrastructure	2	4	6	4	48	-	M	Keep infrastructure localized to reduce footprint	2	4	4	4	40	-	M	Implement mitigation in accordance with the mitigation measures proposed.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
Soil erosion	Vegetation removal during construction and operations	1	5	8	4	56	-	M	Keep as much original landcover/topsoil as possible	1	3	4	4	32	-	M	Implement mitigation in accordance with the mitigation measures proposed.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
The construction of infrastructure will alter the land use land capability of the area.	Plant establishment	6	2	2	4	40	-	M	Construction activities should be limited to designated areas. No related activities may be undertaken outside of the designated areas. The boundaries will be fenced off to prevent unnecessary impacts on surrounding land capabilities. All fences will be routinely inspected and maintained. The surrounding land (not used for mining or operational purposes) will be kept in the state it was prior to the mining related construction activities.	2	2	1	2	10	-	L	Develop a plan clearly defining the construction area. Workers should complete induction prior to construction activities being undertaken.	During construction	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
Issues related to FAUNA AND FLORA																				
Direct impacts on flora species of conservation importance.	Plant establishment	8	5	4	5	85	-	H	Exclude sensitive areas and provide protection for nearby sensitive areas.	8	5	3	1	16	-	L	Develop environmental monitoring plans that identify and address issues of concern as well as include relevant aspects in awareness training.	Seasonal/Bi-annual	Environmental control officer/Ecologist/Proponent	Included in construction costs.
Direct impacts on fauna species of conservation importance.	Plant establishment	8	5	4	5	85	-	H	Exclude sensitive areas and provide protection for nearby sensitive areas.	8	5	3	1	16	-	L	Develop environmental monitoring plans that identify and address issues of concern as well as include relevant aspects in awareness training.	Seasonal/Bi-annual	Environmental control officer/Ecologist/Proponent	Included in construction costs.
Loss or disruption of mammal migration routes.	Plant establishment	6	5	2	5	65	-	H	Ensure minimal footprint clearance; ensure minimal human/animal conflict potential; implement	6	5	2	2	26	-	L	Develop and implement awareness programmes aimed at ensuring that persistent and deliberate impacts on	Ongoing	Environmental control officer/Health & Safety	Included in construction costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION M	D	S	P	TOTAL	STATUS	SP	RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION M	D	S	P	TOTAL	STATUS	SP	ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
CONSTRUCTION PHASE ACTIVITY 3: PLANT CONSTRUCTION																				
									awareness programmes; allow for natural crossings where possible; control movement of personnel; and limit speeds of vehicles.								animals in nearby natural habitat are prevented.		Officer/Contractor/Site Manager	
Direct impacts on sensitive/pristine habitat types.	Plant establishment	8	5	3	3	48	-	M	Exclude sensitive areas and provide protection for nearby sensitive areas; limit the spread of impacts to nearby sensitive areas.	8	5	3	2	32	-	M	Develop environmental monitoring plans that identify and address issues of concern as well as include relevant aspects in awareness training.	Seasonal/Bi-annual	Environmental control officer	Included in construction costs.
Direct impacts on common fauna species of the study area.	Plant establishment	4	4	2	5	50	-	M	Ensure minimal footprint clearance; ensure minimal human/animal conflict potential; implement awareness programmes; control movement of personnel; and limit speeds of vehicles.	4	4	2	3	30	-	M	Develop and implement awareness programmes aimed at ensuring that persistent and deliberate impacts on animals in nearby natural habitat are prevented.	Ongoing	Environmental control officer/Health & Safety Officer/Contractor/Site Manager	Included in construction costs.
Faunal interaction with structures, servitudes and/or personnel.	Plant establishment	4	5	3	4	48	-	M	Ensure minimal footprint clearance; ensure minimal human/animal conflict potential; implement awareness programmes; control movement of personnel; and limit speeds of vehicles.	4	4	2	3	30	-	M	Develop and implement awareness programmes aimed at ensuring that persistent and deliberate impacts on animals in nearby natural habitat are prevented.	Ongoing	Environmental control officer/Health & Safety Officer/Contractor/Site Manager	Included in construction costs.
Impacts on surrounding habitat/species, including ecosystem functioning.	Plant establishment	6	4	2	3	36	-	M	Limit spread of impacts to adjacent areas and provide adequate protection for nearby sensitive areas.	6	4	2	2	24	-	L	Develop environmental monitoring plans that identify and address issues of concern as well as include relevant aspects in awareness training.	Seasonal/Bi-annual	Environmental control officer/Health & Safety Officer	Included in construction costs.
Issues related to AIR QUALITY																				
Fugitive dust emissions as a result of the movement of vehicles and removal of material for construction purposes will have a negative impact in terms of visual characteristics/air quality.	Heavy vehicle movement	6	2	2	4	40	-	M	The impact during construction phase is limited to a short period only. All mine haul roads will be treated with dust suppressant chemicals or watered in order to reduce the impact of dust on the aesthetics of the surrounding area.	2	2	2	3	18	-	L	Establish a dust management plan in consultation with the environmental manager and include dust suppression as part of the contractor's responsibility.	Ongoing	Environmental Control Officer	Included in construction costs.
Generation of windblown dust	Exposure of underlying soil	4	2	2	3	24	-	L	Recover exposed land promptly, where possible.	2	2	2	3	18	-	L	Establish a dust management plan in consultation with the environmental manager and include dust suppression as part of the contractor's responsibility.	Daily	Environmental Control Officer	Included in construction costs.
Issues related to NOISE																				
Noise will be generated as a result of plant establishment.	Heavy vehicle movement	6	2	2	4	40	-	M	Construction activities will take place 24 hours a day.	4	2	2	3	24	-	L	Where noise becomes a nuisance, management measures will be investigated and implemented to address these.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
									The use of noise barriers or earth berms and screening of noise at individual source where an activity can be clearly heard at the boundary will be implemented.								Machinery with low noise levels and maintained in a good order to be used and to comply with the IFC's Health and Safety Regulations.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
																	Use mufflers on engine exhausts and compressor components, and vibration isolation for mechanical equipment.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
Issues related to TRAFFIC																				
Increase in vehicular movement on site will impact traffic volumes in the project area.	Heavy vehicle movement	8	4	4	5	80	-	H	As part of the construction requirements access roads will have to be established and/or upgraded.	6	4	3	3	39	-	M	Ensure that road construction meets the requirements of the operation.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
									Enforce speed limit restrictions on all vehicles.								Speed enforcement must be implemented (40 km/hr for heavy vehicles and 60 km/hr for light vehicles on gravel roads). Implement a strict penalty system for non-compliance.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
									Do not allow pedestrian pick-ups on any roads.								Implement a strict penalty system for non-compliance .	During construction phase	Environmental Control Officer/ Project Manager/Health &	Included in construction costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION M	D	S	P	TOTAL	STATUS	SP	RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION M	D	S	P	TOTAL	STATUS	SP	ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
CONSTRUCTION PHASE ACTIVITY 3: PLANT CONSTRUCTION																				
																			Safety Officer	
Issues related to VISUAL																				
Fugitive dust emissions as a result of vegetation clearance and associated bare areas may have a negative impact in terms of air quality and visual characteristics.	Heavy vehicle movement	8	2	2	5	60	-	M	Effective dust management must be employed during the construction phase.	4	2	1	3	21	-	L	Draw up a dust management plan in consultation with the environmental manager and include dust suppression as part of the contractor's responsibility.	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.
Visual impact of plant infrastructure and influence on surrounding land owners.	All Infrastructure construction	8	3	2	4	52	-	M	Topsoil and subsoil stockpiles including soft spoils must be constructed in such a way as to serve as visual barriers for the surrounding landowners.	4	2	2	3	24	-	L	The top 500 mm of topsoil will be removed from the area where surface infrastructure is to be developed. The topsoil will be stored in berms along the perimeter of the site. Care will be taken to ensure that the berm is not located within any surface water channels. The berms will not exceed 5 m in height.	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.
									Structures that are required to be built form steel or concrete may be painted a dark natural tone fitting in with the surrounding environment.								Olive greens and tans can be used at base of buildings and top parts be lighter grey to blend in with skyline. Pure whites, blacks and bright colours should be avoided. Avoid shiny and bare metal.	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.
									An ecological approach to rehabilitation and vegetative screening measures, as opposed a horticultural approach to landscaping should be adopted. For example communities of indigenous plants enhance bio-diversity and blend well with existing vegetation. This ecological approach to landscaping costs significantly less to maintain than conventional landscaping methods and is more sustainable.								A registered landscape architect should be consulted for this purpose. Trees and shrubs can be used to screen structures and break stark contrasting lines if carefully planned and positioned.	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.
Issues related to SOCIAL																				
No further impacts envisaged - impacts on social aspects are addressed in footprint clearance.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to HERITAGE																				
Evidence of 2 sites of archaeological/cultural importance occur within the greater project area. Potential impacts on these must be minimised.	Graves/ grave yards	8	4	2	3	42	-	M	Should it be directly impacted on by the mine the graves may be exhumed and the human remains reburied. Before this may happen the necessary advertising, possible social consultation and permitting applications should be implemented. Should the graves however not be impacted on directly, there will definitely be a secondary impact. The graves should then be fenced in a management plan for the preservation and maintenance thereof be written.	4	4	2	2	20	-	L	It is possible that more cultural sites may be present. Also the subterranean presence of archaeological and/or historical sites, features or artefacts are always a distinct possibility. Care should also be taken when development work commences that if any more artefacts are uncovered, a qualified archaeologist be called in to investigate.	Ongoing	Environmental control officer	N/A
Issues related to WETLANDS																				
Two hillslope seepage wetlands will be directly impacted by the proposed surface infrastructure layout and will likely be completely and permanently destroyed during site clearing activities preceding construction. The affected wetlands are wetland units 3 and 4.	Loss of wetland habitat	6	5	1	5	60	-	M	The loss of these wetlands could be offset through the implementation of a wetland management and rehabilitation plan for the remaining wetlands within the study area that aims to improve the condition of these wetlands and the role they play in especially biodiversity support, which is considered to be the most important function of the wetlands on	4	5	1	5	50	-	M	Develop a wetland management and rehabilitation plan, and implement throughout the construction, operation and closure phases of the mine.	Ongoing	Environmental control officer	N/A

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CONSTRUCTION PHASE ACTIVITY 3: PLANT CONSTRUCTION																				
									site.											
Disturbances to the soils within the wetland catchments during vegetation clearing and site preparation could result in increased sediment movement off the site and into down slope wetland areas. However, as most of the site is already cultivated and the soils are regularly disturbed through ploughing activities, the construction activities are unlikely to significantly increase sediment movement unless undertaken during the rainy season.	Increased sediment movement	6	5	1	3	36	-	M	Earthworks and vegetation clearing activities on site should ideally be undertaken during the dry season to minimize sediment transport during surface runoff following rainfall events.	4	5	1	1	10	-	L	Develop a wetland management and rehabilitation plan, and implement throughout the construction, operation and closure phases of the mine.	Ongoing	Environmental control officer	N/A
																	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
									Earthworks and vegetation clearing activities should also be phased to minimize the extent of disturbed areas at any one time.								The contractor will ensure that all activities, material and equipment storage and personnel movement take place within the designated area.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
																	Employees and contractors will complete induction on the EMP, Environmental Awareness Plan and Emergency Response Plan prior to construction activities being undertaken. All workers will be made aware of the penalty systems for non compliance.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
																	Draw up a procedure clearly reflecting the method and phases of clearance of vegetation only in areas where construction will take place.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
									Temporary toe berms should be installed on the down slope side of large bare soils areas and any soil stockpiles to trap sediments eroded odd these areas.								The topsoil material will be stockpiled in a designated area for rehabilitation at closure/decommissioning.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
																	Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the National Water Act, 1998.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
																	The site should be monitored for erosion and sediment movement during and after rainfall events and suitable interventions put in place to repair any erosion damage and to prevent further sediment movement off the site.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in construction costs.
During construction of the surface infrastructure large areas will be covered with impermeable surfaces such as buildings, roads, paving etc., significantly increasing the generation of surface run-off from these areas, as well as the velocity of surface runoff. Infiltration and recharge of the shallow perched water table within the soil profile will decrease as a result. These changes within the runoff characteristics of the landscape will translate into changes to the supporting hydrology of the wetlands and lead to further degradation of receiving wetlands through increasing flood peaks and decreasing low flows, resulting in changed seasonality of the affected wetlands. Wetland units 5 and a further pan immediately to the	Altered Hydrology	6	2	2	5	50	-	M	To minimize the changes to the runoff characteristics of the landscape, the extent of hardened surfaces on site should be kept as small as possible. In addition, connectivity between areas of hardened surfaces should be minimized and such areas should ideally be separated by vegetated strips that encourage infiltration of rainwater into the soil. Care should however be taken to only allow clean water to infiltrate the soils. Dirty water areas should ideally be bunded and all runoff from these areas should be captured and used within the mining operations, with zero discharge of dirty water.	6	2	1	3	27	-	L	Design and construct all structures to ensure clean and dirty water separation as stipulated in Regulation 704 of the National Water Act, 1998.	Prior to construction	Environmental Control Officer/ Project Manager	Included in construction costs.
																	Maintain and monitor the implementation of dirty water separation infrastructure.	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.
																	Construct the required erosion protection measures.	During construction phase	Environmental Control Officer/ Project Manager	Included in construction costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION M	D	S	P	TOTAL	STATUS	SP	RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION M	D	S	P	TOTAL	STATUS	SP	ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
CONSTRUCTION PHASE ACTIVITY 3: PLANT CONSTRUCTION																				
north of the infrastructure area (but outside the study area) are likely to be most affected.																				
Clearing of vegetation and soil disturbance could lead to mobilisation of sediments and dust which may be blown or washed into receiving water bodies (wetlands and pans) within the vicinity. This would lead to increased turbidity (decreased water quality) which may have a negative impact on aquatic fauna. When the suspended solids (soil particles) settle out on the substrates in the wetlands, it leads to further deterioration in habitat quality. Sediments are colonised by Typha reeds or alien weeds, causing a decline in habitats during the wet season. This may result in a decline in overall biodiversity. Water quality impacts, resulting from spills, leaks, dust or dirty storm water, will result in the loss of taxa that may be sensitive to water quality. In addition, altered hydrology, in terms of timing, duration and quantity of water will affect habitat availability. Reduced flows or shorter periods of inundation may reduce both the availability and suitability of habitats and will have an impact on aquatic fauna.	Decline in habitats and biota	6	4	2	4	48	-	M	The loss of these wetlands could be offset through the implementation of a wetland management and rehabilitation plan for the remaining wetlands within the study area that aims to improve the condition of these wetlands and the role they play in especially biodiversity support, which is considered to be the most important function of the wetlands on site.	6	4	1	2	22	-	L	Develop a wetland management and rehabilitation plan, and implement throughout the construction, operation and closure phases of the mine.	Ongoing	Environmental control officer	N/A
Issues related to RADIATION																				
Impact on public safety as a result of exposure to radioactivity.	Radioactive elements	10	4	2	5	80	-	H	Develop a Radiation Management Plan.	6	4	1	4	44	-	M	Implement the Radiation Management Plan throughout the life of mine and monitor exposure of the public to radioactivity in accordance therewith.	Ongoing	Environmental control officer/Health & Safety officer	Included in Construction and Operational Costs

Table 6.5: Impacts and Management Measures for Construction Phase Activities: Waste Handling.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CONSTRUCTION PHASE ACTIVITY 4: WASTE HANDLING																				
Issues related to GEOLOGY																				
No significant construction impacts are envisaged.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TOPOGRAPHY																				
No significant construction impacts are envisaged.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to GEOHYDROLOGY																				
Handling of waste and transport of building material can cause various types of spills (domestic waste, sewage water, hydrocarbons) which can infiltrate and contaminate of the groundwater system.	Waste Handling	4	4	1	4	36	-	M	A dedicated area for the placement of waste skips must be determined prior to operational activities, and the area will to be cemented. Allowance for keeping clean water run-off away from the skip area through the correct bunding design.	2	4	1	2	14	-	L	The mine will adopt a cradle-to-grave approach to ensure that the waste is removed and disposed of in a prescribed/correct manner, and must be stored in a designated area as part of the waste management strategy. Waste generated will be collected and disposed of in a licensed waste facility and a copy of the valid waste disposal permits will be kept on site.	Ongoing	Environmental control officer	Included in construction & operation costs
Contamination from existing Merriespruit TSF	Waste rock dumping	2	4	1	2	14	-	L	Compacting of base of waste rock dump, monitoring of groundwater quality	2	4	1	0	0	-	L	Compact base of waste rock dump, monitor groundwater quality.	Once-off	Environmental control officer	Included in construction & operation costs
																	Monitor groundwater quality.	Quarterly	Environmental control officer	Included in construction & operation costs
Issues related to HYDROLOGY																				
The generation of waste may lead to surface water contamination.	Waste generation	8	4	2	4	56	-	M	Surface water quality monitoring networks must be set up prior to the construction phase so that any surface water quality issues can be addressed accordingly.	6	4	2	3	36	-	M	Surface water quality sampling will be undertaken on a monthly basis and analysed according to the prescribed monitoring programme contained in the EIA/EMP.	Monthly	Environmental control officer	R 91 000.00
																	Quarterly surface water monitoring reports will be generated by the mine or through a qualified water quality specialist.	Quarterly	Environmental control officer/Water Quality Specialist	R 42 000.00
																	In the event that water quality issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental control officer/Water Quality Specialist	To be determined - depending on severity of incident
Disposal of any type of waste to an area with a waste skip can impact the hydrological environment.	Dirty water run-off and seepage	8	2	2	5	60	-	M	A dedicated area for the placement of waste skips must be determined prior to operational activities, and the area will to be cemented. Allowance for keeping clean water run-off away from the skip area through the correct bunding design.	4	2	1	2	14	-	L	The mine will adopt a cradle-to-grave approach to ensure that the waste is removed and disposed of in a prescribed/correct manner, and must be stored in a designated area as part of the waste management strategy. Waste generated will be collected and disposed of in a licensed waste facility and a copy of the valid waste disposal permits will be kept on site.	Ongoing	Environmental control officer	Included in construction & operation costs
Builders rubble, packaging and other waste generated in the construction process could become a source of pollution for water resources.	Builing waste	2	2	2	5	30	-	M	Builder contracts should include relevant stipulations regarding the storage and removal of building waste.	2	2	1	2	10	-	L	Develop a management plan for the handling of all associated building waste and make it a contractual requirement.	Once-off	Environmental control officer	Included in construction costs.
Fuels and/or toxic materials could be spilled and pollute local water resources.	Spillage	6	3	3	3	36	-	M	Measures should be in place to contain any spills and allow safe collection and disposal of waste.	4	3	2	2	18	-	L	The mine will adopt a cradle-to-grave approach to ensure that the waste is removed and disposed of in a prescribed/correct manner, and must be stored in a designated area as part of the waste management strategy.	Ongoing	Environmental control officer	Included in construction & operation costs
Issues related to SOIL, LAND USE AND LAND CAPABILITY																				

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CONSTRUCTION PHASE ACTIVITY 4: WASTE HANDLING																				
Chemical soil pollution	Spillage and seepage of wastewater	2	5	8	5	75	-	H	Proper chemical waste management	1	3	4	4	32	-	M	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental control officer	Included in construction & operation costs
Change in natural landscape	Ground clearance and waste disposal	1	5	6	5	60	-	M	Keep infrastructure to a minimum to reduce footprint	1	5	4	4	40	-	M	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental control officer	Included in construction & operation costs
The generation of waste may lead to soil contamination.	Waste generation	8	2	2	5	60	-	M	Monitoring of waste generation and soil contamination must be implemented and maintained.	4	2	2	3	24	-	L	In the event that soil contamination occurs, immediate soil clean-up should be undertaken.	In the event of occurrence	Environmental control officer	To be determined - depending on severity of incident
Issues related to FAUNA AND FLORA																				
Direct impacts on flora species of conservation importance.	Waste Handling	8	5	4	4	68	-	H	Exclude sensitive areas and provide protection for nearby sensitive areas.	8	5	4	1	17	-	L	Develop environmental monitoring plans that identify and address issues of concern as well as include relevant aspects in awareness training.	Seasonal/Bi-annual	Environmental control officer/Ecologist/Proponent	Included in construction costs.
Direct impacts on fauna species of conservation importance.	Waste Handling	8	5	4	4	68	-	H	Exclude sensitive areas and provide protection for nearby sensitive areas.	8	5	4	1	17	-	L	Develop environmental monitoring plans that identify and address issues of concern as well as include relevant aspects in awareness training.	Seasonal/Bi-annual	Environmental control officer/Ecologist/Proponent	Included in construction costs.
Loss or disruption of mammal migration routes.	Waste Handling	6	5	2	4	52	-	M	Ensure minimal footprint clearance; ensure minimal human/animal conflict potential; implement awareness programmes; allow for natural crossings where possible; control movement of personnel; and limit speeds of vehicles.	6	5	2	1	13	-	L	Develop and implement awareness programmes aimed at ensuring that persistent and deliberate impacts on animals in nearby natural habitat are prevented.	Ongoing	Environmental control officer/Health & Safety Officer/Contractor/Site Manager	Included in construction costs.
Direct impacts on sensitive/pristine habitat types.	Waste Handling	8	5	3	3	48	-	M	Exclude sensitive areas and provide protection for nearby sensitive areas; limit the spread of impacts to nearby sensitive areas.	8	5	3	1	16	-	L	Develop environmental monitoring plans that identify and address issues of concern as well as include relevant aspects in awareness training; develop hydrocarbon spill reaction and cleanup action plan.	Seasonal/Bi-annual	Environmental control officer	Included in construction costs.
Direct impacts on common fauna species of the study area.	Waste Handling	4	4	2	4	40	-	M	Ensure minimal footprint clearance; ensure minimal human/animal conflict potential; implement awareness programmes; control movement of personnel; limit speeds of vehicles; and avoid open waste areas that could be targeted by rodents and scavengers.	4	4	2	3	30	-	M	Develop and implement awareness programmes; provide adequate waste disposal facilities; manage operational issues with respect to hygiene, ablution and food provision; develop hydrocarbon spill reaction and cleanup action plan.	Ongoing	Environmental control officer/Health & Safety Officer/Contractor/Site Manager	Included in construction costs.
Faunal interaction with structures, servitudes and/or personnel.	Waste Handling	4	5	3	4	48	-	M	Ensure minimal footprint clearance; ensure minimal human/animal conflict potential; implement awareness programmes; control movement of personnel; limit speeds of vehicles; and avoid open waste areas that could be targeted by rodents and scavengers.	4	4	2	2	20	-	L	Develop and implement awareness programmes; provide adequate waste disposal facilities; manage operational issues with respect to hygiene, ablution and food provision.	Ongoing	Environmental control officer/Health & Safety Officer/Contractor/Site Manager	Included in construction costs.
Impacts on surrounding habitat/species, including ecosystem functioning.	Waste Handling	6	4	2	3	36	-	M	Ensure minimal footprint clearance; ensure minimal human/animal conflict potential; implement awareness programmes; control movement of personnel; limit speeds of vehicles; and avoid open waste areas that could be targeted by rodents and scavengers.	6	4	2	1	12	-	L	Develop and implement awareness programmes; provide adequate waste disposal facilities; manage operational issues with respect to hygiene, ablution and food provision; develop hydrocarbon spill reaction and cleanup action plan.	Seasonal/Bi-annual	Environmental control officer/Health & Safety Officer	Included in construction costs.
Issues related to AIR QUALITY																				
No significant construction impacts are envisaged.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to NOISE																				
No significant construction impacts are envisaged.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TRAFFIC																				
No significant construction impacts	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CONSTRUCTION PHASE ACTIVITY 4: WASTE HANDLING																				
are envisaged.																				
Issues related to VISUAL																				
No significant construction impacts are envisaged.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to SOCIAL																				
No further impacts envisaged - impacts on social aspects are addressed in footprint clearance.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to HERITAGE																				
No significant construction impacts are envisaged.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to WETLANDS																				
Leaks or spills causing contamination of surface water, either directly or idirectly, via groundwater seepage. During construction activities a number of potentially polluting substances will be used and likely stored on site, including diesel, oil, cement, explosives (shaft construction) and waste generated during construction activities. Incorrect handling of these materials as well as accidental spills and leaks could result in pollutants entering downslope wetlands via surface runoff, leading to water quality deterioration.	Groundwater seepage	8	3	2	4	52	-	M	All hazardous substances used during the establishment of infrastructure should be stored on impervious surfaces that allow for the containment of spills and leakages (e.g. bunded areas). Should spills occur, these should be reported to the ECO. Larger spills will require the appointment of specialist clean-up teams to rehabilitate the affected area. No hazardous materials may be stockpiled in any wetland area on site. Sufficient spill clean-up materials should be kept on site at all times. All waste should be stored in clearly demarcated areas on site and disposed of at registered, licensed waste facilities.	6	2	1	3	27	-	L	Implement mitigation measures in accordance with the proposed mitigation measures	Ongoing	Environmental control officer	Included in Construction and Operational Costs
Water quality impacts, resulting from spills, leaks, dust or dirty stormwater, will result in the loss of taxa that may be sensitive to water quality. In addition, altered hydrology, in terms of timing, duration and quantity of water will affect habitat availability. Reduced flows or shorter periods of inundation may reduce both the availability and suitability of habitats and will have an impact on aquatic fauna.	Deterioration of water quality	6	4	2	4	48	-	M	Implementation of all mitigation measures listed above for erosion control and water quality management will reduce the severity of impacts. An emergency preparedness plan should be compiled and implemented in the event of major spills (e.g. fuel, mine water or sewage spill). Dust suppression measures should be used. A biomonitoring plan should be compiled and implemented and should include assessments of water quality, habitats and aquatic macroinvertebrates. Sampling sites further down in the Doring River catchment should be included to assess impacts on downstream ecosystems. All mitigation measures relating to water quality should be audited with prompt follow-up action taken in the event of non-compliances	6	4	1	2	22	-	L	Implement mitigation measures in accordance with the proposed mitigation measures	Ongoing	Environmental control officer	Included in Construction and Operational Costs
During construction activities a number of potentially polluting substances will be used and likely stored on site, including diesel, oil, cement, explosives (shaft construction) and waste generated during construction activities. Incorrect handling of these materials as well as accidental spills and leaks could result in pollutants entering down slope wetlands via surface runoff, leading to water quality deterioration.	Deterioration of water quality	6	4	1	3	33	-	M	All hazardous substances used during the establishment of infrastructure should be stored on impervious surfaces that allow for the containment of spills and leakages (e.g. bunded areas). Should spills occur, these should be reported to the ECO. Larger spills will require the appointment of specialist clean-up teams to rehabilitate the affected area. No hazardous materials may be stockpiled in any wetland area on site.	6	3	1	2	20	-	L	Sufficient spill clean-up materials should be kept on site at all times. All waste should be stored in clearly demarcated areas on site and disposed of at registered, licensed waste facilities.	Ongoing	Environmental control officer	Included in Construction and Operational Costs

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CONSTRUCTION PHASE ACTIVITY 4: WASTE HANDLING																				
Issues related to RADIATION																				
Impact on public safety as a result of exposure to radioactivity.	Radioactive elements	10	4	2	5	80	-	H	Develop a Radiation Management Plan.	6	4	1	4	44	-	M	Implement the Radiation Management Plan throughout the life of mine and monitor exposure of the public to radioactivity in accordance therewith.	Ongoing	Environmental control officer/Health & Safety officer	Included in Construction and Operational Costs

6.4 Operational Phase

Wits Gold will during the operational phase encompass underground mining activities. During the operational phase, surface infrastructure will continue to be maintained.

During the operational phase, the following activities could impact on the bio-physical environment and the cultural/social setting:

- Underground Mining Activities;
- Possible compaction of soils and erosion of soil stockpiles and berms by wind and water;
- Impact on surface- and groundwater system due to the operational activities;
- Dust dispersion from workings;
- Clean and dirty water control and maintenance;
- Sewage management; and
- Ancillary activities (workshops, offices, etc) .

6.4.1 Geohydrology

The single largest risk in terms of groundwater impacts during the operational mining phase is that of aquifer dewatering of the deeper lying Witwatersrand Complex. Average inflow volumes that were simulated vary between 200 and 6300 m^3/d. Despite the dewatering volumes, no groundwater users would be affected, as the deeper lying Witwatersrand aquifer is isolated from the upper Karoo aquifer.

6.4.2 Hydrology

It is anticipated that most risks posed to local surface water resources could be effectively managed by an appropriate storm-water management plan.

- Deep seepage from tailings and slimes facilities into local watercourses is unlikely due to the location of discard facilities far from rivers and streams. It is possible that a TSF located towards the east of the planned discard area could allow seepage into deep and well-drained sandy soils that will eventually seep into local river systems. The design of TSFs should consider seepage risks and, if needed, make allowance for sealing or lining of the base of a tailings dam.
- Other seepage will be collected by means of return water drains and transferred to return water dams. In this case, where stormwater will be treated and discharged, water from return water dams should be considered first priority water supply to processing and treatment plants.

- A concern that needs to be considered is that dust created in TSFs could add to local atmospheric pollution. Dust from the tailings dams of other mines in the vicinity of the town of Virginia is widely claimed to pose health risks to local inhabitants. Dust suppression on the TSFs constructed for this mine is considered to be important.
- Dirty water runoff conveyance and storage systems at the mine will be controlled by structures and control measures prescribed in the Storm-water Management Plan.

6.4.3 Soils, Land Use and Land Capability

For the impact assessment, all the following phases of the project cycle were considered for potential impacts on soil and land capability. Below is a description of each of the activities per operational phase that may result in soil impacts:

- Daily traffic on haul roads;
- Construction of ventilation shafts as mining progresses;
- Operations at TSF;
- Daily mining activities resulting in waste generation by mine workers as well as potential fuel and oil spillages by on-site traffic; and
- Treatment of ore to extract gold.

6.4.4 Wetlands

The following impacts are expected to occur as a result of the proposed project activities:

Operational Phase:

- Discharge of stormwater; and
- Water quality deterioration due to storage, handling, leaks and spills of a variety of polluting substances on site.

6.4.5 Air Quality

The proposed activities will result in dust emissions, both from mining activities and fugitive emissions from the large areas of previously vegetated land that will now be exposed. Provided sufficient mitigation measures are instigated, it is unlikely that these emissions resulting from mining activity will result in the exceedence of South Africa’s guidelines for particulate emissions.

The existing Harmony mine tailings dump is an area of concern, although it is impossible to determine whether the emissions that result from Wits Gold DBM's activities will increase or decrease the fugitive dust emissions from the dump in question. It is recommended that care be taken in the design and structure of the dump, and that the existing dust fall out monitoring network be redesigned to centre around the dump, with monitors in the sensitive reception areas of Virginia and Meloding.

6.4.6 Traffic

It is evident that the traffic generated by the proposed development does not have a significant impact on the external road network. In terms of the intersection and road link capacity, no improvements are recommended since the intersections under investigation are expected to operate at acceptable level of service.

The interaction (turning movements) between the construction and public transport and privates vehicles might impose some safety hazardous to the vehicles drivers. It is therefore recommended that the following measures be adopted to mitigate the impact:

- Surfacing of S239 Road between Virginia Way and the S239 / Access Road intersection.
- Construction of an exclusive right turn lane, on the northbound approach as indicated in Drawing 2984/GL/01. The exclusive right turn lane should be constructed with a 60 m long and a 60 m tapper.
- Provision of light at sufficient standards at the intersection of the S239 (Theunissen Street), S1279 and Jan Hofmeyer Street routes and the access to the development.
- No on-street pick up/drop offs at the intersection of the S239 (Theunissen Street) S1279 and Jan Hofmeyer Street routes and the access to the development (drop-offs/pickup should be done on site).

6.4.7 Social

The social change processes shown below are expected to take place as a result of this project.

Demographic processes	Economic processes	Geographic processes
• In-migration; • Presence of temporary workers; • Resettlement; and • Displacement / dispossession.	• Waged labour; and • Conversion and diversification of economy.	• Conversion and diversification of land use; • Enhanced transport and rural accessibility; and • Physical splintering.
Institutional and legal processes	**Emancipatory and empowerment processes**	**Socio-cultural processes**
• No impacts are expected.	• Capacity building.	• Social behaviour.

It is important to pause here and clarify that the actual impacts experienced at a given project site will depend on a variety of factors, that range between the baseline conditions, the public participation process, engagement and capacity building that has taken place, the type of mining methods and minerals mined, the role of politics, most notably in local municipalities and the other processes of social change either already under way (e.g. due to exploration activities), or which may develop during the life of the mine.

6.4.8 Heritage

6.4.8.1 Site 1

The development will have a direct impact on site 1. The exact nature thereof is however not known and should be confirmed by the client. Due to the sensitivity of this issue, graves are always regarded as having a high cultural significance.

With graves it usually is best to incorporate them into the development plan for the site. Should this be possible, the graveyard should then be fenced off and kept intact. Access to any descendants should also be allowed. A management plan needs to be drafted and implemented and it should also be monitored once a year by a heritage expert.

Should the above not be possible the graves will have to be exhumed and the bodies reburied. This is a lengthy process including social consultation for 60 days in order to find families of the deceased and to obtain their permission.

In the case of graves older than 60 years and those with an unknown date of death (as in this case) an archaeologist as well as an undertaker will have to be part of the team involved. For graves with a date of death of younger than 60 years, only an undertaker is involved.

6.4.8.2 Site 2

Site 2 falls to the west and just outside of the footprint area of the proposed mining development. Therefore there will not be a direct impact on the site, but there will be a secondary one. The buildings are regarded as having a medium cultural significance. It still is in a good condition, but is not very unique.

The buildings should remain intact and may even be reutilized. Any structural changes should be communicated with the Provincial Heritage Resources Agency (PHRA) of the Free State Province and a permit will be required to do so. The buildings should not be demolished.

6.4.9 Radiation

Impact on public safety as a result of exposure to radioactivity.

Table 6.6 – **Table 6.17** details the identified impacts and management measures for the operational activities.

Table 6.6: Impacts and Management Measures for Operational Phase Activities: Mining of Gold

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 1: MINING OF GOLD																				
Issues related to GEOLOGY																				
Removal of gold resources will permanently alter the geology of the area.	Mining	10	5	2	5	85	-	H	No mitigation measures are possible, as mining permanently destroys the geological strata. The mining operations will remain within the limits of the designated mining rights area.	10	5	2	5	85	-	H	The mine will make optimal use of the gold resources which forms part of the mining rights area.	N/A	N/A	N/A
The potential sterilisation of other resources due to the establishment of infrastructure on potential mineral resources.	Mining	8	5	2	4	60	-	M	The mine must undertake detailed geological investigations to determine the extent of the resources and ensure that no mining infrastructure is located on areas of potential mineral resources. The mine must ensure to optimally utilise all available gold resources. Should additional gold resources be identified outside the boundaries as stipulated within this report, the necessary applications must be made to the relevant authorities, who will include, but are not limited to the DMR (for mining), DEA (for listed activities); DWA (for water related issues), NDA (for potential impacts on land use and capability), SAHRA (for potential impact on unidentified graves or culturally important sites).	8	5	2	3	45	-	M	Phased mine plans must be developed within legal mining rights area. All mining activities will be undertaken in line with the approved Mining Works Programme and the EMP.	Ongoing	Project Manager	Included in Operational Costs
Issues related to TOPOGRAPHY																				
Structures such as stockpiles and waste rock dumps will change the natural topography of the area.	Stockpiling	10	5	2	5	85	-	H	Ensure that stockpiles and waste rock dumps are designed taking the topography of the area into consideration.	8	4	2	3	42	-	M	The waste rock dump will either be shaped and rock cladded or shaped and grassed. This will be dependent on the optimal utilisation of these resources in the future.	During Operation	Environmental Control Officer/Project Manager	Included in Operational Costs
Potential subsidence as a result of dewatering.	Dewatering	10	5	2	4	68	-	H	Ongoing monitoring must be undertaken of the surface area to determine whether any subsidence is taking place. Should subsidence be detected it must be made safe and rehabilitated as soon as possible.	6	5	2	3	39	-	M	The mine will ensure to backfill area of subsistence as soon as possible after it occurred.	During Operation	Environmental Control Officer/Project Manager	Included in Operational Costs
Issues related to GEOHYDROLOGY																				
Dewatering of the aquifer	Mining	6	4	3	4	52	-	M	No mitigation can be implemented during this phase.	6	4	3	4	52	-	M	Monitoring of groundwater quality	Quarterly. Entire operational phase of mine	Mine Environmental Manager	Included in Operational and Closure Costs
Deterioration in water quality for the surrounding farm owners, wetland and other water users.	Mining	10	5	2	4	68	-	H	Groundwater quality monitoring networks must be set up prior to the construction phase so that any groundwater quality and quantity issues can be addressed accordingly.	8	2	2	5	60	-	M	Groundwater quality sampling will be undertaken on a monthly basis and analysed according to the prescribed monitoring programme contained in the EIA/EMP.	Monthly	Environmental Control Officer/Project Manager	R 91 000.00
																	Quarterly groundwater monitoring reports will be generated by the mine or through a qualified water quality specialist.	Quarterly	Environmental control officer/Water Quality Specialist	R 42 000.00
																	In the event that water quality or quantity issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental control officer/Water Quality Specialist	To be determined - depending on severity of incident
Polluting the groundwater system	Mining	10	5	3	4	72	-	H	Disturbing geological strata is a result	6	4	2	4	48	-	M	Implement water management	Ongoing	Environmental Control	Included in

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 1: MINING OF GOLD																				
from Acid Mine Drainage (sulphates, iron and low pH). Exposure of geological strata will result in geochemical changes and the contamination of the groundwater system.									of mining. Mining areas need to be kept as dry as possible to reduce contact time of water and oxygen with exposed rock and therefore keep contamination to a minimum.								structures on site.		Officer/Project Manager	Operational Costs
Groundwater contamination as a result from seepage from not-compacted Waste Rock Dump.	Groundwater contamination	8	4	2	4	56	-	M	Compact Waste rock Dump footprint area prior to dumping.	6	4	1	3	33	-	M	Sufficient compaction of waste rock dump area prior to dumping to prevent infiltration of potential seepage. Divert run-off to dirty water return water dam	One-off compaction; constant diversion of run-off	Site engineer supervise compaction to required level	Included in Operational Costs
Seepage into underlying aquifer.	Groundwater contamination	8	4	3	4	60	-	M	Lining of facility including installation of drains.	6	4	2	3	36	-	M	Lining of Brownfield's evaporation ponds area, before disposal of tailings commences	One-off construction, constant treatment of seepage	Mine Environmental unmit manages treatment of seepage	Included in Operational Costs
Issues related to HYDROLOGY																				
Contamination of clean water catchment at the plant area.	Product handling	8	3	2	4	52	-	M	Implement clean and dirty water separation.	6	3	2	3	33	-	M	Install clean and dirty water separation channels on site and maintain them throughout the life of mine.	Ongoing	Environmental Control Officer/Project Manager	Included in Operational Costs
Deterioration in water quality is a concern for the surrounding users.	Mining	10	5	2	4	68	-	H	Surface water quality monitoring networks must be set up prior to the construction phase so that any surface water quality issues can be addressed accordingly.	6	4	2	3	36	-	M	Surface water quality sampling will be undertaken on a monthly basis and analysed according to the prescribed monitoring programme contained in the EIA/EMP.	Monthly	Environmental Control Officer/Project Manager	R 91 000.00
																	Quarterly surface water monitoring reports will be generated by the mine or through a qualified water quality specialist.	Quarterly	Environmental control officer/Water Quality Specialist	R 42 000.00
																	In the event that water quality issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental control officer/Water Quality Specialist	To be determined - depending on severity of incident
Drainage water from underground and polluted water from processing plants could pollute river systems.	Disposal of surplus water	6	5	3	4	56	-	M	Water treatment.	6	4	2	4	48	+	M	Polluted surface water must be treated to a better quality standard than that of natural stream-flow and released into streams to benefit downstream users (if appropriate licensing is obtained in terms of the NWA).	Ongoing	Environmental Control Officer	Included in Operational Costs
Runoff from dirty water footprint areas could pollute streams.	Runoff	4	4	3	4	44	-	M	Contain dirty water.	4	5	1	2	20	-	L	Dirty water runoff must be contained and captured in a well designed polution control dam and treated, re-used or lost to evaporation as determined applicable.	Ongoing	Environmental Control Officer	Included in Operational Costs
Issues related to SOIL, LAND USE AND LAND CAPABILITY																				
Soil compaction	Construction of infrastructure	2	4	6	4	48	-	M	Keep infrastructure localized to reduce footprint	2	4	4	4	40	-	M	Implement Mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental Control Officer	Included in Operational Costs
Soil erosion	Vegetation removal during construction and operations	1	5	8	4	56	-	M	Keep as much original landcover/topsoil as possible	1	3	4	4	32	-	M	Implement Mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental Control Officer	Included in Operational Costs
Issues related to FAUNA AND FLORA																				
Loss or disruption of mammal migration routes.	Mining activities	8	5	3	2	32	-	M	Prevent access and impacts within areas of high ecological sensitivity.	8	5	3	1	16	-	L	Develop an environmental monitoring plan aimed at identifying and addressing issues of concern and include relevant aspects in awareness training.	Seasonal/Bi-annual	Environmental control officer/Health & Safety officer/ Ecologist/ Proponent	Included in Operational Costs
Direct impacts on sensitive/pristine habitat types.	Mining activities	8	5	3	2	32	-	M	Prevent access and impacts within areas of high ecological sensitivity.	8	5	3	1	16	-	L	Develop an environmental monitoring plan aimed at identifying and addressing issues of concern and	Seasonal/Bi-annual	Environmental control officer/Health & Safety officer/	Included in Operational Costs

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 1: MINING OF GOLD																				
																	include relevant aspects in awareness training.		Ecologist/ Proponent	
Direct impacts on common fauna species of the study area.	Mining activities	4	4	2	4	40	-	M	Prevent spread of construction related impacts to nearby areas of natural habitat.	4	4	2	2	20	-	L	Develop and implement awareness programmes and prevent persistent and deliberate impacts on animals in nearby natural habitats.	Ongoing	Environmental control officer/Health & Safety officer/ Ecologist/ Contractor/Site Manager	Included in Operational Costs
Faunal interaction with structures, servitudes and/or personnel.	Mining activities	6	4	2	4	48	-	M	Ensure minimal human/animal conflict potential; implement awareness programmes; control movement of personnel; limit speeds of vehicles; avoid open waste areas that could be targeted by rodents and scavengers.	6	4	2	2	24	-	L	Develop and implement awareness programmes and prevent persistent and deliberate impacts on animals in nearby natural habitats.	Ongoing	Environmental control officer/Health & Safety officer/ Ecologist/ Contractor/Site Manager	Included in Operational Costs
Impacts on surrounding habitat/species, including ecosystem functioning.	Mining activities	4	4	2	4	40	-	M	Prevent spread of construction related impacts to nearby areas of natural habitat.	4	4	2	3	30	-	M	Develop and implement awareness programmes; provide adequate waste disposal facilities; manage operational issues with regard to hygiene, ablution and food provision; develop hydrocarbon spill reaction and cleanup action plans.	Seasonal/Bi-annual	Environmental control officer/Health & Safety officer/ Ecologist/ Contractor/Site Manager	Included in Operational Costs
Issues related to AIR QUALITY																				
All activities associated with the mining of gold has the potential to release dust.	Mining activities	10	4	2	4	64	-	H	A dust monitoring network must be set up prior to the construction phase so that any air quality or dust issues can be addressed accordingly.	6	4	2	4	48	-	M	Dust sampling will be undertaken on a monthly basis and analysed according to the prescribed monitoring programme contained in the EIA/EMP.	Monthly	Environmental control officer	R 92 000.00
																	Monthly monitoring reports will be generated by the mine or through a suitably qualified air quality specialist.	Monthly	Environmental control officer/Air Quality Specialist	R 42 000.00
																	In the event that air quality or dust issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental control officer/Air Quality Specialist	To be determined - depending on severity of incident
																	Ensure optimal implementation and maintenance of the dust suppression programme .	Ongoing	Environmental control officer	Included in Operational Costs
																	The road surface to be maintained on a weekly basis.	Weekly	Environmental control officer	Included in Operational Costs
Fugitive dust emissions as a result of the movement of vehicles and removal of material for construction purposes will have a negative impact in terms of visual characteristics/air quality.	Ore handling	6	2	2	4	40	-	M	The impact during construction phase is limited to a short period only. All mine haul roads will be treated with dust suppressant chemicals or watered in order to reduce the impact of dust on the aesthetics of the surrounding area.	2	2	2	3	18	-	L	Establish a dust management plan in consultation with the environmental manager and include dust suppression as part of the contractor's responsibility.	Ongoing	Environmental Control Officer	Included in Operational Costs
Issues related to NOISE																				
Noise disturbances will be present due to the operation of general mining related activities.	Mining activities	10	4	2	5	80	-	H	The use of noise barriers or earth berms and screening of noise at individual source where an activity can be clearly heard at the boundary.	6	4	1	3	33	-	M	Ventilation design to be addressed in Final Mine Plan which will be approved by all relevant authorities prior to construction activities taken place.	Prior to construction	Environmental Control Officer/Project Manager	Included in Operational Costs
									All parts or equipment such as the gearboxes, rotating parts, hydraulics and electric motors to be maintained, serviced, and acoustically screened of where possible.								Develop and implement the acoustic screening plan.	During Construction	Environmental Control Officer/Project Manager	Included in Operational Costs
																	Construct an earthberm around the plant, if necessary.	During Construction	Environmental Control Officer/Project Manager	Included in Operational Costs
Issues related to TRAFFIC																				
Fugitive dust emissions from ore	Transportation	10	4	3	3	51	-	M	Dust suppression methods must be	6	4	2	3	36	-	M	Ensure optimal implementation and	Ongoing	Environmental Control	Included in

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 1: MINING OF GOLD																				
transportation activities will have a negative air quality impact.									implemented around the stockpiling areas and transfer stations and it is recommended that a dust monitoring network be established to monitor levels of dust dispersion. Should it be found that the stockpiles create excessive dust, measures must be implemented to reduce this impact.								maintenance of the dust suppression programme and monitoring programme.		Officer/Project Manager	Operational Costs
																	The road surface to be maintained on a weekly basis.	Weekly	Environmental Control Officer/Project Manager	Included in Operational Costs
Vehicle Safety (access spacing, road alignments, speed differential, lighting).	Transportation	6	4	3	4	52	-	M	Provision of light at sufficient standards at key intersections and the access to the development.	2	4	3	2	18	-	L	Inspect that lighting fixtures are in working order, and replace when necessary.	Weekly inspection	Environmental Control Officer/Project Manager	Included in Operational Costs
									No speeding or on-street pick up/drop offs at key intersections and the access to the development (drop-offs/pickup should be done on site).								Implement a strict penalty fine system for rule breaking.	Ongoing	Environmental Control Officer/Project Manager	N/A
Issues related to VISUAL																				
Light pollution should be seriously and carefully considered and kept to a minimum wherever possible as light at night travels great distances.	Mining activities	8	4	2	4	56	-	M	Security flood lighting and operational lighting should only be used where absolutely necessary and carefully directed, preferably away from sensitive viewing areas, i.e. the residential areas within falling within the viewshed and the roads in close proximity to the site .	6	4	2	3	36	-	M	Wherever possible, lights should be directed downwards so as to avoid illuminating the sky and minimizing light spills.	During Construction	Project Manager	N/A
Issues related to SOCIAL																				
Increase in population size	In-migration	10	4	3	4	68	-	H	Implement according to proposed action plan.	8	4	4	3	48	-	M	• Employment criteria should be communicated to the community in advance (e.g. in newspapers, community forum notice boards, etc); • Local labour should be employed as far as possible; • Verify the details of potential employees in order to ensure that local labour is employed; • Accommodation for members of the workforce, other than security personnel, must not be permitted on site; The only semi-permanent structures that should be allowed on site is guard houses for security personnel; • Camp followers / informal traders must not be allowed to congregate outside the construction site; • Temporary staff should be housed in the surrounding communities, i.e. Bed and Breakfast establishments, etc. to prevent the establishment of construction camps; and • The AgriSA protocol for access to farms should be followed at all times.	Ongoing	Environmental Control Officer	Included in Operational Costs
Effect of temporary workers on social dynamics	Local labour	8	4	3	3	45	-	M	Implement according to proposed action plan.	4	3	3	3	30	-	M	• Chemical latrines or ablution facilities must be provided to workers in close proximity to the site; • Employ local labour as far as possible (within a 20 km radius); • Avoid the establishment of camps, hostels or temporary accommodation for workers. Accommodation should be provided at suitable locations in Virginia and Welkom and surrounds; and • Ensure that during the project construction process and the	Ongoing	Environmental Control Officer	Included in Operational Costs

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 1: MINING OF GOLD																				
																	operational phase of the project, employees receive adequate health support from the project team for work-related health problems.			
Waged labour	Job Creation	6	3	3	4	48	+	M	Implement according to proposed action plan.	8	4	3	4	60	+	M	• Unskilled and unemployed labour should be sourced from the surrounding local communities as far as possible; • Skills development opportunities should be granted to community members and local job seekers, where needed; • Maximise employment opportunities for the local communities and reduce the influx of a foreign labour force whilst ensuring an effective construction and operational phase; • Capture all project relevant skills in the project area with the aim to ensure maximum local employment; • Make use of any existing skills databases and include the local councillors and other representative community structures in the process; • Develop a Recruitment Manual to include a list of employment opportunities that will become available during the project planning, construction and post-construction phases and provide guidelines on procedures to be followed by aspiring employment seekers; • Establish an employment information desk to assist with the day to day management of project related labour issues; • Identify and maximise on appropriate training and skills transfer opportunities that will enhance the skills level of the local labour force during the pre-construction, during construction and during full operation. It is recommended that training and skills development activities start during the construction period; • Project contracts between Wits Gold and the main contractor should stipulate the use of local labour for unskilled and semi-skilled positions and tasks; • Ensure that local businesses, especially those of Historically Disadvantaged Individuals (HDI), women and of Small, Micro and Medium Enterprises (SMMEs) get allocated the maximum appropriate share of project related business opportunities; and • Ensure that the Labour Relations Amendment Act, 2002 (Act No. 12 of 2002) as well as the necessary policies and procedures are taken into consideration to ensure the correct	Ongoing	Environmental Control Officer	Included in Operational Costs

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 1: MINING OF GOLD																				
																	procurement procedures.			
Conversion and diversification of economic activities (local economy)	Mining	4	3	3	3	30	+	M	Implement according to proposed action plan.	6	3	3	4	48	+	M	• Consideration should be given to the fact that agricultural practises will be compromised and that it may become impractical, as well as uneconomical to continue; • Affected landowners must be consulted to establish means to continue farming practises, i.e. as part of a Local Economic Development project to supply the mine with produce; • Economic development should take place in line with the Local Municipality's IDP, as well as their Spatial Development Framework; and • The establishment of new businesses should comply with zoning and local by-law requirements.	Ongoing	Environmental Control Officer	Included in Operational Costs
Conversion and diversification of economic activities (farmers)	Mining	10	4	2	3	48	-	M	Implement according to proposed action plan.	8	3	1	3	36	-	M	• The placement of mine infrastructure should avoid splintering farms, and should be done in consultation with affected landowners; • Consideration should be given to buying out properties in its entirety to reduce the risk of dissolving the economic unit of the farm; • Consideration should be given to the fact that agricultural practises will be compromised and that it may become impractical, as well as uneconomical to continue; and • Affected landowners must be consulted to establish means to continue farming practises, i.e. as part of a Local Economic Development project to supply the mine with produce.	Ongoing	Environmental Control Officer	Included in Operational Costs
Increase in standard of living (broader community)	Job Creation	4	2	3	3	27	+	L	Implement according to proposed action plan.	8	4	3	3	45	+	M	• To increase the standard of living locally, the contractors employed should aim to ensure that local or surrounding people are employed where possible. It is furthermore suggested that all the employees should be motivated to spend their earned income locally. This can be achieved by ensuring that the goods and services required by the employees are provided for locally (if possible). The onus will lie on local shop owners to ensure that the demanded for goods and services are met; and • The employment of local residents during operation (as far as practically possible) would increase the standard of living, since they would have a higher disposable income and less transportation costs.	Ongoing	Environmental Control Officer	Included in Operational Costs
Increase in standard of living (local farmers)	Job Creation	8	4	2	3	42	-	M	Implement according to proposed action plan.	6	3	1	3	30	-	M	• The reduced standard of living of affected landowners should be taken into consideration when determining the appropriate compensation of	Ongoing	Environmental Control Officer	Included in Operational Costs

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION M	D	S	P	TOTAL	STATUS	SP	RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION M	D	S	P	TOTAL	STATUS	SP	ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
OPERATIONAL PHASE ACTIVITY 1: MINING OF GOLD																				
																	landowners.			
Employment creation and decrease in unemployment	Job Creation	4	3	3	3	30	+	M	Implement according to proposed action plan.	6	4	3	3	39	+	M	• It is suggested that non-locals should only be hired when specialist skills, which are not available locally, are required and local business providing such skills cannot be created. The following aspects in this regard should receive priority: o Labour based construction methods should be used whenever practically possible; o Local residents and communities should be employed, wherever possible; o Local construction companies should be used whenever possible, especially for subcontracting work; and o Local suppliers should be used as far as possible.	Ongoing	Environmental Control Officer	Included in Operational Costs
Conversion and diversification of land use	Mining	6	4	3	4	52	-	M	Implement according to proposed action plan.	4	4	3	4	44	-	M	• Educate landowners in terms of their rights and responsibilities prior to the project going ahead; • Assist landowners in identifying ways to adapt their land uses; • Plan to avoid splitting agricultural land and natural habitats; • Integrate the mining area with regional land use planning objectives where possible; and • Take into account surrounding land uses and design post-mining land use options to support and enhance long-term development options.	Ongoing	Environmental Control Officer	Included in Operational Costs
Transportation and rural accessibility	Transportation	4	4	3	2	22	-	L	Implement according to proposed action plan.	6	4	3	4	52	-	M	• Employ local labour as far as possible to limit the negative impacts on the infrastructure and services within the area (e.g. roads); • Wits Gold should, in liaison with the relevant Roads and Traffic Department, assist with the regular maintenance of the roads frequently used by construction and mine traffic; • Speed limits on the local roads surrounding the mining site should be enforced; • Appropriate traffic management measures should be planned for and implemented, especially during the construction phase with the expected increase in heavy vehicle traffic; and • The mitigation measures proposed by the TIA should be implemented, where relevant.	Ongoing	Environmental Control Officer	Included in Operational Costs
Physical splintering	N/A	8	5	3	4	64	-	H	Implement according to proposed action plan.	6	4	3	4	52	-	M	• Wits Gold should consult with other service providers, government institutions and the local and district municipality to determine and mitigate these impacts; • Avoid unnecessary subdivision of land and activities that could be sited on already disturbed land; • Create infrastructure corridors for pipelines, roads, power lines etc; and • Refer to mitigation measures	Ongoing	Environmental Control Officer	Included in Operational Costs

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
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OPERATIONAL PHASE ACTIVITY 1: MINING OF GOLD																				
																	indicated for "Conversion and diversification of land use".			
Capacity building (skills transfer)	N/A	6	2	3	4	44	+	M	Implement according to proposed action plan.	10	3	3	4	64	+	H	• Recruit and train local residents to supply unskilled labour during the construction and operational phase; • The use of diverse activities should be stimulated, allied with, but not reliant on, construction related activities such as outsourcing catering activities to local businesses. The local municipality could assist local residents and business owners to garner the benefit associated with the spin-offs emanating from the proposed mine; • Stakeholders should be mutually accountable for increased opportunities regarding skills and competency development (general education and technical training). This will enable active participation, not only in the construction sector, but also in other spheres of the economy, as well as providing opportunities for career enhancement; • Training should be concentrated on skills that can be readily transferred to other employment opportunities in the local area to avoid persons with trained skills leaving the area for work elsewhere; • The project implementers and/or the contractors should identify the required jobs to be undertaken prior to the construction phase to enable local recruitment and/or some form of basic training; • It is recommended that a comprehensive program for recruiting, hiring, training, orienting and counselling be established. The nature of the training provided does not need to be limited to specific project related tasks and can include financial planning, bookkeeping, general arithmetic etc; • The principles of the Expanded Public Works Programme must be adhered to and effective labour-based construction technologies must be used to increase the positive effects of job creation; • Ensure that stakeholders have knowledge of the support of legislation and regulations; • The implementation of the SLP should be monitored on an annual basis; • Ensure compliance to the BBSEC and MPRDA; and • Ensure that the employment and training of HDSA and women meet the requirements of the BBSEC.	Ongoing	Environmental Control Officer	Included in Operational Costs

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
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OPERATIONAL PHASE ACTIVITY 1: MINING OF GOLD																				
Social behaviour	N/A	6	4	2	3	36	-	M	Implement according to proposed action plan.	6	2	2	3	30	-	M	• Establish a code of conduct for construction and mine workers with strict control measures; • Require mine personnel to wear identification badges to distinguish them from trespassers or unwanted loiterers; • Liaise with the SAPD in order to implement effective crime prevention strategies; and • Liaise with existing forums in the community to communicate information to the community and to assist in the monitoring of compliance.	Ongoing	Environmental Control Officer	Included in Operational Costs
Nutrition	N/A	8	4	4	4	64	-	H	Implement according to proposed action plan.	6	3	3	4	48	-	M	• In relation to exposures from any particular source of mining, protection and safety shall be optimised in order that the magnitude of individual doses, the number of people exposed and the likelihood of incurring exposures all be kept as low as reasonably achievable, economic and social factors being taken into account, within the restriction that the doses to individuals delivered by the source be subject to dose constraints; • Implement a radiation monitoring programme and establish means of isolating radiogenic materials; • Implement the recommendations from the Radiological Study; • Preparation of radiation management plan; • Establish and maintain a safety culture to encourage a questioning and learning attitude to protection and safety and to discourage complacency; • Establish policies and procedures that identify protection and safety and makes it of highest priority; • Promptly identify and correct problems affecting protection and safety; • Safety assessments related to protection and safety measures for sources of radiation associated with mining shall be made at different stages; • All employees on site, as well as surrounding landowners, should receive general radiation safety training to maintain a safe working and living environment for all; and • Establish procedures that ensure there is as little exposure as possible of the workforce and of the public to dust contaminated with radioactive material during mining.	Ongoing	Environmental Control Officer	Included in Operational Costs
Actual health	N/A	8	4	2	4	56	-	M	Implement according to proposed action plan.	4	4	3	3	33	-	M	• In order to reduce the impact on the local community it is important to maximise the use of local labour as	Ongoing	Environmental Control Officer	Included in Operational Costs

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
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OPERATIONAL PHASE ACTIVITY 1: MINING OF GOLD																				
																	far as possible; • Local labour should be employed as far as possible to avoid additional pressure on the existing services; • HIV / Aids awareness campaigns should be initiated by Wits Gold and provided to all its mine employees on a regular basis; • Wits Gold should investigate how they could assist in implementing a community health awareness programme in liaison with the LM; • Environmental pollution must be limited as far as possible and the requirements of the EMP be implemented to reduce the impact on surrounding landowners; • Environmental pollution must be limited as far as possible and the requirements of the EMP be implemented to reduce the impact on surrounding landowners; • The necessary safety precautions should be taken and first aid supplies should be made available on site; • All mine employees (including contractors) should undergo health and safety training on a regular basis; • The general health of employees should be monitored on an on-going basis and employees should be given free access to clinic services; • It is advised that Wits Gold, through consultation with the LM investigate ways in which their LED programmes and infrastructure development component of their SLP can assist in improving the overall health services within the communities; and • The required safety equipment should be provided to employees as well as on site and should be in a good working order.			
Feelings in relation to the project	N/A	6	3	2	3	33	-	M	Implement according to proposed action plan.	6	2	2	2	20	-	L	• A comprehensive PPP should be implemented to effectively consult and involve the affected landowners and communities; • Continuous consultation with the affected communities should take place to keep them informed; • Consultation with the surrounding residents should take place on a continuous basis to understand, assess and mitigate their concerns where appropriate; • Wits Gold must be transparent about the areas they intend mining and the proposed mining method and technology; and • Information about the proposed mining methods should be made available to stakeholders to educate them about mining in general as well as the proposed mining methods.	Ongoing	Environmental Control Officer	Included in Operational Costs

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
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OPERATIONAL PHASE ACTIVITY 1: MINING OF GOLD																				
Aspirations for the future (local landowners)	N/A	10	3	1	3	42	-	M	Implement according to proposed action plan.	8	3	1	3	36	-	M	• It is critical that Wits Gold maintain an open and trusting relationship with the affected communities subsequent to the granting of the mining right.	Ongoing	Environmental Control Officer	Included in Operational Costs
Aspirations for the future (broader community)	N/A	4	2	2	3	24	+	L	Implement according to proposed action plan.	10	4	3	4	68	+	H	• Wits Gold must be honest and transparent about the potential economic benefits and employment opportunities that the proposed mine is likely to effect in these communities, in order to manage any undue expectations.	Ongoing	Environmental Control Officer	Included in Operational Costs
Physical quality of the living environment	N/A	10	4	2	4	64	-	H	Implement according to proposed action plan.	8	4	2	3	42	-	M	• Existing community forums must serve as liaison between the affected stakeholders and Wits Gold and can discuss traffic, dust, noise and construction related concerns with them; • Suppress dust by spraying water or non-contaminating palliative liquids on roads, crusher and screening plant, mills and vehicles; • Prevent dust blowing off transported materials by washing vehicles, wheels and covering loads; • Rehabilitate behind production with adequate top soiling, fertilisation, irrigation and correct choice of grasses to ensure year-round cover; • Prepare a noise reduction plan to cover all significant impacts at source and implement noise reduction and screening to limit exposure. Drilling and blasting is generally intermittent and should be limited to daylight hours when ambient noise levels are highest. A hearing conservation programme must be implemented where noise exceeds 85dB(A) in the mine or must not be more than 7dB(A) above ambient residual noise levels beyond mine boundary or nearest residential community; • The maximum acceptable night time noise levels should not be exceeded; • Traffic calming measures should be put in place to minimise traffic noise; • Adequate monitoring of the biophysical impacts should occur in order to address any unnecessary inconveniences to stakeholders; • Mitigation and monitoring as recommended by the Water Quality Impact Assessments should be implemented; • Plant tall trees as barriers in gardens or in road reserve to reduce the visual and light intrusion, as well as noise impacts; • Recommendations made in the EMP and EMPr should be adhered to. • Rehabilitate behind production with adequate top soiling, fertilisation, irrigation and correct choice of	Ongoing	Environmental Control Officer	Included in Operational Costs

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
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OPERATIONAL PHASE ACTIVITY 1: MINING OF GOLD																				
																	grasses to ensure year-round cover; • Prepare a noise reduction plan to cover all significant impacts at source and implement noise reduction and screening to limit exposure. Drilling and blasting is generally intermittent and should be limited to daylight hours when ambient noise levels are highest. A hearing conservation programme must be implemented where noise exceeds 85dB(A) in the mine or must not be more than 7dB(A) above ambient residual noise levels beyond mine boundary or nearest residential community; • The maximum acceptable night time noise levels should not be exceeded; • Traffic calming measures should be put in place to minimise traffic noise; • Adequate monitoring of the biophysical impacts should occur in order to address any unnecessary inconveniences to stakeholders; • Mitigation and monitoring as recommended by the Water Quality Impact Assessments should be implemented; • Plant tall trees as barriers in gardens or in road reserve to reduce the visual and light intrusion, as well as noise impacts; and • Recommendations made in the EMP and EMPr should be adhered to.			
Aesthetic quality of the living environment	N/A	6	4	2	4	48	-	M	Implement according to proposed action plan.	4	4	2	4	40	-	M	• The design and specific positioning of the infrastructure should aim to minimise the possible negative visual impact of the mine on the surrounding property owners; • The design of the mine buildings should blend in with surrounding environment; • Implement re-vegetation as levels are abandoned to break the form, reduce colour contrast, dust generation or contaminated runoff; and • Recycle dumps or use as backfill with appropriate permission.	Ongoing	Environmental Control Officer	Included in Operational Costs
Availability and quality of housing	N/A	2	3	2	3	21	-	L	Implement according to proposed action plan.	8	4	3	3	45	+	M	• Employees should be educated with regards to their accommodation options; • Housing needs should be monitored and addressed in consultation and cooperation with the applicable LMs; and • Maximise the employment of locals to limit the need for any additional housing infrastructure, as far as possible.	Ongoing	Environmental Control Officer	Included in Operational Costs
Adequacy of physical infrastructure	N/A	10	4	3	4	68	-	H	Implement according to proposed action plan.	8	4	3	3	45	+	M	• Ensure that the needed public services and capital facilities are in place before the peak construction occurs. This will ensure that demand	Ongoing	Environmental Control Officer	Included in Operational Costs

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OPERATIONAL PHASE ACTIVITY 1: MINING OF GOLD																				
																	for these services do not exceed supply; • The provision of infrastructural services must be integrated with the economic needs of the community; • Wits Gold, in liaison with the LM should proactively plan for enough infrastructure and services to meet the maximum potential of the mine in terms of service and infrastructure demand; • Measures must be taken to address infrastructure development as part of future planning; • The relevant authorities, and bodies involved in the supply of bulk services should be informed about the proposed project to ensure that it gets incorporated into their demand projections; • Promote local procurement of suppliers and contractors for the transport system.			
Adequacy and access to social infrastructure	N/A	6	3	2	2	22	-	L	Implement according to proposed action plan.	8	4	2	4	56	+	M	• In consultation with the LM and other mines operating in the area, ensure that the necessary planning for upgrades of social infrastructure, where lacking due to the proposed mine, take place; • Involvement in upliftment programmes should be done according to the priority needs and projects identified as part of the LMs IDP, as well as in consultation with other stakeholders such as the local community representatives, ward committees and youth organisations; • Continuous involvement of the mine would be necessary and should be undertaken in a transparent and supportive manner; • Implement a regular and formalised consultation process with local government to ensure synergy between the mine's social development and LED focus; • Communication of the projects that Wits Gold would be involved in should filter through to all community levels to ensure maximum benefit to the community; and • Community development projects initiated by Wits Gold should avoid benefiting only a selected few but should follow a broad based approach, whilst also taking budgeting constraints into consideration.	Ongoing	Environmental Control Officer	Included in Operational Costs
Personal safety and hazard exposure	N/A	6	4	2	4	48	-	M	Implement according to proposed action plan.	4	3	2	3	27	-	L	• Local, unemployed labour should be employed as far as possible; • Accommodation for members of the workforce, other than security personnel, must not be permitted on site;	Ongoing	Environmental Control Officer	Included in Operational Costs

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
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OPERATIONAL PHASE ACTIVITY 1: MINING OF GOLD																				
																	• The only semi-permanent structures that should be allowed on site is guard houses for security personnel; • Camp followers / informal traders must not be allowed to congregate outside the construction site; • Strict security measures should be put in place. Security personnel should be on site on a permanent basis; • Construction workers should be confined to the construction area and should wear uniforms or identity tags to be easily identified; • The mining area should be fenced to avoid unauthorised entry by humans or animals onto the mining area; • The contractor should communicate the construction schedule and vehicle movements to the neighbouring property owners in advance; • Workers must not be allowed to overnight on the premises and must be transported to their places of residence by bus on a daily basis; • Workers must not be allowed to leave the designated mining areas without permission; • A Health and Safety Plan should be implemented and it must be ensured that all managers are trained in First Aid and other relevant safety courses; • Implement safety measures to limit fire hazards and implement fire breaks if possible; • Wits Gold should, in conjunction with the property owners, develop and implement emergency procedures; • Operational safety risks should be addressed as part of the OHS Act; • A Fire/Emergency Management Plan should be developed and implemented. It is important that this management plan and associated communication channels are developed at the outset of the construction phase. It would be important to regularly review the functionality and efficiency of such a plan in conjunction with the local emergency teams, mine management and neighbouring landowners; • Open fires for cooking and related purposes should not be allowed on site; • Appropriate fire fighting equipment should be on site and construction workers should be appropriately trained for fire fighting; • The construction sites should be clearly marked and “danger” and “no entry” signs should be erected; • Speed limits on the local roads			

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OPERATIONAL PHASE ACTIVITY 1: MINING OF GOLD																				
																	surrounding the construction sites should be enforced; and • Speeding of construction vehicles must be strictly monitored.			
Crime and violence	N/A	4	3	3	2	20	-	L	Implement according to proposed action plan.	4	2	3	2	18	-	L	• Local, unemployed labour should be employed as far as possible; • Wits Gold must liaise with the LMs and labour unions to establish a protocol for ensuring community safety; • Mine workers should be clearly identifiable by ensuring they wear uniforms and identification cards that should be exhibited in a visible place on their body; and • The AgriSA protocol for access to farms should be followed in all instances where access to farmers' land is required.	Ongoing	Environmental Control Officer	Included in Operational Costs
Loss of natural and cultural heritage	N/A	8	5	1	3	42	-	M	Implement according to proposed action plan.	8	2	1	1	11	-	L	• The recommendations of the HIA should be implemented; • Local residents and farmers should be consulted to determine any possible heritage sites not identified by the HIA; and • Local residents and farmers should inform mitigation measures when addressing any potential impact on cultural heritage sites or graves.	Ongoing	Environmental Control Officer	Included in Operational Costs
Social networks	N/A	6	3	2	3	33	-	M	Implement according to proposed action plan.	6	3	2	2	22	-	L	• Employ local residents as far as possible; • Make use of credible SMME's for the provision of goods and services; and • Embark on regular communication efforts towards the community with regards to the mine's involvement in the communities. This could be done through an already established community forum.	Ongoing	Environmental Control Officer	Included in Operational Costs
Functioning of government agencies	N/A	8	3	3	4	56	-	M	Implement according to proposed action plan.	6	4	3	3	39	-	M	• Assist the LM with the diversification of the local economy; • Emphasise the use of local service providers and SMMEs and focus on the development of LED programmes; and • Institute a joint municipal coordinating and implementing committee to support the LM's local economic and social develop needs and requirements, where feasible.	Ongoing	Environmental Control Officer	Included in Operational Costs
Impact equity (affected landowners)	N/A	8	4	1	3	39	-	M	Implement according to proposed action plan.	6	3	1	2	20	-	L	• Negative impacts on the local property owners should be limited as far as possible such as intrusion impacts (dust, noise, and air pollution). Mitigation measures from the specialist studies dealing with these issues should thus be strictly implemented; • Safety and security measures are critical to avoid any increase in criminal activities within the local study area; and • The use of local labour must be maximised as far as possible.	Ongoing	Environmental Control Officer	Included in Operational Costs
Impact equity (community members)	N/A	4	2	3	3	27	+	L	Implement according to proposed	8	4	3	3	45	+	M	• Skills training and development	Ongoing	Environmental Control	Included in

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OPERATIONAL PHASE ACTIVITY 1: MINING OF GOLD																				
									action plan.								should be maximised to benefit as many local employees as possible; and • The use of local labour must be maximised as far as possible.		Officer	Operational Costs
Gendered division of labour	N/A	4	3	3	2	20	+	L	Implement according to proposed action plan.	6	4	3	3	39	+	M	• Women must have equal employment opportunities; • Training and skills development should take place for women; • Salaries of women should be equal to that of men when undertaking the same job; • Commitments made in the SLP with regard to the employment of women should be adhered to; and • Institute a well designed gender equality strategy on the mine.	Ongoing	Environmental Control Officer	Included in Operational Costs
Employment opportunities will be created during the operational phase of the mine.	Employment Opportunities and Skills Inequities	8	4	2	4	56	+	M	The recruitment process would thus only commence once the mining right has been awarded and will be guided by Wits Gold's recruitment policies which promote the employment of local labour by the mine as well as by any appointed contractors. The employment of locals should be maximised as far as possible.	8	4	3	4	60	+	M	·n order to recruit as much of the employees locally as possible, a skills audit process should be undertaken. The general practice should be that if the mine is not able to appoint a local person with the necessary skills, they would employ an "outsider". The intent is to identify local individuals who should be trained to take over the specialised skill from that person.	Prior to operation	Environmental Control Officer/Project Manager/HR Manager	Included in Operational Costs
																	Training and skills development policy and programmes to enhance the employability of locals should be initiated during the build-up phase to ensure long term employment benefits.	Prior to operation	Environmental Control Officer/Project Manager/HR Manager	Included in Operational Costs
																	A recruitment policy should be adopted to enhance employment positive impacts, limit in-migration of outside jobseekers and mitigate the potential impact of residual in-migration.	Prior to operation	Environmental Control Officer/Project Manager/HR Manager	Included in Operational Costs
																	The mine should clearly communicate their anticipated employment figures and job categories to the communities.	Prior to operation	Environmental Control Officer/Project Manager/HR Manager	Included in Operational Costs
																	To limit opportunities for conflict and ensure equity in the workplace, it is advised that The Mine follow a transparent process and develop a local employment procedure and recruitment process in consultation with the local municipality and community representatives.	Prior to operation	Environmental Control Officer/Project Manager/HR Manager	Included in Operational Costs
																	The safety of women employees should be guaranteed. Pro-active safety measures should be put in place to limit any possible conflict between the male and female employees.	Prior to operation	Environmental Control Officer/Project Manager/HR Manager	Included in Operational Costs
During the operational phase of the mine, the workforce would require accommodation. These employees should be assisted by the mine to achieve home ownership through housing subsidies within the nearest existing residential areas or	Accommodation of Permanent Workforce	6	3	3	4	48	-	M	As employees would also be recruited locally (whether appointed as contractors or as permanent personnel) it is anticipated that these employees would already own houses within the nearest communities. Those recruited from within the	6	3	2	4	44	-	M	Employees should be educated with regards to their accommodation options.	Prior to operation	Environmental Control Officer/Project Manager/HR Manager	Included in Social and Labour Plan costs
																	Housing needs should be monitored and addressed in consultation and cooperation with the local municipality.	Prior to operation	Environmental Control Officer/Project Manager/HR Manager	Included in Social and Labour Plan costs

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 1: MINING OF GOLD																				
community systems. This could place some additional pressure on the existing housing infrastructure in the area.									region, however, would require some form of housing subsidy or be compensated for transport costs.								Maximise the employment of locals to limit the need for any additional housing infrastructure, as far as possible.	Prior to operation	Environmental Control Officer/Project Manager/HR Manager	Included in Social and Labour Plan costs
																	Maximise the employment of locals to limit the possibility of informal settlements developing in or near the mine; or in or near existing settlements in the Virginia area.	Prior to operation	Environmental Control Officer/Project Manager/HR Manager	Included in Social and Labour Plan costs
																	Employees from within the region could receive some housing subsidy or be compensated for transport costs. Salary packages should thus address this issue.	Prior to operation	Environmental Control Officer/Project Manager/HR Manager	Included in Social and Labour Plan costs
Impact equity refers to fairness of the distribution of the impacts (positive and negative) across the community. Ideally it must be ensured that the people who will benefit from the development must also share in carrying the costs. The project will lead to gain on a regional level, whereas the local people who will be impacted on such as the local farming community will not necessarily benefit in terms of financial benefits and employment opportunities.	Impact equity	6	4	3	4	52	-	M	Should the proposed skills training and development through the Learnership Programmes be undertaken in a comprehensive manner, then some local employees could benefit from this development.	6	4	2	3	36	-	M	Negative impacts on the local property owners should be limited as far as possible such as intrusion impacts (dust, noise, and air pollution). Mitigation measures from the specialist studies dealing with these issues should thus be strictly implemented.	Prior to operation	Environmental Control Officer/Project Manager/HR Manager	Included in Operational Costs
																	Safety and security measures are critical to avoid any increase in criminal activities within the local study area.	Prior to operation	Environmental Control Officer/Project Manager/HR Manager	Included in Social and Labour Plan costs
																	Skills training and development should be maximised to benefit as many local employees as possible.	Prior to operation	Environmental Control Officer/Project Manager/HR Manager	Included in Social and Labour Plan costs
To ensure local economic development, the the mine should assist the local communities to become involved in the local procurement process by identifying business opportunities and linking SMMEs to these.	Local Economic Contribution and Procurement	6	4	2	4	48	+	M	The mine must formulate a Procurement Policy to provide HDSAs and surrounding communities with a preferred supplier status in all three levels of procurement, namely capital goods, consumables and services. The company is also committed to assist potential HDSA suppliers and SMMEs, through mentoring, to become part of the mine's supply chain.	6	4	3	4	52	+	M	The mine should adopt a Procurement Plan whereby they aim to provide Historically Disadvantaged South Africans (HDSAs) and SMME"s with the opportunity to become involved in the procurement of capital goods, consumables and services. This Plan should be implemented in conjunction with the local municipality and their LED targets. These programmes could focus on providing support and technical advice to entrepreneurs and/or SMMEs to enable them to supply goods and materials for operations at the future mine.	Prior to operation	Environmental Control Officer/Project Manager/HR Manager	Included in Social and Labour Plan costs
Although education and training is mainly the responsibility of government, there is increased pressure on the business sector in South Africa to increase the development and skills of their workforce.	Capacity Building and Skills Training	6	4	2	3	36	+	M	In accordance with the Human Resources Development Strategy for South Africa (2010-2030), a Workplace Skills Plan (WSP) will be submitted to the DMR within three months upon mine production.	6	4	3	4	52	+	M	The WSP will contain the number of employees, levels of skills and types of skills development programs that are developed specifically for the proposed mine and can only be compiled after the workforce for the mine has been sourced.	Prior to operation	Environmental Control Officer/Project Manager/HR Manager	Included in Social and Labour Plan costs
									The Mine should ensure that employees have the opportunities to improve their existing qualifications.								The mine should ensure that the quality of life of the employees and their families are improved through the provision of capacity building and skills training programmes.	Prior to operation	Environmental Control Officer/Project Manager/HR Manager	Included in Social and Labour Plan costs
									The implementation of the Career Development and Progression Plan; the Skills Development Plan; the Mentorship and Coaching Plan; the Internship / Bursary Plan; and Employment Equity Plan should be monitored on an annual basis to ensure that it is comprehensively								Appoint a specialist to conduct annual audits on the Social and Labour Plan.	Annually	Environmental Control Officer/Project Manager/HR Manager	R 87 500.00
																	The above learnership programmes should be implemented in such a manner that it would ensure statutory compliance, recognition of prior learning and certification according to	On-going	Environmental Control Officer/Project Manager/HR Manager	Included in Social and Labour Plan costs

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 1: MINING OF GOLD																				
									attended to and implemented as stipulated as part of the updated Social and Labour Plan.								the South African Qualifications Authority (SAQA) process and requirements.			
																	Portable skills training should be identified in consultation with the affected employees. The provision of portable skills is critical to prepare employees for possible retrenchments and/or decommissioning.	On-going	Environmental Control Officer/Project Manager/HR Manager	Included in Social and Labour Plan costs
																	-n-house training through learnerships to fill the hard-to-fill vacancies would be crucial for long term capacity building and skills development within the local communities.	On-going	Environmental Control Officer/Project Manager/HR Manager	Included in Social and Labour Plan costs
																	Ensure compliance to Mining Charter and MPRDA through annual audits.	Annually	Environmental Control Officer/Project Manager/HR Manager	R 68 000.00
																	Ensure that HDSA and women are considered and determine the required staff component in this regard.	On-going	Environmental Control Officer/Project Manager/HR Manager	Included in Social and Labour Plan costs
The mine will result in social development and social services support through their investments and interventions within the communities through skills training and capacity building, community development projects, infrastructure support as well as local economic development.	Social Development and Social Services Support	6	4	2	3	36	+	M	The mine intends to adhere to corporate responsibility principles, which include fulfilling responsibilities to the communities surrounding the mine and from their labour sending areas. This will be done through the Local Economic Development (LED) programmes, which are a requirement of a SLP for the approval of the DMR.	6	4	3	4	52	+	M	All projects should be designed in line with the local municipality's IDP priorities, and the projects should be proposed on this basis. Projects are thus envisaged to be initiated and sustained by local community members and in this way, the community could build its own skills base and have ownership of projects from the outset.	On-going	Environmental Control Officer/Project Manager/HR Manager	Included in Social and Labour Plan costs
									Inputs from the local Department of Health, Department of Agriculture, Department of Education and the district municipality should be obtained to propose and agree on sustainable development projects for implementation by the mine.								Implement a regular and formalised consultation process with local government to ensure synergy between the mine's social development and LED focus, and that of the local municipality.	On-going	Environmental Control Officer/Project Manager/HR Manager	Included in Social and Labour Plan costs
Due to the mining industry's general history and negative track-record, the mine is also regarded in this negative light. The mine is therefore perceived as an outside agency that contributes minimally towards benefits for the local community (i.e. farmers). The mine is seen to make decisions that would negatively impact on the neighbouring landowners quality of life which may result in the formation of interest groups against the project due to uncertainty, annoyance and failure to deliver promised benefits to the local community.	Conflict between locals and the mine	8	4	3	4	60	-	M	The mine should embark on a transparent communication process with the surrounding property owners.	6	4	2	3	36	-	M	The establishment of a community forum consisting of representatives of the project proponent, contractors, local leaders such as councillors, the Environmental Control Officer and the property owners could be established. One of the aims of such a forum would be to provide an opportunity and forum for open discussions regarding possible hostile relationships.	On-going	Environmental Control Officer/Project Manager/HR Manager	Included in Social and Labour Plan costs
If a large number of outsiders with different values, beliefs and practices migrate to the area during the operational phase and settle within the communities, it could result in the disruption of the existing social networks. Overall, this impact would result in challenges with regards to the provision of infrastructure and services and	Impact on social networks	8	4	3	3	45	+	M	Embark on regular communication efforts with the community with regards to the mine's involvement in the communities. This could be done through an established forum.	6	4	3	3	39	-	M	The establishment of a community forum consisting of representatives of the project proponent, contractors, local leaders such as councillors, the Environmental Control Officer and the property owners could be established. One of the aims of such a forum would be to provide an opportunity and forum for open discussions regarding possible hostile	On-going	Environmental Control Officer/Project Manager/HR Manager	Included in Social and Labour Plan costs

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 1: MINING OF GOLD																				
increased expectations in this regard.																	relationships.			
Construction of the proposed gold mine could impact on property values of surrounding properties.	Change in property values	10	5	2	5	85	-	H	Mitigation measures as proposed by all the specialist studies should be strictly implemented especially those related to impacts that could affect property prices negatively, such as noise, air quality, security and traffic related impacts.	6	4	2	4	48	-	M	The mine will implement all mitigation measures as required in the specialist studies.	On-going	Environmental Control Officer/Project Manager/HR Manager	Included in Social and Labour Plan costs
The possible impact on the water quality and quantity are of concern to the neighbouring land owners. The livelihood of the farmers and land owners in the area depends on their water quality and quantity.	Water impacts	8	5	3	4	64	-	H	Water remains a scarce commodity and any decrease in the water tables would result in severe negative impacts on the neighbours activities with subsequent economic losses. The issue of water and the possible impact on the water sources would remain a critical issue and needs to be addressed to avoid social mobilisation against the proposed project.	6	4	2	3	36	-	M	Surface water quality sampling will be undertaken on a monthly basis and analysed according to the prescribed monitoring programme contained in the EIA/EMP.	Monthly	Environmental Control Officer/Project Manager	R 91 000.00
																	Quarterly surface water monitoring reports will be generated by the mine or through a qualified water quality specialist.	Quarterly	Environmental control officer/Water Quality Specialist	R 42 000.00
																	In the event that water quality issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental control officer/Water Quality Specialist	To be determined - depending on severity of incident
The proposed project will have positive impacts on the local municipality as it would ensure continued job creation for the life of mine, continued ore production with resulting regional and local economic benefits and by creating other economic spin-offs benefiting the entire region.	Impact on the Local Municipality	6	4	2	4	48	+	M	The Municipality's input would be required to identify and implement feasible community and social development projects and ensure compliance to the regulations and EMP. The presence of the proposed mine and implementation of social development support would require inputs in terms of the planning processes of the local municipality.	8	4	2	4	56	+	M	Institute a joint municipal coordinating and implementing committee to support the municipality's local economic and social develop needs and requirements, where feasible.	On-going	Environmental Control Officer/Project Manager/HR Manager	Included in Social and Labour Plan costs
Occupational health and safety risks associated with mining operations are always a source of concern. Existing health services such as the clinics in nearby towns would come under additional pressure with the growth in the workforce in the area as well as due to the possible increase in the prevalence of HIV/Aids among the local population. The prevalence of HIV/Aids among the mine employees would be a threat to a stable mining environment necessary to sustain operations. If a significant number of mineworkers are affected and are classified as physically unfit, it could lead to lower productivity, increased health related expenses (e.g. health insurance, sick leave, funeral benefits) and higher training costs to replace workers.	Health Risks	8	4	2	3	42	-	M	The general health of employees should be monitoring on an on-going basis.	6	3	2	3	33	-	M	HIV / Aids awareness campaigns should be focused on the mine employees.	On-going	Environmental Control Officer/Project Manager/HR Manager	Included in Social and Labour Plan costs
																	Local labour should be employed as far as possible to avoid additional pressure of outsiders on the existing services.	On-going	Environmental Control Officer/Project Manager/HR Manager	Included in Social and Labour Plan costs
																	Environmental pollution must be limited and the mine should be managed and operated according to International Best Practice.	On-going	Environmental Control Officer/Project Manager/HR Manager	Included in Social and Labour Plan costs
																	The mine could assist in implementing a community health awareness plan.	On-going	Environmental Control Officer/Project Manager/HR Manager	Included in Social and Labour Plan costs
																	The mine could, through LED programmes and infrastructure development assist in improving the overall health services within the communities.	On-going	Environmental Control Officer/Project Manager/HR Manager	Included in Social and Labour Plan costs
Property owners relate the development of mines in the area to the increase in criminal activities within the area due to the increase in outsiders to the current setting. It is thus the viewpoint that the development of the new proposed mine would increase the crime levels	Safety and Security Risks	8	3	2	4	52	-	M	Strict security measures should be put in place. Security personnel should be on site on a permanent basis.	6	3	2	3	33	-	M	As far as possible, the movement of workers should be confined to the work site to avoid any increased safety and security risks.	During Operation	Environmental Control Officer/Project Manager/HR Manager	Included in Operational Costs
																	Before operations commences, representatives from the local municipality and community-based organisations, as well as neighbouring	During Operation	Environmental Control Officer/Project Manager/HR Manager	Included in Operational Costs

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 1: MINING OF GOLD																				
within the surrounding area thereby severely affected the quality of life of the property owners.																	residents should be informed of the details of the size of the workforce and operational schedules.			
																	Mining employees should be easily identified as part of the mining team by e.g. wearing specific clothing and/or identity tags.	During Operation	Environmental Control Officer/Project Manager/HR Manager	Included in Operational Costs
																	Ensure adequate housing facilities for outside workers and transportation to and from the mine site.	During Operation	Environmental Control Officer/Project Manager/HR Manager	Included in Operational Costs
																	Criminal incidents should be communicated to the workforce and mine employees to ensure a general awareness of the safety situation in the area.	During Operation	Environmental Control Officer/Project Manager/HR Manager	Included in Operational Costs
																	Operational safety risks should be addressed as part of the Occupational Health and Safety Act (1993).	During Operation	Environmental Control Officer/Project Manager/HR Manager	Included in Operational Costs
Issues related to HERITAGE																				
Evidence of 2 sites of archaeological/cultural importance occur within the greater project area. Potential impacts on these must be minimised.	Graves/ grave yards	8	4	2	4	56	-	M	Should it be directly impacted on by the mine the graves may be exhumed and the human remains reburied. Before this may happen the necessary advertising, possible social consultation and permitting applications should be implemented. Should the graves however not be impacted on directly, there will definitely be a secondary impact. The graves should then be fenced in a management plan for the preservation and maintenance thereof be written.	4	3	1	3	24	-	L	It is possible that more cultural sites may be present. Also the subterranean presence of archaeological and/or historical sites, features or artefacts are always a distinct possibility. Care should also be taken when development work commences that if any more artefacts are uncovered, a qualified archaeologist be called in to investigate.	Ongoing	Environmental control officer	N/A
Issues related to WETLANDS																				
Water quality deterioration (e.g. AMD) where contaminated groundwater emerges at surface waterbodies. Typically, salt and metal concentrations will increase and pH will decrease. This may cause a loss of sensitive biota. This impact is likley to be greater after closure than during the operational phase.	Subsidence	10	3	3	4	64	-	H	Do not pump water from underground workings directly into surface water ecosystems, but rather into pollution control facilities. Ensure adequate monitoring. Wetlands should not be undermined, so as to avoid subsidence and pooling of water. At the very least pillar extraction should not take place under any wetlands. Ensure water treatment and pumping facilities are adequately maintained and have adequate capacity.	6	5	3	4	56	-	M	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental control officer	Included in Operational Costs.
River banks and dam walls may be destabilised by blasting - especially those banks that have become exposed by cattle watering or alien invasion.	Blasting	6	2	1	4	36	-	M	Implement alien vegetation control programme and protect banks from vegetation removal. Stabilise and rehabilitate unstable dam/river banks in close proximity to blasting areas.	4	2	1	3	21	-	L	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental control officer	Included in Operational Costs.
Water that is removed from underground mined areas is effectively removed from the landscape, resulting in decreased base flows, longer no-flow periods and reduced summer flows as well as longer seasonal drying in temporary pans. Flow-sensitive biota may be lost. Water quality impacts will also be exacerbated.	Decreased flow in rivers/wetlands	10	5	3	4	72	-	H	Wetlands should ideally not be undermined, so as to avoid subsidence and pooling of water. At the very least pillar extraction should not take place under any wetlands. Ensure water treatment and pumping facilities are adequately maintained and have adequate capacity. Ensure water treatment and pumping facilities are adequately maintained and have adequate capacity. Treated water should ideally be returned to surface ecosystems (if compliant with water quality requirements) in a diffuse way	8	5	3	3	48	-	M	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental control officer	Included in Operational Costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 1: MINING OF GOLD																				
									that does not cause erosion or result in sudden changes in flows. Flow rates in rivers should be monitored and should comply with DWA recommendations.											
Undermining of wetlands could result in wetland loss and degradation where surface subsidence occurs. Fractures in the strata underlying the wetlands could result in loss of surface water to groundwater, leading to decreased base flows, desiccation of wetlands and changes in species composition.	Subsidence	8	5	3	3	48	-	M	Wetlands should ideally not be undermined, so as to avoid subsidence and pooling of water that can cause AMD. At the very least pillar extraction should not take place under any wetlands. Ensure water treatment and pumping facilities are adequately maintained and have adequate capacity. Monitor flows in rivers and valley bottom wetlands to comply with DWA recommendations.	6	5	3	2	28	-	L	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental control officer	Included in Operational Costs.
Decreased abundance and diversity of aquatic biota due to changes in water quality and flows.	Loss of biodiversity	8	5	3	4	64	-	H	Apply all mitigation above. Water quality monitoring and biomonitoring should be implemented throughout the operational phase and non-compliance with target values should trigger immediate auditable interventions.	6	5	3	3	42	-	M	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental control officer	Included in Operational Costs.
Issues related to RADIATION																				
Impact on public safety as a result of exposure to radioactivity.	Radioactive elements	10	4	2	5	80	-	H	Develop a Radiation Management Plan. Obtain a Certificate of Registration from the NNR.	6	4	1	4	44	-	M	Implement the Radiation Management Plan throughout the life of mine and monitor exposure of the public to radioactivity in accordance therewith.	Ongoing	Environmental control officer/Health & Safety officer	Included in Construction and Operational Costs

Table 6.7: Impacts and Management Measures for Operational Phase Activities: Product Stockpiling

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 2: STOCKPILING																				
Issues related to GEOLOGY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TOPOGRAPHY																				
The stockpiling of material will impact on the micro and macro topography due to the establishment of the stockpiles.	Stockpiles	8	4	2	4	56	-	M	Stockpile heights will be restricted as far as practically possible.	4	4	2	3	30	-	M	Determine the height restriction for stockpile and implement.	Ongoing	Environmental control officer/Project Manager	Included in Operational Costs
									Stockpiles will only be placed within the designated mine area boundaries.								The visual management measures as incorporated during the construction phase will be maintained during the operational phase.	Ongoing	Project Manager	Included in Operational Costs
Issues related to GEOHYDROLOGY																				
Impacts on the groundwater regime as a result of infiltration.	Water infiltration	8	4	2	4	56	-	M	Clean water needs to be kept away from the stockpiling area to minimise water infiltrating from the site. Keep stockpiles as small as possible, to minimise their footprint.	4	4	1	3	27	-	L	Optimal operation and maintenance of clean and dirty water system will be conducted.	Ongoing	Environmental control officer/Project Manager	Included in Operational Costs
Seepage into underlying aquifer.	Groundwater contamination	8	5	3	4	64	-	H	Bunded or compacted stockpile footprint areas. Concrete slabs with seepage control measures and storm water management.	8	4	2	2	28	-	L	Divert seepage and run-off to dirty return water dams	Rainfall events	Plant Engineer	Included in Operational Costs
Issues related to HYDROLOGY																				
Stockpiling could lead to runoff from stockpiles and rainfall could start to seep into the stockpiles which could then impact on the clean water resources.	Water quality	8	4	2	4	56	-	M	Water associated with stockpiles will be dirty water and therefore has to be channelled and contained in a PCD. A clean water diversion berm and cut-off trench must be constructed upstream from all dirty water delineated areas. Dirty water areas must be kept as small as possible.	4	3	2	3	27	-	L	Optimal operation and maintenance of clean and dirty water system will be conducted.	Ongoing	Environmental control officer/Project Manager	Included in Operational Costs
									All contaminated surface water run-off to be contained within a downstream lined pollution control dam. These structures should be located well away from surface water resources and drainage lines.								Ensure optimal operation and maintenance of clean and dirty water system and erosion control measures.	Ongoing	Environmental control officer/Project Manager	Included in Operational Costs
									WUL requirements must be adhered to.								Quarterly performance assessment reviews will be conducted against the conditions listed in the approved Water Use Licence.	Quarterly	Environmental control officer/Project Manager	Included in Operational Costs
									A silt trap to be installed at the inflow of the pollution control dam as to collect all suspended solids and prevent the dam from losing its design capacity through siltation.								The silt trap to be regularly inspected and cleaned to ensure optimum functioning.	Weekly	Environmental control officer/Project Manager	Included in Operational Costs
																	Designs of the separation structures to be undertaken in terms of GN704.	Prior to operation	Environmental control officer/Project Manager	Included in Operational Costs
																	Designs of the pollution control dams to be undertaken in terms of GN704.	Prior to operation	Environmental control officer/Project Manager	Included in Operational Costs
Vehicular activity on haul roads will give rise to dust deposition that will lead to siltation and diffuse pollution of the water bodies in the mining area. Vehicular movement could negatively impact on the surface (haul road) runoff and contaminate this outside the dirty water catchment.	Pollution	8	4	2	5	70	-	H	Ensure optimal operation and maintenance of clean and dirty water system and the erosion control measures.	4	4	1	3	27	-	L	Road wetting/dust suppression measures to prevent siltation must be in place.	Ongoing	Environmental control officer/Project Manager	Included in Operational Costs
																	Isolating stockpiles (topsoil and overburden) by means of trenches to contain dirty water associated with them and diversion berms to allow the clean water to report to the clean catchment.	Ongoing	Environmental control officer/Project Manager	Included in Operational Costs
																	An ongoing storm water management plan is required in order to effectively manage the separation of clean and	Ongoing	Environmental control officer/Project Manager	Included in Operational Costs

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 2: STOCKPILING																				
																	dirty water.			
																	Cut-off berms to prevent siltation must be in place around all disturbed areas	Ongoing	Environmental control officer/Project Manager	Included in Operational Costs
																	Overburden should be layered with topsoil (0.3 m) and covered with vegetation to reduce erosion of topsoil.	Ongoing	Environmental control officer/Project Manager	Included in Operational Costs
Clean surface run-off water entering the storage stockpile area and becoming contaminated.	Contaminated run-off	8	4	2	4	56	-	M	Clean and dirty water separation system to be constructed upstream from the stockpile area and divert clean water around the stockpile area as to prevent it from entering the area.	6	4	2	3	36	-	M	Ensure optimal operation and maintenance of clean and dirty water system and the erosion control measures.	Ongoing	Environmental control officer/Project Manager	Included in Operational Costs
Rainwater falling onto the stockpile area and causing areas of ponding.	Ponding	6	3	2	3	33	-	M	Sloping of the area is required in order to divert contaminated storm water to a pollution control collection facility purposely designed in terms of GN704. Design should be based on a number of years rainfall record and allow for the wettest year and a freeboard of 0.8 m above the full water supply level. This dam must be operated as empty.	4	2	2	2	16	-	L	Ensure optimal operation and maintenance of clean and dirty water system and the erosion control measures.	Ongoing	Environmental control officer/Project Manager	Included in Operational Costs
Polluted runoff and drainage from stckpiles could pollute water resources.	Stockpiles	6	5	3	4	56	-	M	An appropriate set of drains contain runoff and divert same into a designed pollution control dam.	4	4	1	1	9	-	L	Ensure that dirty water is diverted to the pollution control dam.	Ongoing	Environmental control officer/Project Manager	Included in Operational Costs
Issues related to SOIL, LAND USE AND LAND CAPABILITY																				
Soil compaction	Construction of infrastructure	2	4	6	4	48	-	M	Keep infrastructure localized to reduce footprint	2	4	4	4	40	-	M	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental control officer/Project Manager	Included in Operational Costs
Soil physical and chemical degradation as result of stockpiles and spillages during operations.	Stockpiles	8	3	2	4	52	-	M	There will be an incident management system including procedures and training for dealing with incidents. Major spillage incidents will be reported to the DMR, DWA, DEA and the Department of Agriculture. Appropriate remedial measures will be implemented in consultation with these regulatory authorities.	6	3	2	3	33	-	M	A detailed waste management strategy will be established and implemented.	During operational phase and ongoing	Environmental control officer/Project Manager	Included in Operational Costs
									If spills do occur and soils become contaminated, the appropriate remedial measures will be identified in consultation with an appropriate qualified specialist. If necessary, the polluted soils will be classified as waste and will be discarded at an appropriate permitted waste site. After the removal of the contaminated soils, the affected areas will be landscaped and rehabilitated.								Waste should be removed by licensed waste disposal companies.	During operational phase and ongoing	Environmental control officer/Project Manager	Included in Operational Costs
Issues related to FAUNA AND FLORA																				
Loss or disruption of mammal migration routes.	Stockpiles	8	5	3	2	32	-	M	Prevent access and impacts within areas of high ecological sensitivity; control vehicle movement.	8	5	3	1	16	-	L	Develop an environmental monitoring plan aimed at identifying and addressing issues of concern and include relevant aspects in awareness training.	Seasonal/Bi-annual	Environmental control officer/Health & Safety officer/ Ecologist/ Proponent	Included in Operational Costs
Direct impacts on sensitive/pristine habitat types.	Stockpiles	8	5	3	2	32	-	M	Prevent access and impacts within areas of high ecological sensitivity.	8	5	3	1	16	-	L	Develop an environmental monitoring plan aimed at identifying and addressing issues of concern and include relevant aspects in awareness training.	Seasonal/Bi-annual	Environmental control officer/Health & Safety officer/ Ecologist/ Proponent	Included in Operational Costs
Direct impacts on common fauna species of the study area.	Stockpiles	4	4	2	4	40	-	M	Prevent access and impacts within areas of high ecological sensitivity;	4	4	2	2	20	-	L	Develop and implement awareness programmes and prevent persistent	Ongoing	Environmental control officer/Health & Safety	Included in Operational Costs

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 2: STOCKPILING																				
									control vehicle movement.								and deliberate impacts on animals in nearby natural habitats.		officer/ Ecologist/ Contractor/Site Manager	
Faunal interaction with structures, servitudes and/or personnel.	Stockpiles	6	4	2	4	48	-	M	Ensure minimal human/animal conflict potential; implement awareness programmes; control movement of personnel; limit speeds of vehicles; avoid open waste areas that could be targeted by rodents and scavengers.	6	4	2	2	24	-	L	Develop and implement awareness programmes and prevent persistent and deliberate impacts on animals in nearby natural habitats.	Ongoing	Environmental control officer/Health & Safety officer/ Ecologist/ Contractor/Site Manager	Included in Operational Costs
Impacts on surrounding habitat/species, including ecosystem functioning.	Stockpiles	4	4	2	4	40	-	M	Prevent spread of construction related impacts to nearby areas of natural habitat; control runoff from stockpiles.	4	4	2	3	30	-	M	Develop and implement awareness programmes; provide adequate waste disposal facilities; manage operational issues with regard to hygiene, ablution and food provision; develop hydrocarbon spill reaction and cleanup action plans.	Seasonal/Bi-annual	Environmental control officer/Health & Safety officer/ Ecologist/ Contractor/Site Manager	Included in Operational Costs
Issues related to AIR QUALITY																				
Fugitive dust emissions from stockpiles will have a negative air quality impact.	Stockpiles	8	4	3	4	60	-	M	Dust suppression methods must be implemented around the stockpiling areas and transfer stations and it is recommended that a dust monitoring network be established to monitor levels of dust dispersion. Should it be found that the stockpiles create excessive dust, measures must be implemented to reduce this impact.	6	4	2	3	36	-	M	Ensure optimal implementation and maintenance of the dust suppression programme and monitoring programme.	Ongoing	Environmental control officer/Project Manager	Included in Operational Costs
All activities associated with mining has the potential to release dust.	Stockpiles	8	4	3	4	60	-	M	A dust monitoring network must be set up prior to the construction phase so that any air quality or dust issues can be addressed accordingly.	4	4	2	3	30	-	M	Dust sampling will be undertaken on a monthly basis and analysed according to the prescribed monitoring programme contained in the EIA/EMP.	Monthly	Environmental control officer	R 92 000.00
																	Monthly monitoring reports will be generated by the mine or through a suitably qualified air quality specialist.	Monthly	Environmental control officer/Air Quality Specialist	R 42 000.00
																	In the event that air quality or dust issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental control officer/Air Quality Specialist	To be determined - depending on severity of incident
																	Ensure optimal implementation and maintenance of the dust suppression programme .	Ongoing	Environmental control officer	Included in Operational Costs
																	The road surface to be maintained on a weekly basis.	Weekly	Environmental control officer	Included in Operational Costs
Issues related to NOISE																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TRAFFIC																				
Transportation of product from the mine area to the plant and stockpiles will cause a noise disturbance.	Stockpiles	8	4	3	4	60	-	M	Ore to be transported with road-worthy vehicles that are well maintained and a speed limit of 40 k m/h to be maintained.	8	4	2	3	42	-	M	Draw up an implement a vehicle inspection and service programme.	Ongoing	Environmental control officer/Project Manager	Included in Operational Costs
									Gravel road to be maintained as a good and smooth surface at all times.								The road surface to be maintained on a weekly basis.	Weekly	Environmental control officer/Project Manager	Included in Operational Costs
Issues related to VISUAL																				
Fugitive dust emissions from the stockpiles will have a negative visual impact.	Stockpiles	8	4	3	4	60	-	M	Dust suppression methods must be implemented around the stockpiling areas and transfer stations and it is recommended that a dust monitoring network be established to monitor levels of dust dispersion. Should it be	4	4	2	3	30	-	M	Ensure optimal implementation and maintenance of the dust suppression programme and monitoring programme.	Ongoing	Environmental control officer/Project Manager	Included in Operational Costs

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 2: STOCKPILING																				
									found that the stockpiles create excessive dust, measures must be implemented to reduce this impact.											
Issues related to SOCIAL																				
Fugitive dust emissions from the stockpiles will have a negative social impact.	Stockpiles	8	4	3	4	60	-	M	Dust impacts will be considered as more of a nuisance than a health impact. Dust suppression methods must be implemented around the stockpiling areas and transfer stations and it is recommended that a dust monitoring network be established to monitor levels of dust dispersion. Should it be found that the stockpiles create excessive dust, measures must be implemented to reduce this impact.	4	4	2	3	30	-	M	Ensure optimal implementation and maintenance of the dust suppression programme and monitoring programme.	Ongoing	Environmental control officer/Project Manager	Included in Operational Costs
Issues related to HERITAGE																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to WETLANDS																				
Dust from stockpiles, trucks and roads may be flushed or blown into the surface waters. This would lead to increased turbidity (decreased water quality) and sedimentation of wetlands. In addition, dust from the stockpile may cause a salinisation of surface waterbodies, either directly or indirectly via seepage. This may lead to a deterioration in biotic integrity and loss of sensitive biota.	Deterioration in water quality	8	4	3	4	60	-	M	The product stockpiles must be located within the dirty water ara of the mine and all runoff from the stockpiles should be captured in the dirty water system. No dirty water may be discharged into any wetland or water resource on site unless treated to the required standards. Overloading of trucks must be prohibited and strictly enforced to reduce spillages. Dust control measures must be employed. Runoff from the vehicle washbays must be directed into the dirty water system and oil effectively trapped. Spills should be prevented and an emergency preparedness plan should be compiled to address major spills. Ensure adequate pollution control measures (trenches, linings, pollution control dams, etc.) to be in place so as to contain dirty storm water and seepage. Should monitoring (biomonitoring, groundwater or surface water monitoring or environmental audits) detect any signs of pollution, detailed investigations need to be initiated.	4	4	3	3	33	-	M	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental control officer	Included in Operational Costs.
Seepage of pollutants (especially acid mine drainage) into groundwater and then running into surface waters (AMD is characterised by high salinities and metal concentrations).	Water pollution	8	4	3	4	60	-	M	Ensure adequate pollution control measures (trenches, linings, pollution control dams, etc.) to be in place so as to contain dirty storm water and seepage. Should monitoring (biomonitoring, groundwater or surface water monitoring or environmental audits) detect any signs of pollution, detailed investigations need to be initiated.	6	4	3	3	39	-	M	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental control officer	Included in Operational Costs.
Issues related to RADIATION																				
Impact on public safety as a result of exposure to radioactivity.	Radioactive elements	10	4	2	5	80	-	H	Develop a Radiation Management Plan.	6	4	1	4	44	-	M	Implement the Radiation Management Plan throughout the life of mine and monitor exposure of the public to radioactivity in accordance therewith.	Ongoing	Environmental control officer/Health & Safety officer	Included in Construction and Operational Costs

Table 6.8: Impacts and Management Measures for Operational Phase Activities: Clean and Dirty Water Separation Infrastructure

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 3: CONTROL OF CLEAN AND DIRTY WATER SEPARATION INFRASTRUCTURE																				
Issues related to GEOLOGY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TOPOGRAPHY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to GEOHYDROLOGY																				
Poor quality seepage may occur into the underlying strata if the dams are situated on permeable soil formation or on a groundwater flow path like dykes and/or fauls systems. Overflow of dams can also result in down-stream contamination of surface water bodies and seepage into groundwater.	Pollution control dams	6	4	2	3	36	-	M	Lining of all pollution control dams will be undertaken by the mine.	4	3	1	2	16	-	L	Pollution control dams will be inspected regularly to monitored and mitigate the possibility of seepage.	Weekly	Environmental Control Officer/Project Manager	Included in Operational Costs
									Dam levels will be kept at the required levels (refer to GN 704).								Maintenance and operation of clean and dirty water system will be ensured at all times	Ongoing	Environmental Control Officer/Project Manager	Included in Operational Costs
									Groundwater quality monitoring networks must be set up prior to the construction phase so that any groundwater quality and quantity issues can be addressed accordingly.	6	4	2	3	36	-	M	Groundwater quality sampling will be undertaken on a monthly basis and analysed according to the prescribed monitoring programme contained in the EIA/EMP.	Monthly	Environmental Control Officer/Project Manager	R 91 000.00
																	Quarterly groundwater monitoring reports will be generated by the mine or through a qualified water quality specialist.	Quarterly	Environmental control officer/Water Quality Specialist	R 42 000.00
																	In the event that water quality or quantity issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental control officer/Water Quality Specialist	To be determined - depending on severity of incident
Seepage of dirty water into underlying aquifer.	Groundwater contamination	8	5	3	4	64	-	H	Lining of dirty water retention facilities	8	4	2	2	28	-	L	Monitor lining of the dirty return water dams & facilities	Monitor during low water conditions	Mine Environmental Unit & Plant Engineer	Included in Operational Costs
Issues related to HYDROLOGY																				
Reduction in catchment yield. Stream flow reduction will be caused by separating the clean and dirty water through berms and trenches.	Clean and dirty water separation infrastructure	6	3	2	4	44	-	M	Ensure the dirty water catchment area is as small as possible to avoid unnecessary losses to the stream flow.	4	3	2	3	27	-	L	Maintenance and operation of clean and dirty water system and erosion control measures will be ensured at all times	Ongoing	Environmental Control Officer/Project Manager	Included in Operational Costs
																	A dynamic water and salt balance will be drawn up by the mine prior to commencing with operational activities.	Monthly	Environmental Control Officer/Project Manager	Included in Operational Costs
									Surface water quality monitoring networks must be set up prior to the construction phase so that any surface water quality issues can be addressed accordingly.	6	4	2	3	36	-	M	Surface water quality sampling will be undertaken on a monthly basis and analysed according to the prescribed monitoring programme contained in the EIA/EMP.	Quarterly	Environmental control officer/Water Quality Specialist	R 91 000.00
																	Quarterly surface water monitoring reports will be generated by the mine or through a qualified water quality specialist.	In the event of occurrence	Environmental control officer/Water Quality Specialist	R 42 000.00
																	In the event that water quality issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of action to ameliorate the situation.	Prior to operational activities	Environmental control officer/Water Quality Specialist	To be determined - depending on severity of incident
Runoff from clean water areas if allowed to flow into the dirty water footprint area could mix with polluted water and overflow into river systems or reduce flow into	Clean and dirty water separation infrastructure	4	4	3	3	33	-	M	A designed system of berms and drains seperating clean and dirty water and allowing clean water to pass into local streams must be established.	4	4	2	1	10	-	L	Ensure that adequate stormwater management measures and clean and dirty separation mechanisms are implemented on site.	Ongoing	Environmental control officer	Included in Operational Costs

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 3: CONTROL OF CLEAN AND DIRTY WATER SEPARATION INFRASTRUCTURE																				
local river systems.																				
Issues related to SOIL, LAND USE AND LAND CAPABILITY																				
Chemical soil pollution	Spillage and seepage of wastewater	2	5	8	5	75	-	H	Proper chemical waste management	1	3	4	4	32	-	M	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental control officer	Included in Operational Costs
Change in natural landscape	Ground clearance and waste disposal	1	5	6	5	60	-	M	Keep infrastructure to a minimum to reduce footprint	1	5	4	4	40	-	M	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental control officer	Included in Operational Costs
Stream flow reduction will be caused by separating the clean and dirty water through berms and trenches.	Clean and dirty water separation infrastructure	8	3	2	4	52	-	M	Discharge points for clean storm water and treated effluent should include erosion protection measures as well as energy dissipaters and should release flows in a diffuse manner to encourage dispersion.	4	3	1	3	24	-	L	Optimum operation and maintenance of control measures will be conducted to ensure proper flow of clean water from the site.	Ongoing	Environmental control officer	Included in Operational Costs
Issues related to FAUNA AND FLORA																				
Loss or disruption of mammal migration routes.	Overall mining activities	8	5	3	2	32	-	M	Prevent access and impacts within areas of high ecological sensitivity; control vehicle movement; prevent standing and open water.	8	5	3	1	16	-	L	Develop an environmental monitoring plan aimed at identifying and addressing issues of concern and include relevant aspects in awareness training.	Seasonal/Bi-annual	Environmental control officer/Health & Safety officer/ Ecologist/ Proponent	Included in Operational Costs
Direct impacts on sensitive/pristine habitat types.	Overall mining activities	8	5	3	2	32	-	M	Prevent access and impacts within areas of high ecological sensitivity.	8	5	3	1	16	-	L	Develop an environmental monitoring plan aimed at identifying and addressing issues of concern and include relevant aspects in awareness training.	Seasonal/Bi-annual	Environmental control officer/Health & Safety officer/ Ecologist/ Proponent	Included in Operational Costs
Direct impacts on common fauna species of the study area.	Overall mining activities	4	4	2	4	40	-	M	Prevent access and impacts within areas of high ecological sensitivity; control vehicle movement; prevent standing and open water.	4	4	2	2	20	-	L	Develop and implement awareness programmes and prevent persistent and deliberate impacts on animals in nearby natural habitats.	Ongoing	Environmental control officer/Health & Safety officer/ Ecologist/ Contractor/Site Manager	Included in Operational Costs
Faunal interaction with structures, servitudes and/or personnel.	Overall mining activities	6	4	2	4	48	-	M	Ensure minimal human/animal conflict potential; implement awareness programmes; control movement of personnel; limit speeds of vehicles; prevent standing and open water; avoid open waste areas that could be targeted by rodents and scavengers.	6	4	2	2	24	-	L	Develop and implement awareness programmes and prevent persistent and deliberate impacts on animals in nearby natural habitats.	Ongoing	Environmental control officer/Health & Safety officer/ Ecologist/ Contractor/Site Manager	Included in Operational Costs
Impacts on surrounding habitat/species, including ecosystem functioning.	Overall mining activities	4	4	2	4	40	-	M	Prevent spread of construction related impacts to nearby areas of natural habitat; prevent effluents from impacting nearby natural habitat.	4	4	2	3	30	-	M	Develop and implement awareness programmes; provide adequate waste disposal facilities; manage operational issues with regard to hygiene, ablution and food provision; develop hydrocarbon spill reaction and cleanup action plans.	Seasonal/Bi-annual	Environmental control officer/Health & Safety officer/ Ecologist/ Contractor/Site Manager	Included in Operational Costs
Issues related to AIR QUALITY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to NOISE																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TRAFFIC																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to VISUAL																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to SOCIAL																				
Possibility of decreasing water quality or quantity.	Overall mining activities	10	4	2	3	48	-	M	Surface and groundwater quality monitoring networks must be set up prior to the construction	6	4	2	3	36	-	M	Surface and groundwater quality sampling will be undertaken on a monthly basis and analysed according	Monthly	Environmental Control Officer/Project Manager	R 91 000.00

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 3: CONTROL OF CLEAN AND DIRTY WATER SEPARATION INFRASTRUCTURE																				
									phase so that any surface water quality issues can be addressed accordingly.								to the prescribed monitoring programme contained in the EIA/EMP.			
																	Quarterly surface and groundwater monitoring reports will be generated by the mine or through a qualified water quality specialist.	Quarterly	Environmental control officer/Water Quality Specialist	R 42 000.00
																	In the event that water quality issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental control officer/Water Quality Specialist	To be determined - depending on severity of incident
Issues related to HERITAGE																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to WETLANDS																				
Storm water runoff may contain contaminated dust, contaminated minewater, sewage treatment effluent, spills (e.g toxic products or hazardous waste such as oils and fuels in workshops & stores) may lead to pollution of freshwater ecosystems, with a consequent loss of biota or integrity. Seepage of pollutants into groundwater may eventually find its way into surface waterbodies.	Deterioration in water quality	8	3	3	5	70	-	H	Clean and dirty water must at all times be separated. Clean water should be diverted around dirty areas and returned to the natural water resources. Dirty water systems should meet the requirements of GN704 as a minimum. Current sources of pollution should be addressed appropriately (e.g. treatment plants, lining of pollution control dams). No dirty water may be discharged unless treated to meet the applicable standards and under authorisation from the DWA. Maintain biomonitoring programme (ensure the inclusion of toxicity testing to determine their potential risk to the aquatic fauna should they be released/spilled and to enable the determination of safe dilution factors for releases.	6	3	3	2	24	-	L	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental control officer	Included in Operational Costs.
Issues related to RADIATION																				
Impact on public safety as a result of exposure to radioactivity.	Radioactive elements	10	4	2	5	80	-	H	Develop a Radiation Management Plan.	6	4	1	4	44	-	M	Implement the Radiation Management Plan throughout the life of mine and monitor exposure of the public to radioactivity in accordance therewith.	Ongoing	Environmental control officer/Health & Safety officer	Included in Construction and Operational Costs

Table 6.9: Impacts and Management Measures for Operational Phase Activities: Generation and waste handling

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 4: GENERATION AND HANDLING OF WASTE																				
Issues related to GEOLOGY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TOPOGRAPHY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to GEOHYDROLOGY																				
Potential groundwater contamination	Waste rock	6	4	1	3	33	-	M	Compaction of base, stormwater management in lined PCD	3	4	1	0	0	-	L	Groundwater quality monitoring	Quarterly	Mine Environmental Manager	Included in Operational Costs
Groundwater contamination, potential impact downstream receptors	TSF	8	5	2	5	75	-	H	TSF water management to minimise infiltration (low rate of rise - more evaporation), lined return water dam	8	4	1	4	52	-	M	Groundwater quality monitoring	Monthly	Mine Environmental Manager	Included in Operational Costs
Issues related to HYDROLOGY																				
The generation of waste may lead to surface water contamination.	Waste generation	8	4	2	4	56	-	M	Surface water quality monitoring networks must be set up prior to the construction phase so that any surface water quality issues can be addressed accordingly.	6	4	2	3	36	-	M	Surface water quality sampling will be undertaken on a monthly basis and analysed according to the prescribed monitoring programme contained in the EIA/EMP.	Monthly	Environmental control officer	R 91 000.00
																	Quarterly surface water monitoring reports will be generated by the mine or through a qualified water quality specialist.	Quarterly	Environmental control officer/Water Quality Specialist	R 42 000.00
																	In the event that water quality issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental control officer/Water Quality Specialist	To be determined - depending on severity of incident
Disposal of any type of waste to an area with a waste skip.	Waste generation	8	2	2	5	60	-	M	A dedicated area for the placement of waste skips must be determined prior to operational activities, and the area will to be cemented. Allowance for keeping clean water run-off away from the skip area through the correct bunding design.	4	2	1	2	14	-	L	The mine will adopt a cradle-to-grave approach to ensure that the waste is removed and disposed of in a prescribed/correct manner, and must be stored in a designated area as part of the waste management strategy. Waste generated will be collected and disposed of in a licensed waste facility and a copy of the valid waste disposal permits will be kept on site.	Ongoing	Environmental control officer	Included in Operational Costs
Waste generated at the mine could pollute local water resources.	Waste generation	6	4	2	3	36	-	M	Control the storage, handling and safe disposal of waste.	4	4	1	1	9	-	L	The mine will adopt a cradle-to-grave approach to ensure that the waste is removed and disposed of in a prescribed/correct manner, and must be stored in a designated area as part of the waste management strategy.	Ongoing	Environmental control officer	Included in Operational Costs
Issues related to SOIL, LAND USE AND LAND CAPABILITY																				
Chemical soil pollution	Spillage and seepage of wastewater	2	5	8	5	75	-	H	Proper chemical waste management	1	3	4	4	32	-	M	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental control officer	Included in Operational Costs
Change in natural landscape	Ground clearance and waste disposal	1	5	6	5	60	-	M	Keep infrastructure to a minimum to reduce footprint	1	5	4	4	40	-	M	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental control officer	Included in Operational Costs
The generation of waste may lead to soil contamination.	Waste generation	8	2	2	5	60	-	M	Monitoring of waste generation and soil contamination must be implemented and maintained.	4	2	2	3	24	-	L	In the event that soil contamination occurs, immediate soil clean-up should be undertaken.	In the event of occurrence	Environmental control officer	To be determined - depending on severity of incident
Issues related to FAUNA AND FLORA																				
Loss or disruption of mammal migration routes.	Waste generation & handling	4	4	3	2	22	-	L	Develop dedicated waste handling areas; prevent access to rodents and opportunistic species; prevent the spread of waste.	4	4	3	1	11	-	L	Develop control measures; develop a monitoring plan; implement an awareness programme; and provide adequate waste disposal facilities.	Ongoing	Environmental control officer/Health & Safety officer/	Included in Operational Costs

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 4: GENERATION AND HANDLING OF WASTE																				
																			Ecologist/ Proponent	
Direct impacts on sensitive/pristine habitat types.	Waste generation & handling	6	4	3	3	39	-	M	Develop dedicated waste handling areas; prevent the spread of waste.	6	4	3	2	26	-	L	Develop control measures; develop a monitoring plan; implement an awareness programme; and provide adequate waste disposal facilities.	Ongoing	Environmental control officer/Health & Safety officer/ Ecologist/ Proponent	Included in Operational Costs
Direct impacts on common fauna species of the study area.	Waste generation & handling	6	4	2	3	36	-	M	Develop dedicated waste handling areas; prevent access to rodents and opportunistic species; prevent the spread of waste.	6	4	2	2	24	-	L	Develop control measures; develop a monitoring plan; implement an awareness programme; and provide adequate waste disposal facilities.	Ongoing	Environmental control officer/Health & Safety officer/ Ecologist/ Contractor/Site Manager	Included in Operational Costs
Faunal interaction with structures, servitudes and/or personnel.	Waste generation & handling	4	4	2	4	40	-	M	Develop dedicated waste handling areas; prevent access to rodents and opportunistic species; prevent the spread of waste.	4	4	2	2	20	-	L	Develop control measures; develop a monitoring plan; implement an awareness programme; and provide adequate waste disposal facilities.	Ongoing	Environmental control officer/Health & Safety officer/ Ecologist/ Contractor/Site Manager	Included in Operational Costs
Impacts on surrounding habitat/species, including ecosystem functioning.	Waste generation & handling	4	4	2	3	30	-	M	Develop dedicated waste handling areas; prevent the spread of waste.	4	4	2	2	20	-	L	Develop control measures; develop a monitoring plan; implement an awareness programme; provide adequate waste disposal facilities; and implement waste sortingand the re-use of materials.	Ongoing	Environmental control officer/Health & Safety officer/ Ecologist/ Contractor/Site Manager	Included in Operational Costs
Issues related to AIR QUALITY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to NOISE																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TRAFFIC																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to VISUAL																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to SOCIAL																				
The generation of waste may lead to surface water and/or soil contamination affecting neighbouring residents.	Waste generation	6	4	2	3	36	-	M	Surface and groundwater quality monitoring networks must be set up prior to the construction phase so that any surface water quality issues can be addressed accordingly.	4	3	1	3	24	-	L	Surface and groundwater quality sampling will be undertaken on a monthly basis and analysed according to the prescribed monitoring programme contained in the EIA/EMP.	Monthly	Environmental Control Officer/Project Manager	R 182 000.00
																	Quarterly surface and groundwater monitoring reports will be generated by the mine or through a qualified water quality specialist.	Quarterly	Environmental control officer/Water Quality Specialist	R 84 000.00
																	In the event that water quality issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental control officer/Water Quality Specialist	To be determined - depending on severity of incident
Issues related to HERITAGE																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to WETLANDS																				
Water quality deterioration related to accidental spills during general	Spillages	10	4	3	4	68	-	H	Designated waste handling and storage facilities must be put in place at the	6	4	3	2	26	-	L	Implement mitigation in accordance with the mitigation measures	Ongoing	Environmental control officer	Included in Operational Costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION M	D	S	P	TOTAL	STATUS	SP	RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION M	D	S	P	TOTAL	STATUS	SP	ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
OPERATIONAL PHASE ACTIVITY 4: GENERATION AND HANDLING OF WASTE																				
operational activities (fuels, cement, etc). Storm water flushing contaminated areas as well as dust can carry pollutants into water bodies either directly or indirectly via groundwater. Water quality deterioration will especially affect aquatic fauna intolerant to water quality alteration but can have an impact on all aquatic fauna (especially fuel and sewage spills).									start of the construction phase. These facilities must be located on bunded areas that do not allow seepage of pollutants into the ground or the run-off of polluted water. All waste must be disposed off in registered waste disposal facilities. The waste facilities should be located within the dirty water area of the mine.Identify potential areas where seepage and spills can occur into the natural environment. Take necessary precautions to reduce potential spills and seepage. Ensure that hazardous substances (e.g. fuels) do not wash into drains or nearby waterbodies. Maintain aquatic biomonitoring programme. Hazardous waste should be responsibly disposed of by a certified service provider. An emergency preparedness plan should be compiled detailing required actions in case of spills or leaks. Any spill/leak incidents should be followed up by auditable actions.								proposed.			
Increased hazardous waste (e.g. PVC, tyres, hydrocarbons, etc)	Hazardous waste	8	4	3	4	60	-	M	Hazardous waste should be responsibly stored (in bunded/cemented areas) and disposed of by a certified service provider. The generation of hazardous waste should be minimised and recycling implemented as far as possible (e..g oil recycling).	2	2	1	2	10	-	L	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental control officer	Included in Operational Costs.
Issues related to RADIATION																				
Impact on public safety as a result of exposure to radioactivity.	Radioactive elements	10	4	2	5	80	-	H	Develop a Radiation Management Plan.	6	4	1	4	44	-	M	Implement the Radiation Management Plan throughout the life of mine and monitor exposure of the public to radioactivity in accordance therewith.	Ongoing	Environmental control officer/Health & Safety officer	Included in Construction and Operational Costs

Table 6.10: Impacts and Management Measures for Operational Phase Activities: Hydrocarbon storage

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 5: HYDROCARBON STORAGE AND HANDLING																				
Issues related to GEOLOGY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TOPOGRAPHY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to GEOHYDROLOGY AND HYDROLOGY																				
The use of diesel, oil and other hazardous chemical substances may lead to the contamination of surface and groundwaer resources. Storage of fuel, lubricants and explosives may lead to hydrocarbon contamination by diesel and oil spillages during the re-fuelling and movement (on and off site, and the workshop area) of mining trucks. The storage of explosives may cause contamination of the water resources when there are leaks or seepage of chemicals.	Hydrocarbon storage and handling	8	4	2	4	56	-	M	Non mining waste that include, but are not limited to, grease, lubricants, paints, flammable liquids, garbage, abandoned machinery and other combustible materials generated during activities should be placed and stored in a controlled manner in a designated area.	4	3	1	3	24	-	L	Regular safety checks and maintenance of the storage tanks should be undertaken by suitably qualified safety officers.	Weekly	Environmental control officer	Included in Operational Costs
									All hydrocarbons should be stored in designated, bunded areas with a capacity of at least 110% of the volume stored.								Conduct inspections to determine if there are any compromises to the bunded facility.	Weekly	Environmental control officer	Included in Operational Costs
									Bunded areas should not allow seepage of pollutants into the ground or the run-off of polluted water.								Any rainfall and storm water collected within the bunded area should remain separate from other storm water and will need to be treated to an acceptable level prior to release.	Weekly	Environmental control officer	Included in Operational Costs
									Spill kits should be readily available and all employees must be trained in the utilisation thereof.								Inspect the availability and content of the spill kits in all areas of the operation.	Weekly	Environmental control officer	Included in Operational Costs
									Should a spill take place the area should be cleaned immediately and the contaminated area will be rehabilitated as appropriate.								Employees to report hydrocarbon spills that took place at the end of their shift to their supervisor, in order to record all spills.	End of shift	Supervisor	Included in Operational Costs
									Employees will be educated by means of training and the Environmental Awareness Plan to make them aware of the necessity to prevent spillages by the implementation of good housekeeping practices.								Employees must undergo induction and training in terms of the Environmental Awareness Plan.	Prior to appointment	Environmental control officer	Included in Operational Costs
									The management of chemicals and hydrocarbons should form part of the Emergency Response Programme.								Employees must undergo induction and training in terms of the Emergency Response Programme .	Prior to appointment	Environmental control officer	Included in Operational Costs
									In the event of a major spill that could result in major soil and water contamination the DWA should be informed immediately and a remediation strategy should be enforced.								Ensure that all Material Data Sheets (MSDS) is available for all material stored, and displayed properly.	Ongoing	Environmental control officer	Included in Operational Costs
									No activities associated with hydrocarbons and or chemicals (i.e. wash bays etc.) may be undertaken outside of an effectively designed contained area.								Employees must undergo induction and training in terms of the Emergency Response Programme .	Prior to appointment	Environmental control officer	Included in Operational Costs
Spillage and contamination of runoff water.	Stormwater management	8	4	3	4	60	-	M	Containment and transfer of 'dirty' water to a PCD	6	3	2	3	33	-	M	Ensure an appropriate stormwater management plan is in place on site.	Ongoing	Environmental control officer	Included in Operational Costs
Fuel storage areas not included in securely bunded area on site.	Fuel spillage	8	3	2	5	65	-	H	Construct bunded fuel storage area's	6	2	2	2	20	-	L	Report all spillages and expedite clean-up thereof.	On occurrence	Environmental control officer	Included in Operational Costs
Spills of hydrocarbons could mix with runoff water and pollute water resources.	Stormwater management	6	4	3	3	39	-	M	A suitable oil trap must be installed to remove hydrocarbons from runoff water and stores same for safe disposal off-site.	4	4	2	1	10	-	L	Inspect oil trap and storage of oil captured for disposal.	Daily	Environmental control officer	Included in Operational Costs
Issues related to SOIL, LAND USE AND LAND CAPABILITY																				

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION M	D	S	P	TOTAL	STATUS	SP	RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION M	D	S	P	TOTAL	STATUS	SP	ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
OPERATIONAL PHASE ACTIVITY 5: HYDROCARBON STORAGE AND HANDLING																				
The use of diesel, oil and other hazardous chemical substances may lead to the contamination of soils.	Hydrocarbon storage and handling	8	3	2	3	39	-	M	Non mining waste that include, but are not limited to, grease, lubricants, paints, flammable liquids, garbage, abandoned machinery and other combustible materials generated during activities should be placed and stored in a controlled manner in a designated area.	6	2	1	3	27	-	L	Regular safety checks and maintenance of the storage tanks should be undertaken by suitably qualified safety officers.	Weekly	Environmental control officer	Included in Operational Costs
									All hydrocarbons should be stored in designated, bunded areas with a capacity of at least 110% of the volume stored.								Conduct inspections to determine if there are any compromises to the bunded facility.	Weekly	Environmental control officer	Included in Operational Costs
									Bunded areas should not allow seepage of pollutants into the ground or the run-off of polluted water.								Any rainfall and storm water collected within the bunded area should remain separate from other storm water and will need to be treated to an acceptable level prior to release.	Weekly	Environmental control officer	Included in Operational Costs
									Spill kits should be readily available and all employees must be trained in the utilisation thereof.								Inspect the availability and content of the spill kits in all areas of the operation.	Weekly	Environmental control officer	Included in Operational Costs
									Should a spill take place the area should be cleaned immediately and the contaminated area will be rehabilitated as appropriate.								Employees to report hydrocarbon spills that took place at the end of their shift to their supervisor, in order to record all spills.	End of shift	Supervisor	Included in Operational Costs
									Employees will be educated by means of training and the Environmental Awareness Plan to make them aware of the necessity to prevent spillages by the implementation of good housekeeping practices.								Employees must undergo induction and training in terms of the Environmental Awareness Plan.	Prior to appointment	Environmental control officer	Included in Operational Costs
									The management of chemicals and hydrocarbons should form part of the Emergency Response Programme.								Employees must undergo induction and training in terms of the Emergency Response Programme .	Prior to appointment	Environmental control officer	Included in Operational Costs
									In the event of a major spill that could result in major soil and water contamination the DWA should be informed immediately and a remediation strategy should be enforced.								Ensure that all Material Data Sheets (MSDS) is available for all material stored, and displayed properly.	Ongoing	Environmental control officer	Included in Operational Costs
									No activities associated with hydrocarbons and or chemicals (i.e. wash bays etc.) may be undertaken outside of an effectively designed contained area.								Employees must undergo induction and training in terms of the Emergency Response Programme .	Prior to appointment	Environmental control officer	Included in Operational Costs
Issues related to FAUNA AND FLORA																				
Direct impacts on sensitive/pristine habitat types.	Storage & spillage	6	4	2	5	60	-	M	Develop proper storage & maintenance areas; ensure adequate bunding; use driptrays extensively; ensure spill clean-up packs and method guidance is provided.	6	4	2	3	36	-	M	Develop an action plan for the storage of hydrocarbons; implement preventative measures during filling and maintenance; develop action procedures in the event of a spill including reporting, cleaning, and rehabilitation; implement constant evaluation of systems and operational vehicles.	Ongoing	Environmental control officer/Health & Safety officer/ Ecologist/ Proponent	Included in Operational Costs
Impacts on surrounding habitat/species, including ecosystem functioning.	Storage & spillage	6	4	2	5	60	-	M	Develop proper storage & maintenance areas; ensure adequate bunding; use driptrays extensively; ensure spill clean-up packs and method guidance is provided.	6	4	2	3	36	-	M	Develop an action plan for the storage of hydrocarbons; implement preventative measures during filling and maintenance; develop action procedures in the event of a spill including reporting, cleaning, and rehabilitation; implement constant evaluation of systems and operational vehicles.	Ongoing	Environmental control officer/Health & Safety officer/ Ecologist/ Proponent	Included in Operational Costs

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION M	D	S	P	TOTAL	STATUS	SP	RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION M	D	S	P	TOTAL	STATUS	SP	ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
OPERATIONAL PHASE ACTIVITY 5: HYDROCARBON STORAGE AND HANDLING																				
The handling and storage of fuel and flammable chemicals creates a fire risk.	Fire risk	8	5	2	4	60	-	M	There shall be an emergency preparedness plan is in place in order to fight accidental fires should they occur.	6	2	1	3	27	-	L	Employees must undergo induction and training in terms of the Emergency Response Programme .	Prior to appointment	Environmental control officer	Included in Operational Costs
									There must be sufficient fire-fighting equipment. This equipment must fulfil the South African Occupation Health and Safety requirements.								Inspect the availability of the fire fighting equipment and ensure it is in working order.	Weekly	Environmental control officer	Included in Operational Costs
									All vegetation adjacent to the fuel storage tanks will be continually removed.								Conduct regular inspection and removal of vegetation around bunded areas.	Weekly	Environmental control officer	Included in Operational Costs
									The induction and awareness programmes will address fire-related issues.								All provisions relating to fire safety will be related during the induction and awareness training programme.	Prior to appointment	Environmental control officer	Included in Operational Costs
Faunal interactions with infrastructure, structures, servitudes and personnel.	Hydrocarbon storage and handling	4	5	3	4	48	-	M	It is likely that the animals will move to the surrounding areas when the construction activities start. The animals will move back once mining activities have ceased and rehabilitation has taken place. Rehabilitation will assist in the natural relocation of animals back into the area after mining.	4	5	3	2	24	-	M	Ensure that no animals are unnecessary hurt or influenced by the construction activities. No animals may be caught, hunted or poached. implement a strict penalty system for non-compliance	During construction phase	Environmental Control Officer/ Project Manager	Included in Operational Costs
Impacts on surrounding habitat or species, including ecosystem functioning	Hydrocarbon storage and handling	8	4	3	3	45	-	M	Construction activities should be limited to the designated areas.	8	4	2	3	42	-	M	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in Operational Costs
Increase in environmental degradation, pollution (air, soils, surface water)	Hydrocarbon storage and handling	4	5	3	4	48	-	M	Construction activities should be limited to the designated areas.	4	4	2	3	30	-	M	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	During construction phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in Operational Costs
Issues related to AIR QUALITY																				
Fugitive VOCs	Diesel storage	2	4	1	2	14	-	L	Appropriate design and air emissions licence application if necessary.	2	4	1	1	7	-	L	Design appropriate bunding. Apply for AEL if >500 m3	Once	Design Engineer/Environmental Control Officer	R 20 000.00
Issues related to NOISE																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TRAFFIC																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to VISUAL																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to SOCIAL																				
The handling and storage of fuel creates a fire risk. Please refer to the Fauna and Flora section for impacts associated with fire risk.	Fire risk	0	0	0	0	0	N	N	Please refer to the Fauna and Flora section for management measures and action plans associated with fire risk as a result of flammable chemical storage.	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
The use of diesel, oil and other hazardous chemical substances may lead to the contamination of soils and water resources. Please refer to the Hydrology/Geohydrology and Soil, Land Use and Land Capability sections for impacts associated with hydrocarbon storage and handling.	Hydrocarbon storage and handling	0	0	0	0	0	N	N	Please refer to the Hydrology/Geohydrology and Soil, Land Use and Land Capability sections for management measures and action plans associated with hydrocarbon storage and handling.	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 5: HYDROCARBON STORAGE AND HANDLING																				
Issues related to HERITAGE																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to WETLANDS																				
Water quality decline as a result of spills and leaks. The intensity of this impact may vary. Large fuel spills can result in the total loss of all aquatic biota, while small leaks may result in gradual loss of sensitive species over time. In either case, biodiversity will decline.	N/A	8	2	3	4	52	-	M	All hazardous material should be stored on impervious surfaces that allow for the containment of spills and leakages (e.g. bunded areas). Should spills occur, these should be reported to the environmental coordinator. Larger spills will require the appointment of specialist clean-up teams to rehabilitate the affected area. No hazardous materials may be stockpiled in any wetland area on site. Maintain aquatic biomonitoring programme. An emergency preparedness plan should be compiled detailing required actions in case of spills or leaks. Any spill/leak incidents should be followed up by auditable actions.	6	2	2	3	30	-	M	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental control officer	Included in Operational Costs.
Issues related to RADIATION																				
Impact on public safety as a result of exposure to radioactivity.	Radioactive elements	10	4	2	5	80	-	H	Develop a Radiation Management Plan.	6	4	1	4	44	-	M	Implement the Radiation Management Plan throughout the life of mine and monitor exposure of the public to radioactivity in accordance therewith.	Ongoing	Environmental control officer/Health & Safety officer	Included in Construction and Operational Costs

Table 6.11: Impacts and Management Measures for Operational Phase Activities: Change House

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 6: CHANGE HOUSE																				
Issues related to GEOLOGY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TOPOGRAPHY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to GEOHYDROLOGY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to HYDROLOGY																				
It is estimated that approximately 200 litres of water per person per day will be used for the purposes of the change house.	Surface water pollution	10	3	2	5	75	-	H	The mine will ensure optimum functioning, maintenance and drainage for the change house.	6	2	2	3	30	-	M	A dynamic water and salt balance will be drawn up by the mine prior to commencing with operational activities	Prior to operational activities	Environmental control officer	Included in Operational Costs
Wash water from the change house could pollute local water systems.	Surface water pollution	4	4	2	4	40	-	M	Wash water will be passed through an appropriate system of filters/silt traps to remove inorganic materials, before flowing into the sewage system.	4	4	1	1	9	-	L	Inspect filters/silt traps to ensure optimal functioning of the system.	Daily	Environmental control officer	Included in Operational Costs
Issues related to SOIL, LAND USE AND LAND CAPABILITY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to FAUNA AND FLORA																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to AIR QUALITY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to NOISE																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TRAFFIC																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to VISUAL																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to SOCIAL																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to HERITAGE																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to WETLANDS																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to RADIATION																				
Impact on public safety as a result of exposure to radioactivity.	Radioactive elements	10	4	2	5	80	-	H	Develop a Radiation Management Plan.	6	4	1	4	44	-	M	Implement the Radiation Management Plan throughout the life of mine and monitor exposure of the public to radioactivity in accordance therewith.	Ongoing	Environmental control officer/Health & Safety officer	Included in Construction and Operational Costs

Table 6.12: Impacts and Management Measures for Operational Phase Activities: Workshops & Washbay

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 7: WORKSHOPS & WASH BAY																				
Issues related to GEOLOGY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TOPOGRAPHY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to GEOHYDROLOGY																				
Risk of groundwater contamination as a result of workshop and wash bay related activities.	Groundwater pollution	8	4	2	5	70	-	H	Workshops and wash bays must be constructed within the dirty water area of the mine. Clean and dirty water separation structures to be constructed around the workshop and wash bay areas.	4	4	2	3	30	-	M	Designs of the separation structures to be undertaken in terms of GN704.	Prior to operation	Environmental control officer/Project Manager	Included in Operational Costs
									A downstream lined pollution control dam must be constructed for the collection of dirty water run-off from this delineated area.								Designs of the pollution control dams to be undertaken in terms of GN704.	Prior to operation	Environmental control officer/Project Manager	Included in Operational Costs
									A silt trap must be installed at the inflow of the pollution control dam to collect all suspended solids and prevent the dam from losing its design capacity through siltation.								The silt trap must be regularly inspected and cleaned to ensure optimum functioning.	Weekly	Environmental control officer/Project Manager	Included in Operational Costs
									All heavy vehicles within the mining rights area will make use of drip-trays when parked.								Ensure drip trays are adequately utilised and in working order.	Ongoing	Environmental control officer/Project Manager	Included in Operational Costs
Issues related to HYDROLOGY																				
Risk of surface water contamination as a result of workshop and wash bay related activities.	Surface water pollution	8	4	2	5	70	-	H	Workshops and wash bays must be constructed within the dirty water area of the mine. Clean and dirty water separation structures to be constructed around the workshop and wash bay areas.	4	4	2	3	30	-	M	Designs of the separation structures to be undertaken in terms of GN704.	Prior to operation	Environmental control officer/Project Manager	Included in Operational Costs
									A downstream lined pollution control dam must be constructed for the collection of dirty water run-off from this delineated area.								Designs of the pollution control dams to be undertaken in terms of GN704.	Prior to operation	Environmental control officer/Project Manager	Included in Operational Costs
									A silt trap must be installed at the inflow of the pollution control dam to collect all suspended solids and prevent the dam from losing its design capacity through siltation.								The silt trap must be regularly inspected and cleaned to ensure optimum functioning.	Weekly	Environmental control officer/Project Manager	Included in Operational Costs
									All heavy vehicles within the mining rights area will make use of drip-trays when parked.								Ensure drip trays are adequately utilised and in working order.	Ongoing	Environmental control officer/Project Manager	Included in Operational Costs
Wash water containing heavy silt loads could settle in pollution control dams and reduce storage capacity.	Surface water pollution	4	4	1	4	36	-	M	Suitable silt traps must be provided to trap and remove silt from wash water.	4	4	1	1	9	-	L	Inspect silt traps to ensure optimal functioning.	Daily	Environmental control officer	Included in Operational Costs
Runoff from workshops and washbays could be contaminated with hydrocarbons.	Surface water pollution	4	4	3	3	33	-	M	Suitable oil traps must be provided to trap and store hydrocarbons for safe disposal off-site.	4	4	1	1	9	-	L	Inspect oil traps to ensure optimal functioning.	Daily	Environmental control officer	Included in Operational Costs
Issues related to SOIL, LAND USE AND LAND CAPABILITY																				
Risk of soil contamination as a result of workshop and wash bay related activities.	Soil contamination	8	4	2	5	70	-	H	Workshops and wash bays must be constructed within the dirty water area of the mine. Clean and dirty water separation structures to be constructed around the workshop and wash bay areas.	4	4	2	3	30	-	M	Designs of the separation structures to be undertaken in terms of GN704.	Prior to operation	Environmental control officer/Project Manager	Included in Operational Costs
									A downstream lined pollution control dam must be constructed for the collection of dirty water run-off from this delineated area.								Designs of the pollution control dams to be undertaken in terms of GN704.	Prior to operation	Environmental control officer/Project Manager	Included in Operational Costs

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 7: WORKSHOPS & WASH BAY																				
									A silt trap must be installed at the inflow of the pollution control dam to collect all suspended solids and prevent the dam from losing its design capacity through siltation.								The silt trap must be regularly inspected and cleaned to ensure optimum functioning.	Weekly	Environmental control officer/Project Manager	Included in Operational Costs
									All heavy vehicles within the mining rights area will make use of drip-trays when parked.								Ensure drip trays are adequately utilised and in working order.	Ongoing	Environmental control officer/Project Manager	Included in Operational Costs
Issues related to FAUNA AND FLORA																				
Direct impacts on sensitive/pristine habitat types.	Operational activities	6	4	2	3	36	-	M	Prevent spillages and effluent spillage.	4	4	2	2	20	-	L	Develop an action plan for the prevention of effluent spillage; develop a procedure in the event of a spillage, including reporting, cleaning, and rehabilitation; implement constant evaluation of systems and operational vehicles; and implement awareness training.	Ongoing	Environmental control officer/Health & Safety officer/ Ecologist/ Proponent	Included in Operational Costs
Impacts on surrounding habitat/species, including ecosystem functioning.	Operational activities	6	4	2	3	36	-	M	Prevent spillages and effluent spillage.	4	4	2	2	20	-	L	Develop an action plan for the prevention of effluent spillage; develop a procedure in the event of a spillage, including reporting, cleaning, and rehabilitation; implement constant evaluation of systems and operational vehicles; and implement awareness training.	Ongoing	Environmental control officer/Health & Safety officer/ Ecologist/ Proponent	Included in Operational Costs
Issues related to AIR QUALITY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to NOISE																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TRAFFIC																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to VISUAL																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to SOCIAL																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to HERITAGE																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to WETLANDS																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to RADIATION																				
Impact on public safety as a result of exposure to radioactivity.	Radioactive elements	10	4	2	5	80	-	H	Develop a Radiation Management Plan.	6	4	1	4	44	-	M	Implement the Radiation Management Plan throughout the life of mine and monitor exposure of the public to radioactivity in accordance therewith.	Ongoing	Environmental control officer/Health & Safety officer	Included in Construction and Operational Costs

Table 6.13: Impacts and Management Measures for Operational Phase Activities: Treatment of Sewage Effluent

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 8: TREATMENT OF SEWAGE EFFLUENT																				
Issues related to GEOLOGY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TOPOGRAPHY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to GEOHYDROLOGY																				
Contamination of underlying aquifer	Sewage effluent treatment/transport	6	4	2	4	48	-	M	Lining of sewage treatment facility, maintenance of infrastructure, treatment of effluent, closed system	4	4	1	2	18	-	L	Lining of sewage treatment facility, maintenance of infrastructure, treatment of effluent, closed system, Groundwater monitoring	Quarterly monitoring, including bacteria	Mine Environmental Manager	Included in Operational Costs
Seepage from the on site sewage management facility can occur if not managed correctly .	Sewage treatment facility	10	3	2	3	45	-	M	Maintenance features should be designed properly.	6	2	1	3	27	-	L	Maintain and implement relevant measures and upgrade where and when necessary.	Ongoing	Environmental control officer/Project Manager	Included in Operational Costs
									Follow the Emergency Response procedure in the event of a major spillage incident.								Follow the Emergency Response Procedure in the event of a major spillage incident.	Ongoing	Environmental control officer/Project Manager	Included in Operational Costs
									Monitoring programme should be maintained for organic compounds.								Monitor the organic compounds from the facility as part of the surface and groundwater monitoring programme on a quarterly basis, or as requested from the DWA.	Quarterly	Environmental control officer/Project Manager	Included in Operational Costs
									The containment facility around the treatment plant should be adequate for any accidental spillages.								Conduct weekly assessments on the containment facility of the sewage treatment facility.	Weekly	Environmental control officer/Project Manager	Included in Operational Costs
									Groundwater quality monitoring networks must be set up prior to the construction phase so that any groundwater quality and quantity issues can be addressed accordingly.								Groundwater quality sampling will be undertaken on a monthly basis and analysed according to the prescribed monitoring programme contained in the EIA/EMP.	Monthly	Environmental Control Officer/Project Manager	R 91 000.00
																	Quarterly groundwater monitoring reports will be generated by the mine or through a qualified water quality specialist.	Quarterly	Environmental control officer/Water Quality Specialist	R 42 000.00
																	In the event that water quality or quantity issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental control officer/Water Quality Specialist	To be determined - depending on severity of incident
Issues related to HYDROLOGY																				
Seepage from the on site sewage management facility can occur if not managed correctly .	Sewage treatment facility	10	3	2	3	45	-	M	Maintenance features should be designed properly.	6	2	1	3	27	-	L	Maintain and implement relevant measures and upgrade where and when necessary.	Ongoing	Environmental control officer/Project Manager	Included in Operational Costs
									Follow the Emergency Response procedure in the event of a major spillage incident.								Follow the Emergency Response Procedure in the event of a major spillage incident.	Ongoing	Environmental control officer/Project Manager	Included in Operational Costs
									Monitoring programme should be maintained for organic compounds.								Monitor the organic compounds from the facility as part of the surface and groundwater monitoring programme on a quarterly basis, or as requested from the DWA.	Quarterly	Environmental control officer/Project Manager	Included in Operational Costs
									The containment facility around the treatment plant should be adequate for any accidental spillages.								Conduct weekly assessments on the containment facility of the sewage treatment facility.	Weekly	Environmental control officer/Project Manager	Included in Operational Costs
									Surface water quality monitoring networks must be set up prior to the construction phase so that any surface								Surface water quality sampling will be undertaken on a monthly basis and analysed according to the prescribed	Monthly	Environmental Control Officer/Project Manager	R 91 000.00

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 8: TREATMENT OF SEWAGE EFFLUENT																				
									water quality issues can be addressed accordingly.								monitoring programme contained in the EIA/EMP.			
																	Quarterly surface water monitoring reports will be generated by the mine or through a qualified water quality specialist.	Quarterly	Environmental control officer/Water Quality Specialist	R 42 000.00
																	In the event that water quality issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental control officer/Water Quality Specialist	To be determined - depending on severity of incident
Sewage from the mining site could pollute local water systems.	Sewage treatment facility	4	4	2	4	40	-	M	An appropriate sewage treatment plant will treat water to acceptable standards before discharging.	4	4	1	1	9	-	L	Maintain and implement relevant measures and upgrade where and when necessary.	Ongoing	Environmental control officer/Project Manager	Included in Operational Costs
Issues related to SOIL, LAND USE AND LAND CAPABILITY																				
Chemical soil pollution	Spillage and seepage of wastewater	2	5	8	5	75	-	H	Proper chemical waste management	1	3	4	4	32	-	M	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental control officer/Project Manager	Included in Operational Costs
Stream flow reduction will be caused by separating the clean and dirty water through berms and trenches.	Sewage treatment facility	8	2	2	4	48	-	M	Discharge points for clean storm water and treated effluent should include erosion protection measures as well as energy dissipaters and should release flows in a diffuse manner to encourage dispersion.	4	2	1	3	21	-	L	Inspect sewage plant for leaks .	Daily	Environmental control officer	Included in Operational Costs
Issues related to FAUNA AND FLORA																				
Direct impacts on sensitive/pristine habitat types.	Sewage treatment facility	6	4	2	3	36	-	M	Prevent any open/standing water; prevent effluent spillage.	6	4	2	1	12	-	L	Develop and implement amonitoring programme; prevent any effluent spillage/leaking; discourage animals from utlising unnatural sources of water.	Ongoing	Environmental control officer/Health & Safety officer/ Ecologist/ Proponent	Included in Operational Costs
Direct impacts on common fauna species of the study area.	Sewage treatment facility	6	4	2	4	48	-	M	Prevent any open/standing water; prevent effluent spillage.	6	4	2	2	24	-	L	Develop and implement amonitoring programme; prevent any effluent spillage/leaking; discourage animals from utlising unnatural sources of water.	Ongoing	Environmental control officer/Health & Safety officer/ Ecologist/ Proponent	Included in Operational Costs
Faunal interaction with structures, servitudes and/or personnel.	Sewage treatment facility	6	4	2	4	48	-	M	Prevent any open/standing water; prevent effluent spillage.	6	4	2	2	24	-	L	Develop and implement amonitoring programme; prevent any effluent spillage/leaking; discourage animals from utlising unnatural sources of water.	Ongoing	Environmental control officer/Health & Safety officer/ Ecologist/ Proponent	Included in Operational Costs
Impacts on surrounding habitat/species, including ecosystem functioning.	Sewage treatment facility	6	4	3	4	52	-	M	Prevent any open/standing water; prevent effluent spillage.	6	4	3	2	26	-	L	Develop and implement amonitoring programme; prevent any effluent spillage/leaking; discourage animals from utlising unnatural sources of water.	Ongoing	Environmental control officer/Health & Safety officer/ Ecologist/ Proponent	Included in Operational Costs
Issues related to AIR QUALITY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to NOISE																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TRAFFIC																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to VISUAL																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to SOCIAL																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 8: TREATMENT OF SEWAGE EFFLUENT																				
Issues related to HERITAGE																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to WETLANDS																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to RADIATION																				
Impact on public safety as a result of exposure to radioactivity.	Radioactive elements	10	4	2	5	80	-	H	Develop a Radiation Management Plan.	6	4	1	4	44	-	M	Implement the Radiation Management Plan throughout the life of mine and monitor exposure of the public to radioactivity in accordance therewith.	Ongoing	Environmental control officer/Health & Safety officer	Included in Construction and Operational Costs

Table 6.14: Impacts and Management Measures for Operational Phase Activities: Conveyor Belt

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 9: CONVEYOR BELT																				
Issues related to GEOLOGY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TOPOGRAPHY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to GEOHYDROLOGY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to HYDROLOGY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to SOIL, LAND USE AND LAND CAPABILITY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to FAUNA AND FLORA																				
Loss/disruption of mammal migration routes.	Conveyor belt operation	4	4	2	2	20	-	L	Ensure constant maintenance; prevent use of servitudes as roads/throughfares by personnel/vehicles.	4	4	2	1	10	-	L	Develop and implement a biodiversity monitoring and management programme.	Ongoing/Bi-annual	Environmental control officer/Ecologist	Included in Operational Costs.
Direct impacts on sensitive/pristine habitat types.	Conveyor belt operation	4	4	2	2	20	-	L	Limit impacts to approved servitudes only.	4	4	2	1	10	-	L	Develop and implement a biodiversity monitoring and management programme.	Ongoing/Bi-annual	Environmental control officer/Ecologist	Included in Operational Costs.
Direct impacts on common fauna species of the study area.	Conveyor belt operation	2	4	2	2	16	-	L	Ensure constant maintenance; prevent use of servitudes as roads/throughfares by personnel/vehicles.	2	4	2	1	8	-	L	Develop and implement a biodiversity monitoring and management programme.	Ongoing/Bi-annual	Environmental control officer/Ecologist	Included in Operational Costs.
Faunal interaction with structures, servitudes and/or personnel.	Conveyor belt operation	2	4	2	2	16	-	L	Ensure constant maintenance; prevent use of servitudes as roads/throughfares by personnel/vehicles.	2	4	2	1	8	-	L	Develop and implement a biodiversity monitoring and management programme.	Ongoing/Bi-annual	Environmental control officer/Ecologist	Included in Operational Costs.
Impacts on surrounding habitat species, including ecosystem functioning.	Conveyor belt operation	2	4	2	2	16	-	L	Limit impacts to approved servitudes only.	2	4	2	1	8	-	L	Develop and implement a biodiversity monitoring and management programme.	Ongoing/Bi-annual	Environmental control officer/Ecologist	Included in Operational Costs.
Issues related to AIR QUALITY																				
Fugitive dust emissions	Ore handling	4	4	1	4	36	-	M	Design conveyor belts with covers.	2	4	1	3	21	-	L	Include dust mitigation measures during the design phase of the conveyor belts. Establish dust monitoring system alon conveyor belt routes.	Once off	Design Engineer	Included in Operational Costs.
Issues related to NOISE																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TRAFFIC																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to VISUAL																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to SOCIAL																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to HERITAGE																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to WETLANDS																				
Dust from conveyors, trucks, roads and bridge crossings may be flushed aor blown into the surface waters. This would lead to increased turbidity (decreased water quality) and	Deterioration in water quality	8	4	3	4	60	-	M	Conveyor routes should avoid wetland areas. No dirty storm water may be discharged into any wetland or water resource on site unless treated to the required standards. Overloading of	6	4	3	3	39	-	M	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental control officer	Included in Operational Costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 9: CONVEYOR BELT																				
sedimentation. In addition, dust may cause a salinisation and acidification of surface waterbodies, either directly or via subsurface seepage. This may lead to a deterioration in biotic integrity. and loss of sensitive biota.									trucks must be prohibited and stirctly enforced to reduce spillages. Dust control measures must be employed. Spills should be prevented and an emergency preparedness plan put in place to cater for major spills.											
Issues related to RADIATION																				
Impact on public safety as a result of exposure to radioactivity.	Radioactive elements	10	4	2	5	80	-	H	Develop a Radiation Management Plan.	6	4	1	4	44	-	M	Implement the Radiation Management Plan throughout the life of mine and monitor exposure of the public to radioactivity in accordance therewith.	Ongoing	Environmental control officer/Health & Safety officer	Included in Construction and Operational Costs

Table 6.15: Impacts and Management Measures for Operational Phase Activities: Tailings Storage Facility (TSF)

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 10: TAILINGS STORAGE FACILITY																				
Issues related to GEOLOGY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TOPOGRAPHY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to GEOHYDROLOGY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to HYDROLOGY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to SOIL, LAND USE AND LAND CAPABILITY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to FAUNA AND FLORA																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to AIR QUALITY																				
Fugitive dust emissions	Ore handling	4	4	1	4	36	-	M	Implement speed control and wetting of road surfaces.	2	4	1	3	21	-	L	Include dust mitigation measures during the design phase of the conveyor belts. Implement vehicle handling procedures and monitor/manage implementation thereof continuously.	Once off	Environmental Control Office/Health and Safety Officer	Included in Operational Costs.
Windblown dust generation	TSF operation	6	5	2	4	52	-	M	Implement appropriate edge design and revegetate where possible.	4	4	2	4	40	-	M	Erect vegetative wind breaks.	Ongoing	Environmental Control Office	Included in Operational Costs.
																	Explore the revegetation and dump cladding options.	Ongoing	Environmental Control Office	Included in Operational Costs.
																	Extend dust fallout monitoring system into neighbouring communities/townships.	Ongoing	Environmental Control Office	Included in Operational Costs.
Issues related to NOISE																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TRAFFIC																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to VISUAL																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to SOCIAL																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to HERITAGE																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to WETLANDS																				
Seepage from the tailings facilities and waste rock dumps could potentially lead to the formation of acid rock drainage and contamination of groundwater. Contaminated groundwater may find its way into wetlands and streams.	Water Quality Impacts	6	4	2	5	60	-	M	Clean and dirty water must at all times be separated. Clean water should be diverted around dirty areas and returned to the natural water resources. Dirty water systems should meet the requirements of GN704 as a minimum. No dirty water may be discharged on site. Leaks or spills associated with the tailings facilities should be prevented as far as possible and immediate remedial action taken in the event of an incident. The	4	4	2	5	50	-	M	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental control officer	Included in Operational Costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 10: TAILINGS STORAGE FACILITY																				
									tailings facility should be suitably lined and designed according to stringent safety standards. An emergency preparedness plan should be compiled in case of a major incident.											
Water quality impacts, resulting from spills, leaks (e.g. from dirty water pipelines), dust, dirty stormwater or seepage (from stockpiles and tailings facilities), will result in the loss of taxa that may be sensitive to water quality.	Loss of biodivertisty	6	4	3	5	65	-	H	Implementation of all mitigation measures listed for erosion control and water quality management will reduce the severity of impacts. An emergency preparedness plan should be compiled and implemented in the event of major spills (e.g. fuel, mine water or tailings). Dust suppression measures should be used. A biomonitoring plan should be compiled and implemented and should include assessments of water quality, habitats and aquatic macroinvertebrates. Sampling sites further down in the Doring River catchment should be included to assess impacts on downstream ecosystems. All mitigation measures relating to water quality should be audited with prompt follow-up action taken in the event of non-compliances.	6	4	3	4	52	-	M	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental control officer	Included in Operational Costs.
Issues related to RADIATION																				
Impact on public safety as a result of exposure to radioactivity.	Radioactive elements	10	4	2	5	80	-	H	Develop a Radiation Management Plan.	6	4	1	4	44	-	M	Implement the Radiation Management Plan throughout the life of mine and monitor exposure of the public to radioactivity in accordance therewith.	Ongoing	Environmental control officer/Health & Safety officer	Included in Construction and Operational Costs

Table 6.16: Impacts and Management Measures for Operational Phase Activities: Operation of Plant

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 11: OPERATION OF PLANT																				
Issues related to GEOLOGY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TOPOGRAPHY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to GEOHYDROLOGY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to HYDROLOGY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to SOIL, LAND USE AND LAND CAPABILITY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to FAUNA AND FLORA																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to AIR QUALITY																				
Fugitive dust emissions	Ore handling	4	4	1	4	36	-	M	Implement speed control and wetting of road surfaces.	2	4	1	3	21	-	L	Include dust mitigation measures during the design phase of the conveyor belts. Implement vehicle handling procedures and monitor/manage implementation thereof continuously.	Once off	Environmental Control Office/Health and Safety Officer	Included in Operational Costs.
Fugitive dust emissions	Crushing	6	4	1	4	44	-	M	Ensure crushing operations are covered and sprays for dust suppression are utilised.	2	4	1	3	21	-	L	Include dust mitigation measures during the design phase of the conveyor belts. Implement vehicle handling procedures and monitor/manage implementation thereof continuously.	Once off	Environmental Control Office/Health and Safety Officer	Included in Operational Costs.
Issues related to NOISE																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TRAFFIC																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to VISUAL																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to SOCIAL																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to HERITAGE																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to WETLANDS																				
Discharge of stormwater usually occurs at low points in the landscape, often into wetland areas. Increased flow volumes and velocities result in erosion and channel incision within the wetlands, as well as deteriorating water quality.	Erosion at Stormwater Outlets	6	4	2	5	60	-	M	Generation of stormwater should be minimised (see Section 7.4.3 above). A detailed stormwater management needs to be compiled and implemented. Sediment and litter traps should be incorporated at inlets to the stormwater system. Only clean water should be discharged and discharge points should be located outside wetland areas. Points of discharge should be protected against erosion and regularly monitored for erosion damage. Any damage should be	4	2	2	5	40	-	M	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental control officer	Included in Operational Costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 11: OPERATION OF PLANT																				
									immediately repaired and corrective measures put in place to prevent further erosion damage.											
The storage of fuel on site, the wash bay and workshops provide sources of hydrocarbon pollution, while the waste rock dumps could potentially lead to the formation of acid rock drainage. The waste storage and handling facilities also pose a source of a number of pollutants and toxicants that could potentially enter downslope wetlands.	Water Quality Impacts	6	4	2	5	60	-	M	Clean and dirty water must at all times be separated. Clean water should be diverted around dirty areas and returned to the natural water resources. Discharge points of clean water should be protected against erosion and should aim to mimic the hydrology of the receiving water resource. No concentrated discharge should take place. Discharge points should also be regularly monitored and damage repaired. Dirty water systems should meet the requirements of GN704 as a minimum. No dirty water may be discharged on site.	4	4	2	5	50	-	M	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental control officer	Included in Operational Costs.
Water quality impacts, resulting from spills, leaks (e.g. from dirty water pipelines), dust, dirty stormwater or seepage, will result in the loss of taxa that may be sensitive to water quality. In addition, altered hydrology, in terms of timing, duration and quantity of water will affect habitat availability. Reduced flows or shorter periods of inundation may reduce both the availability and suitability of habitats and will have an impact on aquatic fauna.	Loss of biodiversity	6	4	3	5	65	-	H	Implementation of all mitigation measures listed for erosion control and water quality management will reduce the severity of impacts. An emergency preparedness plan should be compiled and implemented in the event of major spills (e.g. fuel, mine water or sewage spill). Dust suppression measures should be used. A biomonitoring plan should be compiled and implemented and should include assessments of water quality, habitats and aquatic macroinvertebrates. Sampling sites further down in the Doring River catchment should be included to assess impacts on downstream ecosystems. All mitigation measures relating to water quality should be audited with prompt follow-up action taken in the event of non-compliances.	6	4	3	4	52	-	M	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental control officer	Included in Operational Costs.
Issues related to RADIATION																				
Impact on public safety as a result of exposure to radioactivity.	Radioactive elements	10	4	2	5	80	-	H	Develop a Radiation Management Plan.	6	4	1	4	44	-	M	Implement the Radiation Management Plan throughout the life of mine and monitor exposure of the public to radioactivity in accordance therewith.	Ongoing	Environmental control officer/Health & Safety officer	Included in Construction and Operational Costs

Table 6.17: Impacts and Management Measures for Operational Phase Activities: Linear Infrastructure

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 12: LINEAR INFRASTRUCTURE																				
Issues related to GEOLOGY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TOPOGRAPHY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to GEOHYDROLOGY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to HYDROLOGY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to SOIL, LAND USE AND LAND CAPABILITY																				
Soil compaction	Construction of infrastructure	2	4	6	4	48	-	M	Keep infrastructure localized to reduce footprint	2	4	4	4	40	-	M	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental Control Officer	Included in Operational Costs.
Soil erosion	Vegetation removal during construction and operations	1	5	8	4	56	-	M	Keep as much original landcover/topsoil as possible	1	3	4	4	32	-	M	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental Control Officer	Included in Operational Costs.
Issues related to FAUNA AND FLORA																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to AIR QUALITY																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to NOISE																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TRAFFIC																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to VISUAL																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to SOCIAL																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to HERITAGE																				
No significant impacts are envisaged during the operational phase .	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to WETLANDS																				
Leaking pipelines carrying dirty water will result in contamination of surface water or groundwater. Leaks from clean or dirty water pipelines may also create localised erosion nick-points.	Leaking water pipelines	8	3	2	3	39	-	M	Pipelines should be regularly inspected for leaks and for erosion nick-points. Any incident involving leaking pipelines should be immediately addressed in an auditable fashion. An emergency preparedness plan should be compiled and implemented in case of major leaks. Erosion nick-points should be stabilised, where possible.	6	2	2	3	30	-	M	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental control officer	Included in Operational Costs.
Loss of sensitive biota and habitats as a result of spills or leaks from dirty water pipelines. The severity of this impact will depend on the locality.	Loss of biodiversity	6	5	3	2	28	-	L	Pipelines should be regularly inspected for leaks and for erosion nick-points. Any incident involving leaking pipelines should be immediately addressed in an auditable fashion. An emergency preparedness plan should be compiled and implemented in case of major	6	5	2	2	26	-	L	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental control officer	Included in Operational Costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
OPERATIONAL PHASE ACTIVITY 12: LINEAR INFRASTRUCTURE																				
									leaks. Erosion nick-points should be stabilised, where possible.											
Issues related to RADIATION																				
Impact on public safety as a result of exposure to radioactivity.	Radioactive elements	10	4	2	5	80	-	H	Develop a Radiation Management Plan.	6	4	1	4	44	-	M	Implement the Radiation Management Plan throughout the life of mine and monitor exposure of the public to radioactivity in accordance therewith.	Ongoing	Environmental control officer/Health & Safety officer	Included in Construction and Operational Costs

6.5 Closure and Decommissioning Phase

Closure for mining activities is highly important as far as the environmental factors are concerned. If mitigation measures are not followed properly it could have devastating impacts. As closure without mitigation factors could have a permanent effect on the area and its surrounds.

The mine will be required to apply for a Closure Certificate according to Section 43 of the MPRDA. Section 43 (1) of the MPRDA stated that *"the holder of a … mining right …remains responsible for any environmental liability, pollution or ecological degradation, and the management thereof, until the Minister has issued a closure certificate to the holder concerned"*.

It is therefore assumed that all environmental impacts will be successfully addressed and managed at this phase. When the decision is taken to decommission the mine, the activities below will be implemented:

- Recovery of all saleable infrastructure;
- Demolition of structures;
- Ripping of all compacted areas, which will be followed with amelioration and vegetation;
- Ensure that all remaining dumps, piles and slopes are sufficiently shaped to blend in with the surrounding infrastructure;
- Amelioration and vegetation of all disturbed areas;
- Maintenance of all re-vegetated areas up until such areas initiate succession and create a sustainable cover;
- Monitoring of key environmental variables (i.e. soils, vegetation, groundwater and
- surface water) in order to demonstrate stability of rehabilitated areas;
- Weed management after closure, limited to areas disturbed by mining or included in the mining area.
- Monitoring will be undertaken for a specific period after closure or up until such time that all areas create a sustainable cover and ecosystem.

6.5.1 Removal of Infrastructure

Following cessation of mining and processing, it is planned that all infrastructures will be decommissioned and removed from site in a systematic and regulated manner. The following activities will be conducted during the decommissioning and closure phase of the project:

Buildings

- All infrastructure will be removed and rehabilitated, should no alternative use be found for the structures;
- Foundations will be removed to a depth of 1m below surface;
- An alternative use for the brick structures will first be sought i.e. they can either be sold/donated to the post-mining landowner on sale of the land. If an alternative use cannot be found, the buildings will be demolished; and
- All material recovered from the demolition of buildings and/or structures will either be transported to a permitted disposal site, sold as scrap or made available to the local community as building materials (provided they are in a satisfactory condition following demolition).

Linear Infrastructure

- Linear infrastructure constructed by the mine (i.e. roads, conveyors and power lines) will be removed if it proves to inhibit land use at decommissioning. Where possible infrastructure will remain for future mining operations as determined by Wits Gold or for social investment opportunities, this will be decided in conjunction with IDP of the area and the local authorities (i.e. municipality). The soils and land capability will be rehabilitated to near pre-mining conditions;
- All roads will be rehabilitated by ripping these structures to a depth of 500mm;
- All fences erected around the mine and linear infrastructure will be dismantled and either disposed of at a permitted disposal site or sold as scrap (provided these structures will no longer be required by the post-mining land owner). Fences erected to cordon-off dangerous excavations will remain in place and will be maintained as and when required; and
- Any overland conveyors, if not used as transportation system by another operation or as a community initiative, will be disassembled and the components removed from the site. The material can either be sold (as a unit) or the components sold as scrap.

Pollution Control Dams

- All PCDs will be maintained to ensure that no leakages occur;
- Overflow pipes will be kept clean;
- Sumps will be kept clean and all pumps will be maintained; and
- The pollution control dams will only be demolished should the area prove to be free draining with no pollution potential after rehabilitation.

6.5.2 Active Rehabilitation - Landscaping

Landscaping activities will involve the active rehabilitation of the area with the following activities taking place:

- Recovery of all saleable infrastructure;
- Demolition and removal of all buildings and structures;
- Ripping of all compacted areas, which will be followed with amelioration and vegetation;
- Ensure that all remaining piles and slopes are sufficiently shaped to blend in with the surrounding environment;
- Amelioration and vegetation of all disturbed areas;
- Maintenance of all re-vegetated areas up until such areas initiate succession and create a sustainable cover;
- Monitoring of key environmental variables (i.e. soils, vegetation, groundwater and surface water) in order to demonstrate stability of rehabilitated areas; and
- Weed management after closure, limited to areas disturbed by mining or included as infrastructure related to the mine.

The final plans for active rehabilitation of the shafts (vertical incline and ventilation) as well as the Brownfields TSF facility have not yet been finalised. The final placement and approach to rehabilitation will be determined during the Bankable Feasibility Study (BFS) for the proposed operation, due for completion in July 2013. It is anticipated that, as a minimum, the shaft area will require fencing around the shafts and capping to make them safe. With regard to the Brownfields TSF site it is anticipated that the slopes will have to be shaped and sloped and vegetation cover established to be self-sustaining. In addition a detailed stormwater management plan will have to be developed for the Brownfields TSF site post operation.

6.5.3 Residual Impacts Post Closure

Although it is assumed that all impacts will be managed and rehabilitated by the closure objectives, some residual impacts may however still be present.

6.5.4 Geohydrology

The groundwater levels in the underground mining area will probably recover during the decommissioning and post-closure phases when mine dewatering is stopped. The groundwater level recovery will depend on a) the extent of interaction and b) dewatering of neighbouring mines. No decant is foreseen due to the topographic position of the mine. The single largest risk in terms of post closure impacts is that of aquifer contamination caused by leachate from the new TSF to be located on the Merriespruit TSF. Static leach tests that were undertaken on a comprehensive tailings sample indicated arsenic (As) concentration of 11 mg/l and sulphate concentration of 700 mg/l. A plume could potentially migrate a 1000 m in a north-westerly direction from the TSF a hundred years after closure.

Pyrite (FeS_2) is present as minor mineral in the tailings. Pyrite will be the major contributor to the products of acid-mine drainage in the tailings. Carbonate minerals which are responsible for buffering, are absent in the tailings and therefore the tailings sample will have a definite potential to produce acid drainage over the long term.

- Various metals were also found in the tailings water in elevated concentrations which exceeded the SANS 241 drinking water standard. These elevated metals include Al, As, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb and Sb. These metals are likely to be associated with the tailings material and could therefore impact on both surface water and groundwater resources. The constituents SO_4, EC and NH_3 were also found in levels exceeding the SANS 241 drinking water standard. The total cyanide level exceeds the screening level SSV1 for Human Health and water resource protection and therefore poses a potential risk to the groundwater.

6.5.5 Hydrology

It is anticipated that most risks posed to local surface water resources could be effectively managed by an appropriate storm-water management plan.

- Deep seepage from tailings and slimes facilities into local watercourses is unlikely due to the location of discard facilities far from rivers and streams. It is possible that a TSF located towards the east of the planned discard area could allow seepage into deep and well-drained sandy soils that will eventually seep into local river systems. The design of TSFs should consider seepage risks and, if needed, make allowance for sealing or lining of the base of a TSF.
- Other seepage will be collected by means of return water drains and transferred to return water dams. In this case, where stormwater will be treated and discharged, water from return water dams should be considered first priority water supply to processing and treatment plants.
- A concern that needs to be considered is that dust created in TSFs could add to local atmospheric pollution. Dust from the tailings dams of other mines in the vicinity of the town of Virginia is widely claimed to pose health risks to local

inhabitants. Dust suppression on the TSFs constructed for this mine is considered to be important.

- Dirty water runoff conveyance and storage systems at the mine will be controlled by structures and control measures prescribed in the Storm-water Management Plan.

6.5.6 Soils, Land Use and Land Capability

For the impact assessment, all the following phases of the project cycle were considered for potential impacts on soil and land capability. Below is a description of each of the activities per closure phase that may result in soil impacts:

- Removal of infrastructure from soil surfaces;
- Removal of topsoil from stockpiles and using it to re-establish vegetation in disturbed areas;
- Increased traffic on haul roads to transport waste materials off-site as well as with construction vehicles to do rehabilitation; and
- It is anticipated that the TSF will remain on site in perpetuity due its permanent nature.

6.5.7 Fauna & Flora

No impacts were identified that could lead to a beneficial impact on the ecological environment of the study area since the proposed development is largely destructive. The following impacts were identified that are relevant to the proposed development:

- Direct impacts:
  - Direct impacts on flora species of conservation importance;
  - Direct impacts on fauna species of conservation importance;
  - Loss, or disruption of mammal migration routes on a local scale;
  - Direct impacts on sensitive/ pristine habitat types of the study area; and
  - Direct impacts on common fauna species occurring on the study area.
- Indirect Impacts:
  - Faunal interactions with structures, servitudes and personnel; and
  - Impacts on surrounding habitat/ species, including ecosystem functioning.

6.5.8 Wetlands

The following impacts are expected to occur as a result of the proposed project activities:

Decommissioning and Closure Phase:

- Increased sediment movement into adjacent wetlands;
- Water quality deterioration due to handling, leaks and spills of a variety of polluting substances on site, as well as through removing and handling of waste and contaminated materials; and
- Decant of acidic mine water from the underground workings.

6.5.9 Air Quality

The closure activities will result in dust emissions, both from mining activities and fugitive emissions from the large areas of previously vegetated land that will now be exposed. Provided sufficient mitigation measures are instigated, it is unlikely that these emissions resulting from mining activity will result in the exceedence of South Africa's guidelines for particulate emissions.

The dump is an area of concern, although it is impossible to determine whether the emissions that result from Wits Gold DBM's activities will increase or decrease the fugitive dust emissions from the dump in question. It is recommended that care be taken in the rehabilitation design of the dump, and that the existing dust fall out monitoring network be redesigned to centre around the rehabilitation activities, with monitors in the sensitive reception areas of Virginia and Meloding.

6.5.10 Traffic

Implement and monitor the traffic volumes throughout the life of mine including closure and decommissioning.

6.5.11 Social

Wits Gold must continue to monitor the impact on the social environment as a result of closure and decommissioning in accordance with the social and labour plan and other Wits Gold HR plans.

6.5.12 Heritage

Care should also be taken when rehabilitation commences that if any more artifacts are uncovered, a qualified archaeologist be called in to investigate. In addition Wits Gold must continue to minimize any impacts on the currently identified sites and any future findings of significance.

6.5.13 Radiation

Impact on public safety as a result of exposure to radioactivity.

Table 6.18 - Table 6.20 details the identified impacts and management measures for the closure and decommissioning activities.

Table 6.18: Impacts and Management Measures for Closure Phase Activities: Removal of Infrastructure

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 1: REMOVAL OF INFRASTRUCTURE																				
Issues related to GEOLOGY																				
No significant closure and decommissioning impacts are envisaged.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TOPOGRAPHY																				
No significant closure and decommissioning impacts are envisaged.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to GEOHYDROLOGY																				
Contaminant soil could impact on groundwater quality	Plant, PCD's, workshops, other infrastructure	4	5	1	3	30	-	M	Removal of dirty soil to landfill	2	5	1	2	16	-	L	Removal of dirty soil to landfill	At closure	Mine Environmental Manager	Included in closure costs.
Issues related to HYDROLOGY																				
Erosion control over rehabilitated areas and the prevention of erosion gullies.	Erosion	8	2	2	4	48	-	M	The topography of all disturbed areas must be rehabilitated in such a manner that the surrounding natural area blends naturally with the rehabilitated areas well as to be free-draining. This will reduce soil erosion and improve natural re-vegetation.	6	2	2	3	30	-	M	Wits Gold will implement the approved rehabilitation plan, and monitor progress by maintaining a photographic record.	Monthly	Environmental Control Officer	Included in closure costs.
Contamination of surface water as a result of removal of infrastructure.	Pollution	8	2	2	4	48	-	M	The detailed waste management strategy implemented during the construction and operation phases must be continuously implemented throughout the closure and decommissioning phase.	6	2	1	2	18	-	L	Wits Gold will continue to implement the waste management strategy and monitor the effectiveness thereof to the activities taking place on site.	Ongoing	Environmental Control Officer	Included in closure costs.
Rubble and waste from site could pollute local water resources.	Pollution	4	5	2	3	33	-	M	Waste that is not removed from site should be spread, covered and suitably rehabilitated.	4	5	2	1	11	-	L	Wits Gold will continue to implement the waste management strategy and monitor the effectiveness thereof to the activities taking place on site.	Ongoing	Environmental Control Officer	Included in closure costs.
Issues related to SOIL, LAND USE AND LAND CAPABILITY																				
The utilisation of hydrocarbons and other chemicals during the removal of infrastructure may lead to the contamination of soils.	Hydrocarbon spillage	6	2	2	4	40	-	M	The detailed waste management strategy implemented during the construction and operation phases must be continuously implemented throughout the closure and decommissioning phase.	4	2	1	3	21	-	L	Wits Gold will continue to implement the waste management strategy and monitor the effectiveness thereof to the activities taking place on site.	Ongoing	Environmental Control Officer	Included in closure costs.
The decommissioning activities may lead to increased sediment movement off the site and soil compaction.	Infrastructure removal	6	2	2	4	40	-	M	Decommissioning activities should as far as possible take place in winter.	4	2	1	3	21	-	L	Draw up a plan clearly defining the area where the removal of infrastructure should take place. Implement the plan with sufficient measures in place not to compact new areas.	Ongoing	Health and Safety Officer/Project Manager/ Environmental Control Officer	Included in closure costs.
									Restrict vehicle movement to haul roads.								Implement a strict penalty fine system for rule breaking with regard to vehicular movement.	Ongoing	Health and Safety Officer/Project Manager/ Environmental Control Officer	N/A
									Clean and dirty water systems should be maintained until closure or when the area is free-draining.								Maintain clean and dirty water systems and undertake regular monitoring and maintenance thereof.	Ongoing	Health and Safety Officer/Project Manager/ Environmental Control Officer	Included in closure costs.
Issues related to FAUNA AND FLORA																				
Direct impacts on flora species of conservation importance.	Infrastructure removal	8	5	3	2	32	-	M	Limit activities to development footprint; prevent the spread of impacts; prohibit any activity within areas of nearby natural habitat.	8	5	3	1	16	-	L	Implement awareness training; develop suitable waste/infrastructure removal routes that makes use of existing roads; and prevent access to nearby areas of natural habitat.	Ongoing	Environmental control officer/Contractor/Site Manager/Proponent	Included in closure costs.
Direct impacts on fauna species of conservation importance.	Infrastructure removal	8	5	3	2	32	-	M	Limit activities to development footprint; prevent the spread of	8	5	3	1	16	-	L	Implement awareness training; develop suitable	Ongoing	Environmental control officer/Contractor/Sit	Included in closure costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 1: REMOVAL OF INFRASTRUCTURE																				
									impacts; prohibit any activity within areas of nearby natural habitat.								waste/infrastructure removal routes that makes use of existing roads; and prevent access to nearby areas of natural habitat.		e Manager/Proponent	
Loss/disruption of mammal migration routes.	Infrastructure removal	4	4	2	2	20	-	L	Limit activities to development footprint; prevent the spread of impacts; prohibit any activity within areas of nearby natural habitat.	4	4	2	1	10	-	L	Implement awareness training; develop suitable waste/infrastructure removal routes that makes use of existing roads; and prevent access to nearby areas of natural habitat.	Ongoing	Environmental control officer/Contractor/Site Manager/Proponent	Included in closure costs.
Direct impacts on sensitive/pristine habitat types.	Infrastructure removal	4	4	2	2	20	-	L	Limit activities to development footprint; prevent the spread of impacts; prohibit any activity within areas of nearby natural habitat.	4	4	2	1	10	-	L	Implement awareness training; develop suitable waste/infrastructure removal routes that makes use of existing roads; and prevent access to nearby areas of natural habitat.	Ongoing	Environmental control officer/Contractor/Site Manager/Proponent	Included in closure costs.
Direct impacts on common fauna species of the study area.	Infrastructure removal	4	4	2	3	30	-	M	Limit activities to development footprint; prevent the spread of impacts; prohibit any activity within areas of nearby natural habitat.	4	4	2	2	20	-	L	Implement awareness training; develop suitable waste/infrastructure removal routes that makes use of existing roads; and prevent access to nearby areas of natural habitat.	Ongoing	Environmental control officer/Contractor/Site Manager/Proponent	Included in closure costs.
Faunal interaction with structures, servitudes and/or personnel.	Infrastructure removal	4	4	2	3	30	-	M	Limit activities to development footprint; prevent the spread of impacts; prohibit any activity within areas of nearby natural habitat.	4	4	2	2	20	-	L	Implement awareness training; develop suitable waste/infrastructure removal routes that makes use of existing roads; and prevent access to nearby areas of natural habitat.	Ongoing	Environmental control officer/Contractor/Site Manager/Proponent	Included in closure costs.
Impacts on surrounding habitat/species, including ecosystem functioning.	Infrastructure removal	4	4	2	2	20	-	L	Limit activities to development footprint; prevent the spread of impacts; prohibit any activity within areas of nearby natural habitat.	4	4	2	1	10	-	L	Implement awareness training; develop suitable waste/infrastructure removal routes that makes use of existing roads; and prevent access to nearby areas of natural habitat.	Ongoing	Environmental control officer/Contractor/Site Manager/Proponent	Included in closure costs.
Increase in alien vegetation establishment on site.	Infrastructure removal	8	3	2	4	52	-	M	The detailed alien vegetation management plan implemented during the construction phase should be maintained for minimum of three years following decommissioning of the mine.	4	2	1	3	21	-	L	The alien vegetation management plan must be implemented and the applicability thereof assessed through bi-annual audits by a suitably qualified flora specialist.	Bi-annually	Environmental Control Officer	R 150 000.00
Issues related to AIR QUALITY																				
All activities associated with the removal of infrastructure and rehabilitation has the potential to release dust.	Rehabilitation activities	6	3	2	4	44	-	M	The dust monitoring network and dust suppression programme established during the construction phase of the project will be maintained throughout the closure phase of the mine. With respect to haul road dust levels, it is recommended to limit vehicle speeds, especially during high risk periods of high winds, high temperature and low humidity.	6	2	2	3	30	-	M	Dust sampling will be undertaken on a monthly basis and analysed according to the prescribed monitoring programme contained in the EIA/EMP.	Monthly	Environmental Control Officer	R 92 000.00
																	Monthly monitoring reports will be generated by the mine or through a suitably qualified air quality specialist.	Monthly	Environmental Control Officer/Air Quality Specialist	R 42 000.00
																	In the event that air quality or dust issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental Control Officer/Air Quality Specialist	To be determined - depending on severity of incident
																	Ensure optimal implementation and maintenance of the dust suppression programme.	Ongoing	Environmental Control Officer	Included in closure costs.
																	The road surface will to be watered on a daily basis.	Daily	Environmental Control Officer	Included in closure costs.
																	The road surface will to be maintained on a weekly basis.	Weekly	Environmental Control Officer	Included in closure costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 1: REMOVAL OF INFRASTRUCTURE																				
Fugitive dust emissions as a result of dust entrainment.	Rehabilitation activities	6	5	2	4	52	-	M	Revegetation of dumps on closure.	2	5	2	4	36	-	M	Allocation of resources to ensure revegetation and cladding of dump at closure.	On closure/annually	Environmental Control Officer	Included in closure costs.
Issues related to NOISE																				
All activities associated with the removal of infrastructure and rehabilitation has the potential to generate noise.	Rehabilitation activities	8	2	2	4	48	-	M	The removal of all infrastructure is to take place during daytime periods only.	6	2	2	3	30	-	M	Where noise becomes a nuisance, management measures will be investigated and implemented to address these.	Ongoing	Health and Safety Officer/Project Manager/ Environmental Control Officer	Included in closure costs.
																	Machinery with low noise levels and maintained in a good order to be used and to comply with the IFC's Health and Safety Regulations.	Ongoing	Health and Safety Officer/Project Manager/ Environmental Control Officer	Included in closure costs.
Issues related to TRAFFIC																				
No significant closure and decommissioning impacts are envisaged.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to VISUAL																				
Fugitive dust emissions as a result of infrastructure removal and associated exposed/bare areas may have an impact in terms of air quality and visual characteristics.	Infrastructure removal	8	2	2	4	48	-	M	Effective dust suppression measures, such as regular road wetting and/or the use of dust suppression chemicals, must be implemented.	6	2	2	3	30	+	M	Establish and implement a dust suppression plan in consultation with the environmental control officer and an air quality specialist as part of the contractor's responsibility.	Ongoing	Environmental Control Officer	Included in closure costs.
The rehabilitation (ripping, topsoil replacement and landscaping) will remove the visual incongruity.	Infrastructure removal	6	5	2	4	52	+	M	An overall visual improvement will be noticed once all mining related infrastructure has been demolished and the area has been landscaped and re-vegetated.	8	5	2	4	60	+	M	Demarcate the decommissioning area and limit the decommissioning activities as far as possible.	Prior to Decommissioning Phase	Health and Safety Officer/Project Manager/ Environmental Control Officer	Included in closure costs.
																	Final shaping will be implemented such that the final profile of the rehabilitated areas are formed to emulate natural contours of the area.	During Closure Phase	Environmental Control Officer/Project Manager	Included in closure costs.
																	Foundations will be removed to a depth of 1 m below the surface and the area rehabilitated.	During Closure Phase	Environmental Control Officer/Project Manager	Included in closure costs.
																	All material recovered from the demolition of buildings and/or structures will either be transported to a permitted disposal site, or made available to the local community as building materials (provided they are in a satisfactory condition following demolition).	During Closure Phase	Environmental Control Officer/Project Manager	Included in closure costs.
																	Linear infrastructure constructed by the mine (i.e. roads, conveyors and power lines) will be removed if it proves to inhibit land use at decommissioning.	During Closure Phase	Environmental Control Officer/Project Manager	Included in closure costs.
																	All fences erected around the mine will be dismantled and disposed of at a permitted disposal site.	During Closure Phase	Health and Safety Officer/Project Manager/ Environmental Control Officer	Included in closure costs.
Issues related to SOCIAL																				
Disruption and nuisance factors associated with the actual decommissioning such as noise, visual and traffic related impacts.	Nuisance	8	3	2	4	52	-	M	Local residents, with the focus on the surrounding landowners, should receive accurate information with regards to the project status, timeframes for decommissioning and other relevant information about issues that could influence their daily living and movement patterns.	6	2	2	3	30	-	M	The community forum established during the construction phase and implemented throughout the operational phase of the DBM Mine should continue, through which issues can be addressed, and a representative from DBM should become involved.	Ongoing	Environmental Control Officer	N/A
Issues related to HERITAGE																				

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 1: REMOVAL OF INFRASTRUCTURE																				
No significant closure and decommissioning impacts are envisaged.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to WETLANDS																				
Removal of surface infrastructure following mine closure will largely result in similar impacts to the initial establishment of infrastructure, as soils are disturbed and exposed to erosion.	Increased sediment movement	6	5	1	3	36	-	L	Earthworks and vegetation clearing activities should also be phased to minimize the extent of disturbed areas at any one time. Earthworks and vegetation clearing activities on site should ideally be undertaken during the dry season to minimize sediment transport during surface runoff following rainfall events.	4	5	1	1	10	-	L	Develop a wetland management and rehabilitation plan, and implement throughout the construction, operation and closure phases of the mine.	Ongoing	Environmental control officer	N/A
																	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	During closure and decommissioning phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in closure costs.
																	The contractor will ensure that all activities, material and equipment storage and personnel movement take place within the designated area.	During closure and decommissioning phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in closure costs.
																	Contractors will complete induction on the EMP, Environmental Awareness Plan and Emergency Response Plan prior to construction activities being undertaken. All workers will be made aware of the penalty systems for non compliance.	During closure and decommissioning phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in closure costs.
									Temporary toe berms should be installed on the down slope side of large bare soils areas and any soil stockpiles to trap sediments eroded odd these areas.								The site should be monitored for erosion and sediment movement during and after rainfall events and suitable interventions put in place to repair any erosion damage and to prevent further sediment movement off the site.	During closure and decommissioning phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in closure costs.
Clearing of vegetation and soil disturbance could lead to mobilisation of sediments and dust which may be blown or washed into receiving water bodies (wetlands and pans) within the vicinity. This would lead to increased turbidity (decreased water quality) which may have a negative impact on aquatic fauna. When the suspended solids (soil particles) settle out on the substrates in the wetlands, it leads to further deterioration in habitat quality. Sediments are colonised by Typha reeds or alien weeds, causing a decline in habitats during the wet season. This may result in a decline in overall aquatic biodiversity	Decline in habitats and biota	6	4	2	4	48	-	M	A biomonitoring plan should be compiled and implemented and should include assessments of water quality, habitats and aquatic macroinvertebrates. Sampling sites further down in the During River catchment should be included to assess impacts on downstream ecosystems.	6	4	1	2	22	-	L	Develop a biomonitoring plan, and implement throughout the construction, operation and closure phases of the mine.	Ongoing	Environmental control officer	Included in closure costs.
Issues related to RADIATION																				
Impact on public safety as a result of exposure to radioactivity.	Radioactive elements	10	4	2	5	80	-	H	Develop a Radiation Management Plan.	6	4	1	4	44	-	M	Implement the Radiation Management Plan throughout the life of mine and monitor exposure of the public to radioactivity in accordance therewith.	Ongoing	Environmental control officer/Health & Safety officer	Included in Construction and Operational Costs

Table 6.19: Impacts and Management Measures for Closure Phase Activities: Active Rehabilitation

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 2: ACTIVE REHABILITATION																				
Issues related to GEOLOGY																				
No significant closure and decommissioning impacts are envisaged.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TOPOGRAPHY																				
No significant closure and decommissioning impacts are envisaged.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to GEOHYDROLOGY																				
Contaminant soil could impact on groundwater quality	Plant, PCD's, workshops, other infrastructure	4	5	1	3	30	-	M	Removal of dirty soil to landfill	2	5	1	2	16	-	L	Removal of dirty soil to landfill	At closure	Mine Environmental Manager	Included in closure costs.
Issues related to HYDROLOGY																				
Runoff from rehabilitated areas will impacts on watercourses especially during intensive rainstorms especially if the area are not free draining.	Active Rehabilitation	6	2	2	3	30	-	M	Berms, should they be necessary, must remain upstream and downstream of the dumps and stockpiles to ensure that clean water is kept separate from dirty water until the area is free draining and re-vegetation has occurred.	4	2	2	2	16	-	L	Continuous rehabilitation of the decommissioning area will be conducted in line with the Best Practice Guidelines released by the DWA. DBM will appoint a specialist to this effect.	Ongoing	Environmental Control Officer	Included in closure costs.
Runoff and drainage from stockpiles and the TSF may continue to yield polluted water.	Active Rehabilitation	6	5	3	4	56	-	M	Stockpiles should be spread and surfaces rehabilitated,	6	5	1	2	24	-	L	The surface of TSF should be rehabilitated and drains/return water dams maintained until rehabilitation is complete and vegetation self-sustaining.	Ongoing	Environmental Control Officer	Included in closure costs.
Issues related to SOIL, LAND USE AND LAND CAPABILITY																				
Soil erosion	Wind and water erosion in unvegetated areas	2	4	6	4	48	-	M	Re-vegetate as soon as possible	1	5	4	4	40	-	M	Implement mitigation in accordance with the mitigation measures proposed.	At closure	Environmental Control Officer	Included in closure costs.
Ripping and topsoil replacement will restore the soil physical characteristics prior to re-vegetation.	Active Rehabilitation	6	2	1	3	27	+	L	Compacted soils will be ripped and topsoil will be replaced. After the topsoil has been replaced the area should be ameliorated and seeded, should self-succession of vegetation not take place. Only species indigenous to the area will be included.	8	2	1	4	44	+	M	Continuous rehabilitation of the decommissioning area will be conducted in line with the Best Practice Guidelines released by the DWA. DBM will appoint a specialist to this effect.	Ongoing	Environmental Control Officer	Included in closure costs.
Issues related to FAUNA AND FLORA																				
Direct impacts on sensitive/pristine habitat types.	Active Rehabilitation	4	4	2	2	20	-	L	Ensure proper soil preparation, seed mixture development and establishment of sufficient vegetation cover; prevent infestation of nearby areas and rehabilitation areas by weeds and invasive species.	4	4	2	1	10	+	L	Develop a rehabilitation and revegetation protocol; develop an alien and invasive vegetation identification and management programme; and ensure ongoing monitoring of rehabilitation areas.	Ongoing	Environmental control officer/Proponent/Ecologist/ Contractor	Included in closure costs.
Impacts on surrounding habitat/species, including ecosystem functioning.	Active Rehabilitation	4	4	2	2	20	-	L	Ensure proper soil preparation, seed mixture development and establishment of sufficient vegetation cover; prevent infestation of nearby areas and rehabilitation areas by weeds and invasive species.	4	4	2	1	10	+	L	Develop a rehabilitation and revegetation protocol; develop an alien and invasive vegetation identification and management programme; and ensure ongoing monitoring of rehabilitation areas.	Ongoing	Environmental control officer/Proponent/Ecologist/ Contractor	Included in closure costs.
Re-vegetation will be undertaken on the decommissioned and rehabilitated areas before mine closure.	Active Rehabilitation	6	3	1	3	30	+	M	Compacted soils will be ripped and topsoil will be replaced. After the topsoil has been replaced the area should be ameliorated and seeded, should self-succession of vegetation not take place. Only species indigenous to the area will be included. Remove alien vegetation post decommissioning, with long term follow-up afterwards.	6	4	2	4	48	+	M	Continuous rehabilitation of the decommissioning area will be conducted in line with the Best Practice Guidelines released by the DWA. DBM will appoint a specialist to this effect.	Ongoing	Environmental control officer/Proponent/Ecologist/ Contractor	Included in closure costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 2: ACTIVE REHABILITATION																				
Issues related to AIR QUALITY																				
All activities associated with the removal of infrastructure has the potential to release dust.	Active Rehabilitation	6	3	2	4	44	-	M	The dust monitoring network and dust suppression programme as set up during the construction phase of the project will be updated and implemented throughout the closure phase of the mine.	6	2	2	3	30	-	M	Dust sampling will be undertaken on a monthly basis and analysed according to the prescribed monitoring programme contained in the EIA/EMP.	Monthly	Environmental Control Officer	R 92 000.00
																	Monthly monitoring reports will be generated by the mine or through a suitably qualified air quality specialist.	Monthly	Environmental Control Officer/Air Quality Specialist	R 42 000.00
																	In the event that air quality or dust issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental Control Officer/Air Quality Specialist	To be determined - depending on severity of incident
																	Ensure optimal implementation and maintenance of the dust suppression programme.	Ongoing	Environmental Control Officer	Included in closure costs.
																	The road surface will to be watered on a daily basis.	Daily	Environmental Control Officer	Included in closure costs.
																	The road surface will to be maintained on a weekly basis.	Weekly	Environmental Control Officer	Included in closure costs.
Fugitive dust emissions as a result of dust entrainment.	Rehabilitation activities	6	5	2	4	52	-	M	Revegetation of dumps on closure.	2	5	2	4	36	-	M	Allocation of resources to ensure revegetation and cladding of dump at closure.	On closure/annually	Environmental Control Officer	Included in closure costs.
Issues related to NOISE																				
All activities associated with the removal of infrastructure and rehabilitation have the potential to generate noise.	Heavy vehicle movement	8	2	2	4	48	-	M	The removal of all infrastructure is to take place during daytime periods only.	6	2	2	3	30	-	M	Where noise becomes a nuisance, management measures will be investigated and implemented to address these.	Ongoing	Health and Safety Officer/Project Manager/ Environmental Control Officer	Included in closure costs.
																	Machinery with low noise levels and maintained in a good order to be used and to comply with the IFC's Health and Safety Regulations.	Ongoing	Health and Safety Officer/Project Manager/ Environmental Control Officer	Included in closure costs.
									Speed control measures will be implemented by the mine through the placement of adequate signage.								Implement a penalty system for non-compliance to speed control measures and ensure that all workers are made aware of the penalty systems.	Ongoing	Health and Safety Officer/Project Manager/ Environmental Control Officer	Included in closure costs.
									Gravel roads to be maintained in as good and smooth a condition as possible.								The road surface will to be maintained on a weekly basis.	Weekly	Environmental Control Officer	Included in closure costs.
Issues related to TRAFFIC																				
No significant closure and decommissioning impacts are envisaged.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to VISUAL																				
The rehabilitation (ripping, topsoil replacement and landscaping) will remove the visual incongruity.	Infrastructure removal	6	5	2	4	52	+	M	An overall visual improvement will be noticed once all mining related infrastructure has been demolished and the area has been landscaped and re-vegetated.	8	5	2	4	60	+	M	Demarcate the decommissioning area and limit the decommissioning activities as far as possible.	Prior to Decommissioning Phase	Health and Safety Officer/Project Manager/ Environmental Control Officer	Included in closure costs.
																	Final shaping will be implemented such that the final profile of the rehabilitated areas are formed to emulate natural contours of the area.	During Closure Phase	Environmental Control Officer/Project Manager	Included in closure costs.
																	Foundations will be removed to a depth of 1 m below the surface and the area rehabilitated.	During Closure Phase	Environmental Control Officer/Project Manager	Included in closure costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION M	D	S	P	TOTAL	STATUS	SP	RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION M	D	S	P	TOTAL	STATUS	SP	ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 2: ACTIVE REHABILITATION																				
																	All material recovered from the demolition of buildings and/or structures will either be transported to a permitted disposal site, or made available to the local community as building materials (provided they are in a satisfactory condition following demolition).	During Closure Phase	Environmental Control Officer/Project Manager	Included in closure costs.
																	Linear infrastructure constructed by the mine (i.e. roads, conveyors and power lines) will be removed if it proves to inhibit land use at decommissioning.	During Closure Phase	Environmental Control Officer/Project Manager	Included in closure costs.
																	All fences erected around the mine will be dismantled and disposed of at a permitted disposal site.	During Closure Phase	Health and Safety Officer/Project Manager/ Environmental Control Officer	Included in closure costs.
Issues related to SOCIAL																				
Disruption and nuisance factors associated with the actual decommissioning such as noise, visual and traffic related impacts.	Nuisance	8	3	2	4	52	-	M	Local residents, with the focus on the surrounding landowners, should receive accurate information with regards to the project status, timeframes for decommissioning and other relevant information about issues that could influence their daily living and movement patterns.	6	2	2	3	30	-	M	The community forum established during the construction phase and implemented throughout the operational phase of DBM should continue, through which issues can be addressed, and a representative from DBM should become involved.	Ongoing	Environmental Control Officer	N/A
Issues related to HERITAGE																				
No significant closure and decommissioning impacts are envisaged.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to WETLANDS																				
Removal of surface infrastructure following mine closure will largely result in similar impacts to the initial establishment of infrastructure, as soils are disturbed and exposed to erosion.	Increased sediment movement	6	5	1	3	36	-	M	Earthworks and vegetation clearing activities should also be phased to minimize the extent of disturbed areas at any one time. Earthworks and vegetation clearing activities on site should ideally be undertaken during the dry season to minimize sediment transport during surface runoff following rainfall events.	4	5	1	1	10	-	L	Develop a wetland management and rehabilitation plan, and implement throughout the construction, operation and closure phases of the mine.	Ongoing	Environmental control officer	N/A
																	Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	During closure and decommissioning phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in closure costs.
																	The contractor will ensure that all activities, material and equipment storage and personnel movement take place within the designated area.	During closure and decommissioning phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in closure costs.
																	Contractors will complete induction on the EMP, Environmental Awareness Plan and Emergency Response Plan prior to construction activities being undertaken. All workers will be made aware of the penalty systems for non compliance.	During closure and decommissioning phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in closure costs.
								Temporary toe berms should be installed on the down slope side of large bare soils areas and any soil stockpiles to trap sediments eroded odd these areas.								The site should be monitored for erosion and sediment movement during and after rainfall events and suitable interventions put in place to repair any erosion damage and to prevent further sediment movement off the site.	During closure and decommissioning phase	Environmental Control Officer/ Project Manager/Health & Safety Officer	Included in closure costs.
Clearing of vegetation and soil	Decline in habitats	6	4	2	4	48	-	M	A biomonitoring plan should be	6	4	1	2	22	-	L	Develop a biomonitoring plan, and	Ongoing	Environmental control	Included in closure

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 2: ACTIVE REHABILITATION																				
disturbance could lead to mobilisation of sediments and dust which may be blown or washed into receiving water bodies (wetlands and pans) within the vicinity. This would lead to increased turbidity (decreased water quality) which may have a negative impact on aquatic fauna. When the suspended solids (soil particles) settle out on the substrates in the wetlands, it leads to further deterioration in habitat quality. Sediments are colonised by Typha reeds or alien weeds, causing a decline in habitats during the wet season. This may result in a decline in overall aquatic biodiversity	and biota								compiled and implemented and should include assessments of water quality, habitats and aquatic macroinvertebrates. Sampling sites further down in the During River catchment should be included to assess impacts on downstream ecosystems.								implement throughout the construction, operation and closure phases of the mine.		officer	costs.
Issues related to RADIATION																				
Impact on public safety as a result of exposure to radioactivity.	Radioactive elements	10	4	2	5	80	-	H	Develop a Radiation Management Plan.	6	4	1	4	44	-	M	Implement the Radiation Management Plan throughout the life of mine and monitor exposure of the public to radioactivity in accordance therewith.	Ongoing	Environmental control officer/Health & Safety officer	Included in Construction and Operational Costs

Table 6.20: Impacts and Management Measures for Closure Phase Activities: Residual Impacts Post Closure

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 3: RESIDUAL IMPACTS POST CLOSURE																				
Issues related to GEOLOGY																				
No significant closure and decommissioning residual impacts are envisaged.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TOPOGRAPHY																				
No significant closure and decommissioning residual impacts are envisaged.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to GEOHYDROLOGY																				
Ongoing groundwater contamination	Ongoing TSF seepage	8	5	2	4	60	-	M	Vegetation of TSF, infiltration only rainfall dependent and therefore lower compared to operations	6	5	1	4	48	-	M	Update impact assessment for closure with monitoring data. Ongoing monitoring if required.		Mine Environmental Manager	Included in closure costs.
Contaminated groundwater reaching surface, impact nearby groundwater and surface water	Flooding of underground workings and potential decant	10	5	2	2	34	-	M	Investigate and determine impact of decant after closure.	10	5	2	2	34	-	M	Investigate and determine impact of decant after closure. Monitoring of mine flooding for 5 years after decommissioning	Quarterly	Mine Environmental Manager	Included in closure costs.
Groundwater contamination	Waste rock dump	4	4	1	3	27	-	L	Potential capping and vegetation	4	5	1	2	20	-	L	Update impact assessment for closure with monitoring data. Ongoing monitoring if required.		Mine Environmental Manager	Included in closure costs.
The groundwater levels in the underground mining area will probably recover during the decommissioning and post-closure phases when mine dewatering is stopped. The groundwater level recovery will depend on a) the extent of interaction and b) dewatering of neighbouring mines. No decant is foreseen due to the topographic position of the mine.	Cessation of dewatering	8	5	2	5	75	+	H	No mitigation for the recovery of groundwater levels is possible. Groundwater levels in the underground workings will recover.	10	5	3	5	90	+	H	Maintain groundwater quality and quantity monitoring programme.	N/A	N/A	Included in closure costs.
The single largest risk in terms of post closure impacts is that of aquifer contamination caused by leachate from the new TSF to be located on the Merriespruit TSF.	Cessation of dewatering	10	5	3	5	90	-	H	Kinetic leach testing and geochemical modelling be undertaken on the tailings in order to evaluate the expected long-term seepage quality emanating from the TSF	8	5	3	3	48	-	M	Maintain groundwater quality and quantity monitoring programme.	N/A	N/A	Included in closure costs.
Groundwater contaminant plume as a result of the flooded mining areas.	Flooded mining areas	10	5	3	5	90	-	H	Groundwater levels in the underground workings will recover. Pollution plumes may migrate to boreholes intersecting deeper aquifers. All mined areas should be flooded as soon as possible to bar oxygen from reacting with remaining pyrite. Groundwater sampling must be undertaken to establish a database of plume movement trends, to aid eventual mine closure.	8	3	2	5	65	-	H	Groundwater quality sampling will be undertaken on a monthly basis and analysed according to the prescribed monitoring programme contained in the EIA/EMP.	Monthly	Environmental Coordinator	R 91 000.00
																	Quarterly groundwater monitoring reports will be generated by the mine or through a qualified water quality specialist.	Quarterly	Environmental Coordinator/Water Quality Specialist	R 42 000.00
																	In the event that water quality or quantity issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental Coordinator/Water Quality Specialist	To be determined - depending on severity of incident
Issues related to HYDROLOGY																				
Runoff from rehabilitated areas will impacts on watercourses especially during intensive rainstorms especially if the area are not free draining.	Active Rehabilitation	6	5	3	3	42	-	M	Berms, should they be necessary, must remain upstream and downstream of the dumps and stockpiles to ensure that clean water is kept separate from dirty water until the area is free draining and re-vegetation has occurred.	6	5	2	1	13	-	L	Continuous rehabilitation of the decommissioning area will be conducted in line with the Best Practice Guidelines released by the DWA. DBM will appoint a specialist to this effect.	Ongoing	Environmental Control Officer	Included in closure costs.
Overtopping of Pollution Control Dams may impact on the surface water quality.	Decanting	8	4	2	4	56	-	M	Pending the decant quality various treatment options could be considered. These include pH	6	4	2	3	36	-	M	DBM will obtain approval from the appropriate government department on the treatment options before	Prior to closure	Environmental Coordinator/Water Quality Specialist	To be determined.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 3: RESIDUAL IMPACTS POST CLOSURE																				
									adjustment and controlled release or containment.								implementing.			
									Collection of decant into a purposely dedicated pollution control dam which may require lining pending the expected water quality.								Pollution control dams should take into account the requirements of GN704 with regards to design capacities.	Prior to closure	Environmental Coordinator/Water Quality Specialist	To be determined.
Continued flows of polluted water from mine drainage and TSF.	Water movement	4	5	3	4	48	-	M	A pollution control dam or treatment works that safely contains or treats water must continue to operate.	4	5	1	1	10	-	L	Maintain water treatment plant operation as long as is necessary.	Ongoing	Environmental Control Officer	Included in closure costs.
Issues related to SOIL, LAND USE AND LAND CAPABILITY																				
Soil compaction	Transport to remove infrastructure	2	4	6	4	48	-	M	Restrict vehicle movement to haul roads, etc.	1	5	4	4	40	-	M	Implement mitigation in accordance with the mitigation measures proposed.	Ongoing	Environmental Control Officer	Included in closure costs.
Issues related to FAUNA AND FLORA																				
Loss, disruption of mammal migration routes	Residual Impacts	4	4	2	2	20	-	L	Ensure removal of major structures and barrriers; ensure safety of animals that might be present within the remaining footprint; ensure that no open pits or standing water remains.	4	4	2	1	10	-	L	Develop and implement a suitable monitoring and management programme with corrective measures.	Bi-annual	Environmental control officer/Ecologist	Included in closure costs.
Direct impacts on sensitive/ pristine habitat types	Residual Impacts	4	4	2	2	20	-	L	Ensure that no effluent from remaining infrastructure and mining areas result; ensure that alien and invasive vegetation are treated; ensure adequate rehabilitation is undertaken.	4	4	2	1	10	-	L	Develop and implement a suitable monitoring and management programme with corrective measures.	Bi-annual	Environmental control officer/Ecologist	Included in closure costs.
Direct impacts on common fauna species of the study area	Residual Impacts	2	4	2	2	16	-	L	Ensure removal of major structures and barriers; ensure safety of animals that might be present within the remaining footprint; ensure that no open pits or standing water remains.	2	4	2	1	8	-	L	Develop and implement a suitable monitoring and management programme with corrective measures.	Bi-annual	Environmental control officer/Ecologist	Included in closure costs.
Faunal interaction with structures, servitudes, personnel	Residual Impacts	2	4	2	2	16	-	L	Ensure removal of major structures and barriers; ensure safety of animals that might be present within the remaining footprint; ensure that no open pits or standing water remains.	2	4	2	1	8	-	L	Develop and implement a suitable monitoring and management programme with corrective measures.	Bi-annual	Environmental control officer/Ecologist	Included in closure costs.
Impacts on surrounding habitat/ species, including ecosystem functioning	Residual Impacts	4	4	2	2	20	-	L	Ensure that no effluent from remaining infrastructure and mining areas result; ensure that alien and invasive vegetation are treated; ensure adequate rehabilitation is undertaken.	4	4	2	1	10	-	L	Develop and implement a suitable monitoring and management programme with corrective measures.	Bi-annual	Environmental control officer/Ecologist	Included in closure costs.
Issues related to AIR QUALITY																				
The potential exists for fugitive dust emissions (wind entrained)	Nuisance	6	2	2	4	40	-	M	Re-vegetation of dump on closure	2	2	2	3	18	-	L	Allocation of resources for closure, cladding and re-vegetation of dump	On closure or annual	Environmental officer	R 500 000.00
																	Monthly monitoring reports will be generated by the mine or through a suitably qualified air quality specialist.	Monthly	Environmental Coordinator/Air Quality Specialist	R 42 000.00
																	In the event that air quality or dust issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental Coordinator/Air Quality Specialist	To be determined - depending on severity of incident
Issues related to NOISE																				
No significant closure and decommissioning residual impacts are envisaged.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TRAFFIC																				
No significant closure and decommissioning residual impacts are envisaged.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to VISUAL																				

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 3: RESIDUAL IMPACTS POST CLOSURE																				
No significant closure and decommissioning residual impacts are envisaged.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to SOCIAL																				
Increase in standard of living (broader community)	N/A	4	2	3	3	27	-	L	Implement according to the proposed action plan.	8	4	3	3	45	-	M	• To increase the standard of living locally, the contractors employed should aim to ensure that local or surrounding people are employed where possible. It is furthermore suggested that all the employees should be motivated to spend their earned income locally. This can be achieved by ensuring that the goods and services required by the employees are provided for locally (if possible). The onus will lie on local shop owners to ensure that the demanded for goods and services are met; and • The employment of local residents during operation (as far as practically possible) would increase the standard of living, since they would have a higher disposable income and less transportation costs.	Ongoing	Environmental Control Officer	Included in closure costs.
Increase in standard of living (local farmers)	N/A	8	4	2	3	42	-	M	Implement according to the proposed action plan.	6	3	1	3	30	-	M	• The reduced standard of living of affected landowners should be taken into consideration when determining the appropriate compensation of landowners.	Ongoing	Environmental Control Officer	Included in closure costs.
Conversion and diversification of land use	N/A	6	4	3	4	52	-	M	Implement according to the proposed action plan.	4	4	3	4	44	-	M	• Educate landowners in terms of their rights and responsibilities prior to the project going ahead; • Assist landowners in identifying ways to adapt their land uses; • Plan to avoid splitting agricultural land and natural habitats; • Integrate the mining area with regional land use planning objectives where possible; and • Take into account surrounding land uses and design post-mining land use options to support and enhance long-term development options.	Ongoing	Environmental Control Officer	Included in closure costs.
Capacity building (skills transfer)	N/A	6	2	3	4	44	+	M	Implement according to the proposed action plan.	10	3	3	4	64	+	H	• Recruit and train local residents to supply unskilled labour during the construction and operational phase; • The use of diverse activities should be stimulated, allied with, but not reliant on, construction related activities such as outsourcing catering activities to local businesses. The local municipality could assist local residents and business owners to garner the benefit associated with the spin-offs emanating from the proposed mine; • Stakeholders should be mutually accountable for increased opportunities regarding skills and competency development (general education and technical training). This will enable active participation, not only in the construction sector, but also in other spheres of the economy,	Ongoing	Environmental Control Officer	Included in closure costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 3: RESIDUAL IMPACTS POST CLOSURE																				
																	as well as providing opportunities for career enhancement; • Training should be concentrated on skills that can be readily transferred to other employment opportunities in the local area to avoid persons with trained skills leaving the area for work elsewhere; • The project implementers and/or the contractors should identify the required jobs to be undertaken prior to the construction phase to enable local recruitment and/or some form of basic training; • It is recommended that a comprehensive program for recruiting, hiring, training, orienting and counselling be established. The nature of the training provided does not need to be limited to specific project related tasks and can include financial planning, bookkeeping, general arithmetic etc; • The principles of the Expanded Public Works Programme must be adhered to and effective labour-based construction technologies must be used to increase the positive effects of job creation; • Ensure that stakeholders have knowledge of the support of legislation and regulations; • The implementation of the SLP should be monitored on an annual basis; • Ensure compliance to the BBSEC and MPRDA; and • Ensure that the employment and training of HDSA and women meet the requirements of the BBSEC.			
Actual health	N/A	8	4	2	4	56	-	M	Implement according to the proposed action plan.	4	4	3	3	33	-	M	• In order to reduce the impact on the local community it is important to maximise the use of local labour as far as possible; • Local labour should be employed as far as possible to avoid additional pressure on the existing services; • HIV / Aids awareness campaigns should be initiated by Wits Gold and provided to all its mine employees on a regular basis; • Wits Gold should investigate how they could assist in implementing a community health awareness programme in liaison with the LM; • Environmental pollution must be limited as far as possible and the requirements of the EMP be implemented to reduce the impact on surrounding landowners; • Environmental pollution must be limited as far as possible and the requirements of the EMP be implemented to reduce the impact on surrounding landowners;	Ongoing	Environmental Control Officer	Included in closure costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 3: RESIDUAL IMPACTS POST CLOSURE																				
																	• The necessary safety precautions should be taken and first aid supplies should be made available on site; • All mine employees (including contractors) should undergo health and safety training on a regular basis; • The general health of employees should be monitored on an on-going basis and employees should be given free access to clinic services; • It is advised that Wits Gold, through consultation with the LM investigate ways in which their LED programmes and infrastructure development component of their SLP can assist in improving the overall health services within the communities; and • The required safety equipment should be provided to employees as well as on site and should be in a good working order.			
Physical quality of the living environment	N/A	10	4	2	4	64	-	H	Implement according to the proposed action plan.	8	4	2	3	42	-	M	• Existing community forums must serve as liaison between the affected stakeholders and Wits Gold and can discuss traffic, dust, noise and construction related concerns with them; • Suppress dust by spraying water or non-contaminating palliative liquids on roads, crusher and screening plant, mills and vehicles; • Prevent dust blowing off transported materials by washing vehicles, wheels and covering loads; • Rehabilitate behind production with adequate top soiling, fertilisation, irrigation and correct choice of grasses to ensure year-round cover; • Prepare a noise reduction plan to cover all significant impacts at source and implement noise reduction and screening to limit exposure. Drilling and blasting is generally intermittent and should be limited to daylight hours when ambient noise levels are highest. A hearing conservation programme must be implemented where noise exceeds 85dB(A) in the mine or must not be more than 7dB(A) above ambient residual noise levels beyond mine boundary or nearest residential community; • The maximum acceptable night time noise levels should not be exceeded; • Traffic calming measures should be put in place to minimise traffic noise; • Adequate monitoring of the biophysical impacts should occur in order to address any unnecessary inconveniences to stakeholders; • Mitigation and monitoring as recommended by the Water Quality Impact Assessments should be implemented; • Plant tall trees as barriers in gardens	Ongoing	Environmental Control Officer	Included in closure costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 3: RESIDUAL IMPACTS POST CLOSURE																				
																	or in road reserve to reduce the visual and light intrusion, as well as noise impacts; • Recommendations made in the EMP and EMPr should be adhered to. • Rehabilitate behind production with adequate top soiling, fertilisation, irrigation and correct choice of grasses to ensure year-round cover; • Prepare a noise reduction plan to cover all significant impacts at source and implement noise reduction and screening to limit exposure. Drilling and blasting is generally intermittent and should be limited to daylight hours when ambient noise levels are highest. A hearing conservation programme must be implemented where noise exceeds 85dB(A) in the mine or must not be more than 7dB(A) above ambient residual noise levels beyond mine boundary or nearest residential community; • The maximum acceptable night time noise levels should not be exceeded; • Traffic calming measures should be put in place to minimise traffic noise; • Adequate monitoring of the biophysical impacts should occur in order to address any unnecessary inconveniences to stakeholders; • Mitigation and monitoring as recommended by the Water Quality Impact Assessments should be implemented; • Plant tall trees as barriers in gardens or in road reserve to reduce the visual and light intrusion, as well as noise impacts; and • Recommendations made in the EMP and EMPr should be adhered to.			
Aesthetic quality of the living environment	N/A	6	4	2	4	48	-	M	Implement according to the proposed action plan.	4	4	2	4	40	-	M	• The design and specific positioning of the infrastructure should aim to minimise the possible negative visual impact of the mine on the surrounding property owners; • The design of the mine buildings should blend in with surrounding environment; • Implement re-vegetation as levels are abandoned to break the form, reduce colour contrast, dust generation or contaminated runoff; and • Recycle dumps or use as backfill with appropriate permission.	Ongoing	Environmental Control Officer	Included in closure costs.
Availability and quality of housing	N/A	2	3	2	3	21	-	L	Implement according to the proposed action plan.	8	4	3	3	45	+	M	• Employees should be educated with regards to their accommodation options; • Housing needs should be monitored and addressed in consultation and cooperation with the applicable LMs; and • Maximise the employment of locals to limit the need for any additional	Ongoing	Environmental Control Officer	Included in closure costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 3: RESIDUAL IMPACTS POST CLOSURE																				
																	housing infrastructure, as far as possible.			
Adequacy and access to social infrastructure	N/A	6	3	2	2	22	-	L	Implement according to the proposed action plan.	8	4	2	4	56	+	M	• In consultation with the municipality and other mines operating in the area, ensure that the necessary planning for upgrades of social infrastructure, where lacking due to the proposed mine, take place; • Involvement in upliftment programmes should be done according to the priority needs and projects identified as part of the LMs IDP, as well as in consultation with other stakeholders such as the local community representatives, ward committees and youth organisations; • Continuous involvement of the mine would be necessary and should be undertaken in a transparent and supportive manner; • Implement a regular and formalised consultation process with local government to ensure synergy between the mine's social development and LED focus; • Communication of the projects that Wits Gold would be involved in should filter through to all community levels to ensure maximum benefit to the community; and • Community development projects initiated by Wits Gold should avoid benefiting only a selected few but should follow a broad based approach, whilst also taking budgeting constraints into consideration.	Ongoing	Environmental Control Officer	Included in closure costs.
Personal safety and hazard exposure	N/A	6	4	2	4	48	-	M	Implement according to the proposed action plan.	4	3	2	3	27	-	L	• Local, unemployed labour should be employed as far as possible; • Accommodation for members of the workforce, other than security personnel, must not be permitted on site; • The only semi-permanent structures that should be allowed on site is guard houses for security personnel; • Camp followers / informal traders must not be allowed to congregate outside the construction site; • Strict security measures should be put in place. Security personnel should be on site on a permanent basis; • Construction workers should be confined to the construction area and should wear uniforms or identity tags to be easily identified; • The mining area should be fenced to avoid unauthorised entry by humans or animals onto the mining area; • The contractor should communicate the construction schedule and vehicle movements to the neighbouring property owners in advance; • Workers must not be allowed to overnight on the premises and must be transported to their places of	Ongoing	Environmental Control Officer	Included in closure costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 3: RESIDUAL IMPACTS POST CLOSURE																				
																	residence by bus on a daily basis; • Workers must not be allowed to leave the designated mining areas without permission; • A Health and Safety Plan should be implemented and it must be ensured that all managers are trained in First Aid and other relevant safety courses; • Implement safety measures to limit fire hazards and implement fire breaks if possible; • Wits Gold should, in conjunction with the property owners, develop and implement emergency procedures; • Operational safety risks should be addressed as part of the OHS Act; • A Fire/Emergency Management Plan should be developed and implemented. It is important that this management plan and associated communication channels are developed at the outset of the construction phase. It would be important to regularly review the functionality and efficiency of such a plan in conjunction with the local emergency teams, mine management and neighbouring landowners; • Open fires for cooking and related purposes should not be allowed on site; • Appropriate fire fighting equipment should be on site and construction workers should be appropriately trained for fire fighting; • The construction sites should be clearly marked and "danger" and "no entry" signs should be erected; • Speed limits on the local roads surrounding the construction sites should be enforced; and • Speeding of construction vehicles must be strictly monitored.			
Crime and violence	N/A	4	3	3	2	20	-	L	Implement according to the proposed action plan.	4	2	3	2	18	-	L	• Local, unemployed labour should be employed as far as possible; • Wits Gold must liaise with the LMs and labour unions to establish a protocol for ensuring community safety; • Mine workers should be clearly identifiable by ensuring they wear uniforms and identification cards that should be exhibited in a visible place on their body; and • The AgriSA protocol for access to farms should be followed in all instances where access to farmers' land is required.	Ongoing	Environmental Control Officer	Included in closure costs.
Loss of natural and cultural heritage	N/A	8	5	1	3	42	-	M	Implement according to the proposed action plan.	8	2	1	1	11	-	L	• The recommendations of the HIA should be implemented; • Local residents and farmers should be consulted to determine any possible heritage sites not identified by the HIA; and • Local residents and farmers should	Ongoing	Environmental Control Officer	Included in closure costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 3: RESIDUAL IMPACTS POST CLOSURE																				
																	inform mitigation measures when addressing any potential impact on cultural heritage sites or graves.			
Social networks	N/A	6	3	2	3	33	-	M	Implement according to the proposed action plan.	6	3	2	2	22	-	L	• Employ local residents as far as possible; • Make use of credible SMME's for the provision of goods and services; and • Embark on regular communication efforts towards the community with regards to the mine's involvement in the communities. This could be done through an already established community forum.	Ongoing	Environmental Control Officer	Included in closure costs.
Functioning of government agencies	N/A	8	3	3	4	56	-	M	Implement according to the proposed action plan.	6	4	3	3	39	-	M	• Assist the LM with the diversification of the local economy; • Emphasise the use of local service providers and SMMEs and focus on the development of LED programmes; and • Institute a joint municipal coordinating and implementing committee to support the municipality's local economic and social develop needs and requirements, where feasible.	Ongoing	Environmental Control Officer	Included in closure costs.
Impact equity (affected landowners)	N/A	8	4	1	3	39	-	M	Implement according to the proposed action plan.	6	3	1	2	20	-	L	• Negative impacts on the local property owners should be limited as far as possible such as intrusion impacts (dust, noise, and air pollution). Mitigation measures from the specialist studies dealing with these issues should thus be strictly implemented; • Safety and security measures are critical to avoid any increase in criminal activities within the local study area; and • The use of local labour must be maximised as far as possible.	Ongoing	Environmental Control Officer	Included in closure costs.
Impact equity (community members)	N/A	4	2	3	3	27	+	L	Implement according to the proposed action plan.	8	4	3	3	45	+	M	• Skills training and development should be maximised to benefit as many local employees as possible; and • The use of local labour must be maximised as far as possible.	Ongoing	Environmental Control Officer	Included in closure costs.
Gendered division of labour	Discrimination	4	3	3	2	20	+	L	Implement according to the proposed action plan.	6	4	3	3	39	+	M	• Women must have equal employment opportunities; • Training and skills development should take place for women; • Salaries of women should be equal to that of men when undertaking the same job; • Commitments made in the SLP with regard to the employment of women should be adhered to; and • Institute a well designed gender equality strategy on the mine.	Ongoing	Environmental Control Officer	Included in closure costs.
Disruption and nuisance factors associated with the actual decommissioning such as noise, visual and traffic related impacts.	Nuisance	8	3	2	4	52	-	M	Local residents, with the focus on the surrounding landowners, should receive accurate information with regards to the project status, timeframes for decommissioning and other relevant information about issues that could influence their daily living and movement patterns.	6	2	2	3	30	-	M	The community forum established during the construction phase and implemented throughout the operational phase of DBM should continue, through which issues can be addressed, and a representative from DBM should become involved.	Ongoing	Environmental Control Officer	N/A
Job losses due to mine closure and decline in local economy as a result	Job losses	8	5	3	4	64	-	H	Capacity building and skills training among employees are critical and	6	3	2	4	44	-	M	Where job losses are inevitable, minimise the extent of the job losses	During Closure and Decommissioning	HR Manager	Included in SLP and closure costs.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 3: RESIDUAL IMPACTS POST CLOSURE																				
of the loss of employment, household income and capital investments.									would be highly beneficial to those involved, especially if they receive portable skills to enable them to also find work elsewhere and in other similar environments. The SLP approved as part of the Mining Right Application in the pre-construction phase aims to develop mechanisms and strategies to prevent job losses or, where these cannot be avoided, to implement appropriate plans to ameliorate the social and economic impact that downscaling of the operations and/or closure may have on employees, communities and the economy.								resulting from major restructuring or retrenchment exercises and to facilitate, as far as practically possible, access to alternative employment opportunities within the company.	Phase		
Population changes and "out flux" of people from the area and a negative impact on the social fabric and social networks.	Population change	8	3	3	4	56	-	M	Wits Gold will undertake a detailed Social Impact Assessment when operations cease in order to determine the actual impacts on the changing social environment at that stage. During the operational phase of DBM, the Company will endeavour to create mine independent self-sustaining enterprises so that the effect of the mine closure on the local economy is minimised.	6	2	2	3	30	-	M	Appoint a Social Scientist to conduct a Social Impact Assessment and propose measures to mitigate population changes.	Prior to closure	HR Manager/Project Manager/ Environmental Control Officer	R 87 500.00
Possible negative impact on the crime levels due to job losses adding to the unemployment rate at that stage.	Safety and security risks	8	2	3	3	39	-	M	Wits Gold will undertake a detailed Social Impact Assessment when operations cease in order to determine the actual impacts on the changing social environment at that stage. During the operational phase of DBM, the Company will endeavour to create mine independent self-sustaining enterprises so that the effect of the mine closure on the local economy is minimised.	6	2	2	3	30	-	M	Appoint a Social Scientist to conduct a Social Impact Study and propose measures to mitigate safety and security risks.	Prior to closure	HR Manager/Project Manager/ Environmental Control Officer	R 87 500.00
Issues related to HERITAGE																				
No significant closure and decommissioning residual impacts are envisaged.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to WETLANDS																				
Removal of surface infrastructure following mine closer will largely result in similar impacts to the initial establishment of infrastructure, as soils are disturbed and exposed to erosion.	Infrastructure removal	6	5	1	4	48	-	M	Rehabilitation earthworks and infrastructure clearing activities on site should be undertaken during the dry season to minimize sediment transport following rainfall events. Activities should also be phased to minimize the extent of disturbed areas at any one time. Temporary toe berms should be installed on the downslope side of large bare soils areas and any soil stockpiles to trap sediments eroded off these areas. The site should be monitored for erosion and sediment movement during and after rainfall events and suitable interventions put in place to repair any erosion damage and to prevent further sediment movement. Following completion, bare soil areas should be ripped, scarified, landscaped and re-vegetated as soon as possible. Re-vegetated areas should	4	5	1	3	30	-	M	Undertake rehabilitation in accordance with the mitigation measures proposed.	During closure and decommissioning phase	Environmental control officer	N/A

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 3: RESIDUAL IMPACTS POST CLOSURE																				
									be monitored to ensure successful re-establishment of vegetation. Ideally, 70 % cover should be obtained after 3 months. A mixture of indigenous grass species should be used for re-vegetation activities.											
Incomplete removal of infrastructure and waste following mine closure could provide sources of pollutants leading to water quality deterioration. Mobilisation of pollutants in contaminated soils due to disturbances of these areas during rehabilitation activities provides further potential pollution sources.	Pollutant mobilisation	6	3	2	4	44	-	M	Complete removal of all infrastructure and waste must be ensured following mine closure. Specialist contractors should be appointed to deal with areas of contaminated soil either through on site amelioration, if possible, or through the complete removal of the contaminated material and disposal on a registered hazardous waste facility.	4	3	1	3	24	-	L	Undertake rehabilitation in accordance with the mitigation measures proposed.	During closure and decommissioning phase	Environmental control officer	N/A
During mining, groundwater levels within the mine will be manipulated and maintained at low levels to allow for mining to take place. Following completion of mining activities the groundwater table is likely to rebound, raising the possibility that decant of mine water, which is likely to be acidic and sulphate and metal rich, could occur. This could result in significant water quality deterioration in receiving wetlands. No information on the acid generation potential of the ore was available, nor any information on the possibility or likely location of a decant point. As such, the precautionary principle was applied in assessing this impact.	Decant of Acid Mine Water	10	4	3	5	85	-	H	No decant or discharge of polluted mine water should be allowed to occur post-closure. If required, continuing pumping and treatment of polluted water should be implemented.	10	4	3	5	85	-	H	Only water meeting the requirements of the DWA standards should be allowed to decant or be discharged into any water course.	During closure and decommissioning phase	Environmental control officer	N/A
Clearing of vegetation and soil disturbance could lead to mobilisation of sediments and dust which may be blown or washed into receiving water bodies (wetlands and pans) within the vicinity. This would lead to increased turbidity which may have a negative impact on aquatic fauna. When the suspended solids (soil particles) settle out on the substrates in the wetlands, it leads to further deterioration in habitat quality. Sediments are colonised by Typha reeds or alien weeds, causing a decline in habitats during the wet season. This may result in a decline in overall aquatic biodiversity. Water quality impacts, resulting from spills, leaks, dust, seepage (from stockpiles, or tailings facilities) or decanting mine water will result in the loss of taxa that may be sensitive to a decline in water quality. In addition, altered hydrology, in terms of timing, duration and quantity of water will affect habitat availability. Reduced flows or shorter periods of inundation may impact on habitats and aquatic fauna.	Vegetation clearance	8	4	3	5	75	-	H	Implementation of all mitigation measures listed previously for erosion control and water quality management will reduce the severity of impacts. No decant or discharge of polluted mine water should be allowed to occur post-closure. If required, continuing pumping and treatment of polluted water should be implemented. Only water meeting the requirements of the DWA standards should be allowed to decant or be discharged into any water course. An emergency preparedness plan should be compiled and implemented in the event of major spills (e.g. fuel, mine water or sewage spill). Dust suppression measures should be used. A biomonitoring plan should be compiled and implemented and should include assessments of water quality, habitats and aquatic macroinvertebrates. Sampling sites further down in the Doring River catchment should be included to assess impacts on downstream ecosystems. All mitigation measures relating to water quality should be audited with prompt follow-up action taken in the event of non-compliances.	6	5	3	4	56	-	M	Undertake rehabilitation in accordance with the mitigation measures proposed.	During closure and decommissioning phase	Environmental control officer	N/A

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CLOSURE AND DECOMMISSIONING PHASE ACTIVITY 3: RESIDUAL IMPACTS POST CLOSURE																				
Issues related to RADIATION																				
Impact on public safety as a result of exposure to radioactivity.	Radioactive elements	10	4	2	5	80	-	H	Develop a Radiation Management Plan.	6	4	1	4	44	-	M	Implement the Radiation Management Plan throughout the life of mine and monitor exposure of the public to radioactivity in accordance therewith.	Ongoing	Environmental control officer/Health & Safety officer	Included in Construction and Operational Costs

6.6 Cumulative Impacts

Section 2 of the NEMA requires the consideration of cumulative impacts as part of any environmental assessment process. Furthermore this is carried forward into Regulation 385 which requires assessment of cumulative impacts in an EIA Report. EIA's have traditionally, however, failed to come to terms with such impacts, largely as a result of the following considerations:

- Cumulative effects may be local, regional or global in scale and dealing with such impacts requires co-ordinated institutional arrangements; and
- EIA's are typically carried out on specific developments, whereas cumulative impacts result from broader biophysical, social and economic considerations, which typically cannot be addressed at the project level.

Cumulative impacts associated with this type of development could lead to initial, incremental or augmentation of existing types of environmental degradation, including impacts on the air, soil and water present within available habitat. Pollution of these elements might not always be immediately visible or readily quantifiable, but incremental or fractional increases might rise to levels where biological attributes could be affected adversely on a local or regional scale. In most cases are these effects are not bound and is dispersed, or diluted over an area that is much larger than the actual footprint of the causal factor. Similarly, developments in untransformed and pristine areas are usually not characterised by visibly significant environmental degradation and these impacts are usually most prevalent in areas where continuous and long-term impacts have been experienced.

The nature of the development is such that pollution and degradation of the surrounding areas are expected to some extent.

Cumulative impacts are assessed over the entire lifespan of the mining operation and are therefore not broken down into the construction, operation and decommission phases as was performed for the EIA.

6.6.1 Groundwater

The groundwater levels in the underground mining area will probably recover during the decommissioning and post-closure phases when mine dewatering is stopped. The groundwater level recovery will depend on a) the extent of interaction and b) dewatering of neighbouring mines. No decant is foreseen due to the topographic position of the mine.

The single largest risk in terms of post closure impacts is that of aquifer contamination caused by leachate from the new TSF to be located on the Merriespruit TSF. Static leach tests that were undertaken on a comprehensive tailings sample indicated arsenic (As) concentration of 11 mg/l and sulphate concentration of 700 mg/l at a water. A plume could potentially migrate a 1000 m in a north-westerly direction from the TSF a hundred years after closure.

Pyrite (FeS_2) is present as minor mineral in the tailings. Pyrite will be the major contributor to the products of acid-mine drainage in the tailings. Carbonate minerals which are responsible for buffering, are absent in the tailings and therefore the tailings sample will have a definite potential to produce acid drainage over the long term.

- Various metals were also found in the tailings water in elevated concentrations which exceeded the SANS 241 drinking water standard. These elevated metals include Al, As, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb and Sb. These metals are likely to be associated with the tailings material and could therefore impact on both surface water and groundwater resources. The constituents SO4, EC and NH3 were also found in levels exceeding the SANS 241 drinking water standard. The total cyanide level exceeds the screening level SSV1 for Human Health and water resource protection and therefore poses a potential risk to the groundwater.

6.6.2 Hydrology

The cumulative impact of concern in the project area relates to the potential for surface water quantity and quality reduction, as well as potential catchment alteration.

It is anticipated that most risks posed to local surface water resources could be effectively managed by an appropriate storm-water management plan.

- Deep seepage from tailings and slimes facilities into local watercourses is unlikely due to the location of discard facilities far from rivers and streams. It is possible that a TSF located towards the east of the planned discard area could allow seepage into deep and well-drained sandy soils that will eventually seep into local river systems. The design of TSFs should consider seepage risks and, if needed, make allowance for sealing or lining of the base of a tailings dam.
- Other seepage will be collected by means of return water drains and transferred to return water dams. In this case, where stormwater will be treated and discharged, water from return water dams should be considered first priority water supply to processing and treatment plants.

- A concern that needs to be considered is that dust created in TSFs could add to local atmospheric pollution. Dust from the tailings dams of other mines in the vicinity of the town of Virginia is widely claimed to pose health risks to local inhabitants. Dust suppression on the TSFs constructed for this mine is considered to be important.
- Dirty water runoff conveyance and storage systems at the mine will be controlled by structures and control measures prescribed in the Storm-water Management Plan.

6.6.3 Ecological (Fauna and Flora)

- Cumulative Impacts:
  - Impacts on SA's conservation obligations & targets (VEGMAP vegetation types);
  - Increase in local and regional fragmentation/ isolation of habitat; and
  - Increase in environmental degradation, pollution (air, soils, surface water).

6.6.4 Wetlands

Two hillslope seepage wetlands will be directly impacted by the proposed surface infrastructure layout and will likely be completely and permanently destroyed during site clearing activities preceding construction. In addition, the existing gravel road crossing over wetland unit 2 will be upgraded as the main access road to the mine shaft. Upgrading and widening of this road will result in further wetland loss.

The most significant impact will be from:

- Loss of wetland habitats;
- Erosion due to stormwater runoff;
- Altered hydrology; and
- Water quality impacts (spills, leaks, acid rock drainage and decant) and associated loss of biota.

6.6.5 Soil, Land Use and Land Capability

The following impacts on soil and land capability are anticipated for the project:

- Soil erosion due to steep slopes and vegetation clearance;
- Topsoil degradation;
- Soil compaction due to regular heavy vehicle transport;

- Chemical soil pollution as a result of potential spillage of petroleum hydrocarbons and other soil pollutants as well as the chemical pollution potential of the chemicals used for gold mining processes;
- Loss of agricultural potential and arable land capability;
- Loss of wetland land capability; and
- Loss of grazing and wilderness land capability.

6.6.6 Air Quality

The proposed activities will result in dust emissions, both from mining activities and fugitive emissions from the large areas of previously vegetated land that will now be exposed. Provided sufficient mitigation measures are instigated, it is unlikely that these emissions resulting from mining activity will result in the exceedence of South Africa's guidelines for particulate emissions.

The dump is an area of concern, although it is impossible to determine whether the emissions that result from Wits Gold DBM's activities will increase or decrease the fugitive dust emissions from the dump in question. It is recommended that care be taken in the design and structure of the dump, and that the existing dust fall out monitoring network be redesigned to centre around the dump, with monitors in the sensitive reception areas of Virginia and Meloding.

6.6.7 Traffic

It is evident that the traffic generated by the proposed development does not have a significant impact on the external road network. In terms of the intersection and road link capacity, no improvements are recommended since the intersections under investigation are expected to operate at acceptable level of service.

The interaction (turning movements) between construction vehicles, public transport and privates vehicles might impose some safety hazardous to the vehicles drivers. It is therefore recommended that the following measures be adopted to mitigate the impact:

- Surfacing of S239 Road between Virginia Way and the S239 / Access Road intersection.
- Construction of an exclusive right turn lane, on the northbound approach as indicated in Drawing 2984/GL/01 – Appendix B. The exclusive right turn lane should be constructed with a 60m long and a 60m tapper.

- Provision of light at sufficient standards at the intersection of the S239 (Theunissen Street), S1279 and Jan Hofmeyer Street routes and the access to the development.
- No on-street pick up/drop offs at the intersection of the S239 (Theunissen Street) S1279 and Jan Hofmeyer Street routes and the access to the development (drop-offs/pickup should be done on site).

6.6.8 Heritage

6.6.8.1 Site 1

The development will have a direct impact on site 1. The exact nature thereof is however not known and should be confirmed by the client. Due to the sensitivity of this issue, graves are always regarded as having a high cultural significance.

With graves it usually is best to incorporate them into the development plan for the site. Should this be possible, the graveyard should then be fenced off and kept intact. Access to any descendants should also be allowed. A management plan needs to be drafted and implemented and it should also be monitored once a year by a heritage expert.

Should the above not be possible the graves will have to be exhumed and the bodies reburied. This is a lengthy process including social consultation for 60 days in order to find families of the deceased and to obtain their permission.

In the case of graves older than 60 years and those with an unknown date of death (as in this case) an archaeologist as well as an undertaker will have to be part of the team involved. For graves with a date of death of younger than 60 years, only an undertaker is involved.

6.6.8.2 Site 2

Site 2 falls to the west and just outside of the footprint area of the proposed mining development. Therefore there will not be a direct impact on the site, but there will be a secondary one. The buildings are regarded as having a medium cultural significance. It still is in a good condition, but is not very unique.

The buildings should remain intact and may even be reutilized. Any structural changes should be communicated with the Provincial Heritage Resources Agency (PHRA) of the Free State Province and a permit will be required to do so. The buildings should not be demolished.

6.6.9 Social

The social change processes shown in the figure below are expected to take place as a result of this project.

Demographic processes

- In-migration;
- Presence of temporary workers;
- Resettlement; and
- Displacement / dispossession.

Economic processes

- Waged labour; and
- Conversion and diversification of economy.

Geographic processes

- Conversion and diversification of land use;
- Enhanced transport and rural accessibility; and
- Physical splintering.

Institutional and legal processes

- No impacts are expected.

Emancipatory and empowerment processes

- Capacity building.

Socio-cultural processes

- Social behaviour.

It is important to pause here and clarify that the actual impacts experienced at a given project site will depend on a variety of factors, that range between the baseline conditions, the public participation process, engagement and capacity building that has taken place, the type of mining methods and minerals mined, the role of politics, most notably in local municipalities and the other processes of social change either already under way (e.g. due to exploration activities), or which may develop during the life of the mine.

6.6.10 Radiation

Impact on public safety as a result of exposure to radioactivity.

Table 6.21 details the identified impacts and management measures for the cumulative impacts.

Table 6.21: Impacts and Management Measures for Cumulative Impacts

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CUMULATIVE IMPACT ASSESSMENT																				
Issues related to GEOLOGY																				
No significant cumulative impacts are envisaged.	N/A	0	0	0	0	0	N	N	N/A	0	0	0	0	0	N	N	N/A	N/A	N/A	N/A
Issues related to TOPOGRAPHY																				
Change in topographical characteristics of the site.	Mining	8	4	2	4	56	-	M	Rehabilitation of the area to be free-draining.	4	4	1	3	27	-	L	Rehabilitate the area concurrent with mining activities and ensure that the area is free draining at completion of the rehabilitation.	Ongoing	Environmental Control Officer	Included in operational costs.
Issues related to GEOHYDROLOGY																				
Potential groundwater contamination risk	Ore stockpiles at plant- seepage of contaminated water to aquifer	6	4	1	4	44	-	M	Concrete slabs with seepage control measures and storm water management	2	4	1	2	14	-	L	Divert seepage and run-off to lined PCD's, concrete slaps with seepage control, groundwater quality monitoring	Quarterly monitoring	Mine Environmental Manager	Included in operational costs.
Contaminant soil could impact on groundwater quality	Plant, PCD's, workshops, other infrastructure	4	5	1	3	30	-	M	Removal of dirty soil to landfill	2	5	1	2	16	-	L	Removal of dirty soil to landfill	At closure	Mine Environmental Manager	Included in operational costs.
Ongoing groundwater contamination	Ongoing TSF seepage	8	5	2	4	60	-	M	Vegetation of TSF, infiltration only rainfall dependent and therefore lower compared to operations	6	5	1	4	48	-	M	Update impact assessment for closure with monitoring data. Ongoing monitoring if required.		Mine Environmental Manager	Included in operational costs.
Contaminated groundwater reaching surface, impact nearby groundwater and surface water	Flooding of underground workings and potential decant	10	5	2	2	34	-	M	Investigate and determine impact of decant after closure.	10	5	2	2	34	-	M	Investigate and determine impact of decant after closure. Monitoring of mine flooding for 5 years after decommissioning	Quarterly	Mine Environmental Manager	Included in operational costs.
Groundwater contamination	Waste rock dump	4	4	1	3	27	-	L	Potential capping and vegetation	4	5	1	2	20	-	L	Update impact assessment for closure with monitoring data. Ongoing monitoring if required.		Mine Environmental Manager	Included in operational costs.
Increase in environmental degradation - groundwater contamination and/or availability.	Contamination	10	5	3	5	90	-	H	Groundwater quality monitoring networks must be set up prior to the construction phase so that any surface water quality issues can be addressed accordingly. Groundwater levels in the underground workings will recover. Pollution plumes may migrate to boreholes intersecting deeper aquifers. All mined areas should be flooded as soon as possible to bar oxygen from reacting with remaining pyrite. Groundwater sampling must be undertaken to establish a database of plume movement trends, to aid eventual mine closure.	8	3	2	5	65	-	H	Groundwater quality sampling will be undertaken on a monthly basis and analysed according to the prescribed monitoring programme contained in the EIA/EMP.	Monthly	Environmental Control Officer	R 91 000.00
																	Quarterly groundwater monitoring reports will be generated by the mine or through a qualified water quality specialist.	Quarterly	Environmental Control Officer/Water Quality Specialist	R 42 000.00
																	In the event that water quality or quantity issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental Control Officer/Water Quality Specialist	To be determined - depending on severity of incident
Issues related to HYDROLOGY																				
Erosion, siltation and hydrocarbon contamination of surface water resources during the operational phase of mining.	Contamination	8	4	2	4	56	-	M	Surface water quality monitoring networks must be set up prior to the construction phase so that any surface water quality issues can be addressed accordingly.	6	4	2	3	36	-	M	Surface water quality sampling will be undertaken on a monthly basis and analysed according to the prescribed monitoring programme contained in the EIA/EMP.	Monthly	Environmental Control Officer	R 91 000.00
																	Quarterly surface water monitoring reports will be generated by the mine or through a qualified water quality specialist.	Quarterly	Environmental Control Officer/Water Quality Specialist	R 42 000.00
																	In the event that water quality issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental Control Officer/Water Quality Specialist	To be determined - depending on severity of incident
Issues related to SOIL, LAND USE AND LAND CAPABILITY																				
Every additional mining operation that	Loss of high	6	4	3	4	52	-	M	Rehabilitate productive land back to	4	3	1	3	24	-	L	During closure and decommissioning	During Closure and	Environmental Control	Included in

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CUMULATIVE IMPACT ASSESSMENT																				
may open in the region will result in areas with potential agricultural soil being degraded to low production potential. This will result in lower yields possible for farmers in the area.	potential agricultural soil								original conditions where possible.								phases the land capability of agriculture and/or grazing should be restored to as near as pre-mining conditions as possible.	Decommissioning Phase	Officer	operational costs.
Once mining has ceased, land may not be restored back to a desired land capability that will sustain crop production. Land capability is rarely restored back to grazing capability and most land is usually left to wilderness land capability.	Loss of arable land capability	6	4	3	4	52	-	M												
Issues related to FAUNA AND FLORA																				
Impacts on SA's conservation obligations & targets.	Land clearance	8	5	4	2	34	-	M	Limit development footprint within approved area only; prevent impacts in adjacent natural habitat.	6	5	2	2	26	-	L	Early identification and prevention of impacts.	Ongoing	Environmental control officer	Included in operational costs.
Increase in local & regional fragmentation/isolation of habitat.	Land clearance	6	5	2	4	52	-	M	Limit development footprint within approved area only; prevent impacts in adjacent natural habitat.	4	5	2	2	22	-	L	Early identification and prevention of impacts.	Ongoing	Environmental control officer	Included in operational costs.
Increase in environmental degradation, pollution of air, soils and water.	Land clearance	6	4	2	4	48	-	M	Prevent peripheral impacts from affecting nearby sensitive areas.	4	4	2	2	20	-	L	Early identification and prevention of impacts.	Ongoing	Environmental control officer	Included in operational costs.
Issues related to AIR QUALITY																				
The modelled data indicates that activity on the dump in question may lead to an increase in ambient PM10 levels over the towns of Virginia and Meloding, with the bulk of these impacts falling on farmland to the south and southwest.	Air pollution	6	4	3	3	39	-	M	A dust monitoring network must be set up prior to the construction phase so that any air quality or dust issues can be addressed accordingly. Although impacts associated with the dust emitting activities within the mine boundary (crushing and ore handling) seem insignificant, every effort should be made to mitigate against any fugitive emissions from these sources. Due to the inherent limitations in dust emission modelling and the extremely stressed nature of this airshed it is recommended that every effort be made to limit dust emissions from the active mine areas.	4	4	2	3	30	-	M	Dust sampling will be undertaken on a monthly basis and analysed according to the prescribed monitoring programme contained in the EIA/EMP.	Monthly	Environmental Control Officer	R 92 000.00
																	Monthly monitoring reports will be generated by the mine or through a suitably qualified air quality specialist.	Monthly	Environmental Control Officer/Air Quality Specialist	R 42 000.00
																	In the event that air quality or dust issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of action to ameliorate the situation.	In the event of occurrence	Environmental Control Officer/Air Quality Specialist	To be determined - depending on severity of incident
Issues related to NOISE																				
Increase in environmental degradation and pollution.	Noise pollution	8	4	2	4	56	-	M	Noise monitoring will be undertaken as specified in the noise monitoring programme.	6	4	2	3	36	-	M	Implement acoustic screening measures as specified in noise monitoring programme.	Ongoing	Environmental Control Officer	Included in operational costs.
Issues related to TRAFFIC																				
Increase in traffic volumes	Traffic increases	6	4	3	3	39	-	M	Monitor and mitigate frequently.	4	4	3	2	22	-	L	Setup a traffic monitoring and action plan.	Monthly	Environmental Control Officer	Included in Construction and Operational Costs
Traffic safety issues	Traffic increases	6	4	3	3	39	-	M	Monitor and mitigate frequently.	4	4	3	2	22	-	L	Setup a traffic monitoring and action plan.	Monthly	Environmental Control Officer	Included in Construction and Operational Costs
Increase in environmental degradation and pollution.	Traffic increases	8	4	2	5	70	-	H	Traffic counts to be undertaken throughout the life of mine to identify and monitor traffic volumes.	6	4	2	4	48	-	M	Implement and monitor the traffic volumes throughout the life of mine.	Quarterly	Environmental Control Officer	R 125 000.00
Issues related to VISUAL																				
Increase in environmental degradation and pollution.	Expansion of tailings facility	10	4	2	4	64	-	H	The tailings facility will continue to expand in size/height during the operational phase of the mine. The tailings facility will remain post closure, and significantly alter the visual characteristics of the area.	6	4	2	3	36	-	M	Ensure ongoing rehabilitation on the sides of the tailings facility and that adequate dust suppression techniques are implemented.	Ongoing	Environmental Control Officer/Air Quality Specialist	Included in operational costs.
Issues related to SOCIAL																				
Disruption and nuisance factors	Nuisance	8	3	2	4	52	-	M	Local residents, with the focus on the	6	2	2	3	30	-	M	The community forum established	Ongoing	Environmental Control	N/A

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CUMULATIVE IMPACT ASSESSMENT																				
associated with the actual decommissioning such as noise, visual and traffic related impacts.									surrounding landowners, should receive accurate information with regards to the project status, timeframes for decommissioning and other relevant information about issues that could influence their daily living and movement patterns.								during the construction phase and implemented throughout the operational phase of DBM should continue, through which issues can be addressed, and a representative from DBM should become involved.		Officer	
Job losses due to mine closure and decline in local economy as a result of the loss of employment, household income and capital investments.	Job losses	8	5	3	4	64	-	H	Capacity building and skills training among employees are critical and would be highly beneficial to those involved, especially if they receive portable skills to enable them to also find work elsewhere and in other similar environments. The SLP approved as part of the Mining Right Application in the pre-construction phase aims to develop mechanisms and strategies to prevent job losses or, where these cannot be avoided, to implement appropriate plans to ameliorate the social and economic impact that downscaling of the operations and/or closure may have on employees, communities and the economy.	6	3	2	4	44	-	M	Where job losses are inevitable, minimise the extent of the job losses resulting from major restructuring or retrenchment exercises and to facilitate, as far as practically possible, access to alternative employment opportunities within the company.	During Closure and Decommissioning Phase	HR Manager	Included in SLP and closure costs.
Population changes and "out flux" of people from the area and a negative impact on the social fabric and social networks.	Population change	8	3	3	4	56	-	M	Wits Gold will undertake a detailed Social Impact Assessment when operations cease in order to determine the actual impacts on the changing social environment at that stage.	6	2	2	3	30	-	M	Appoint a Social Scientist to conduct a Social Impact Assessment and propose measures to mitigate population changes.	Prior to closure	HR Manager/Project Manager/ Environmental Control Officer	R 87 500.00
Possible negative impact on the crime levels due to job losses adding to the unemployment rate at that stage.	Safety and security risks	8	2	3	3	39	-	M	Wits Gold will undertake a detailed Social Impact Assessment when operations cease in order to determine the actual impacts on the changing social environment at that stage.	6	2	2	3	30	-	M	Appoint a Social Scientist to conduct a Social Impact Study and propose measures to mitigate safety and security risks.	Prior to closure	HR Manager/Project Manager/ Environmental Control Officer	R 87 500.00
Issues related to HERITAGE																				
Evidence of 2 sites of archaeological/cultural importance occur within the greater project area. Potential impacts on these must be minimised.	Graves/ grave yards	8	4	2	3	42	-	M	Should it be directly impacted on by the mine the graves may be exhumed and the human remains reburied. Before this may happen the necessary advertising, possible social consultation and permitting applications should be implemented. Should the graves however not be impacted on directly, there will definitely be a secondary impact. The graves should then be fenced in a management plan for the preservation and maintenance thereof be written.	4	4	2	2	20	-	L	It is possible that more cultural sites may be present. Also the subterranean presence of archaeological and/or historical sites, features or artefacts are always a distinct possibility. Care should also be taken when development work commences that if any more artefacts are uncovered, a qualified archaeologist be called in to investigate.	Ongoing	Environmental Control Officer	N/A
Issues related to WETLANDS																				
Clearing of vegetation and soil disturbance could lead to mobilisation of sediments and dust which may be blown or washed into receiving water bodies (wetlands and pans) within the vicinity. This would lead to increased turbidity (decreased water quality) which may have a negative impact on aquatic fauna. When the suspended solids (soil particles) settle out on the substrates in the wetlands, it leads to further deterioration in habitat	Decline in habitats and biota	6	4	2	4	48	-	M	The loss of these wetlands could be offset through the implementation of a wetland management and rehabilitation plan for the remaining wetlands within the study area that aims to improve the condition of these wetlands and the role they play in especially biodiversity support, which is considered to be the most important function of the wetlands on site.	6	4	1	2	22	-	L	Develop a wetland management and rehabilitation plan, and implement throughout the construction, operation and closure phases of the mine.	Ongoing	Environmental control officer	N/A

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							ACTION PLAN	FREQUENCY	RESPONSIBLE PERSON	ANNUAL MANAGEMENT COST
		M	D	S	P	TOTAL	STATUS	SP		M	D	S	P	TOTAL	STATUS	SP				
CUMULATIVE IMPACT ASSESSMENT																				
quality. Sediments are colonised by Typha reeds or alien weeds, causing a decline in habitats during the wet season. This may result in a decline in overall biodiversity. Water quality impacts, resulting from spills, leaks, dust or dirty storm water, will result in the loss of taxa that may be sensitive to water quality. In addition, altered hydrology, in terms of timing, duration and quantity of water will affect habitat availability. Reduced flows or shorter periods of inundation may reduce both the availability and suitability of habitats and will have an impact on aquatic fauna.																				
Issues related to RADIATION																				
Impact on public safety as a result of exposure to radioactivity.	Radioactive elements	10	4	2	5	80	-	H	Develop a Radiation Management Plan.	6	4	1	4	44	-	M	Implement the Radiation Management Plan throughout the life of mine and monitor exposure of the public to radioactivity in accordance therewith.	Ongoing	Environmental control officer/Health & Safety officer	Included in Construction and Operational Costs

7 MONITORING MANAGEMENT PROGRAMME

This chapter of the EIA/EMP report relates to the following sections of the MPRDA and Regulation 527 (GNR 527) of 23 April 2004 promulgated in terms of the MPRDA:

Sections 50(h) and 51(b) of the MPRDR, 2004 under the MPRDA, 2002 requires that an environmental monitoring programme must be developed for a mining operation. The monitoring programme developed for Wits Gold is explained below.

The draft monitoring programme developed for Wits Gold is explained herewith.

The key to the success of environmental management lies in the effective implementation of the proposed mitigation and management measures. Monitoring provides qualitative and quantitative information pertaining to the possible impacts of the development on the environment, and enables the measurement of the effectiveness of environmental management measures.

In order for Wits Gold to comply with the requirements of Regulation 51(b) of the MPRDA, monitoring programmes have to be developed for the different components of the environment that will be impacted on by the proposed mining and related activities. These monitoring programmes are a requirement of Section 24Q of the National Environmental Management Amendment Act 2008, (Act 26 of 2008) and also have to comply with the requirements of the NEMA and associated Regulations promulgated there under.

This draft monitoring programme will allow the proposed mine to monitor its compliance with the approved EMP for the proposed mining and related activities.

The draft monitoring programme will incorporate monitoring of the following environmental components:

- Hydrological (Surface water);
- Geohydrological (Groundwater);
- Biomonitoring;
- Air quality; and
- Radiation.

Further to the environmental monitoring that is required. Wits Gold will have to ensure that the proposed monitoring actions specified in the table that follows are implemented from the initiation of the project until decommissioning/closure.

Table7.1: Proposed monitoring actions and responsibilities

RESPONSIBILITY	MONITORING ACTIONS
Daily Inspection, Observations and Monitoring Activities	
Mining Personnel	General housekeeping. All waste to be deposited in demarcated bins.
	Daily inspection of surface area.
	All maintenance/fitting activities to be conducted on concreted areas.
	Activate dust suppression system on non rainy days immediately prior to the use of the roads by the haul truck.
Grade C and higher	Undertake workplace observations in all areas of the operation and document findings accordingly.
Selected representative	Any water leaks identified must be reported and leaks fixed immediately.
Environmental Officer	Daily monitoring for leakage should be undertaken.
All personnel	Notify environmental department of any hydrocarbon spills immediately (regardless of size). All hydrocarbon spills must be cleaned up immediately.
Weekly Inspection, Observations and Monitoring Activities	
Selected representative	Designated person to monitor amount of waste in waste receptacles. Should the receptacles be approaching full, measures must be implemented to empty receptacle and remove the waste from site.
Monthly Inspection, Observations and Monitoring Activities	
Environmental Officer	Monthly monitoring of water quality within adjacent pans.
	Water quality sampling will be undertaken on a monthly basis and analysed according to the monitoring programme.
	Quarterly surface and groundwater monitoring reports will be generated by the mine or through a water quality specialist
	Long term bi-annual biomonitoring programme, should be implemented.
	Regular monitoring to ensure successful establishment of indigenous vegetation and removal of alien and weedy species should be undertaken for 2 full growing seasons.
	Review and update water balance diagram.
	Update waste itinerary spreadsheet.
	Compare monthly water consumption rates with previous months.
	Investigate reasons for variations, if necessary, and take the appropriate action.
	Compare monthly power consumption rates with previous months.
	Monitor the storm water control measures (trench and berm) along the perimeter of the plant area. If they are becoming eroded or not functioning correctly, the necessary maintenance work must be conducted.
Annual Inspection, Observations and Monitoring Activities	
Mine manager and environmental manager	Confirm the validity of all permits/registrations/licences which include, but are not limited to the renewal of all

RESPONSIBILITY	MONITORING ACTIONS
	permits/registrations/licences that will expire within the coming year.
Environmental Officer	Check sewage system.
Environmental Officer	Check waste management system and wear and tear on waste receptacles.
Post Closure Inspection, Observations and Monitoring Activities	
Mine manager and environmental manager	Regular monitoring of adjacent water resources post-closure as per the recommendations in the aquatic ecology specialist reports should be undertaken.
Mine manager and environmental manager	Water quality monitoring as well as biomonitoring should also continue well beyond closure to ensure that rehabilitation and remediation measures have been effective.

7.1 Geohydrological and Hydrological Monitoring Requirements

The objectives of the geohydrological monitoring programme is to ensure that the water management systems perform according to specifications, to act as an early warning system, to check compliance with license requirements and for reporting purposes. The objectives of these systems will be achieved if there is no impact (attributable to the mine) on the in-stream and downstream fitness for use criteria.

The monitoring programme will assists with overall water management at the site, including but not limited to:

- Prevent pollution and thereby protect the receiving water environment;
- Develop an understanding of the current pollution on the mine and monitor how it changes over time; and
- Assess performance of pollution prevention measures, i.e. compliance with license conditions and catchment objectives.

Reporting

Reporting on surface and groundwater quality and quantity conditions will be included in the quarterly reports for SOFS Mining Operation an annual report will be submitted to the relevant authorities.

The quarterly report will be an update of the database with time-series graphs, statistical analysis (average, maximum, minimum, 5, 50 and 95 percentile values as well as linear performance). Laboratory results will be analysed against the target water quality guidelines for domestic use, livestock watering and irrigation (according to the South

African Water Quality Guidelines, 1996: DWAF). The strictest value between the target water quality objectives or objectives through a reserve determination will be used.
In terms of flow, all water uses and discharges will be measured on an ongoing basis. The flows include:

- Make-up water;
- Volumes of groundwater pumped out for mine dewatering purposes;
- Volumes of water pumped from the plant as part of slimes;
- Volumes of contaminated water that is recovered and used in the plant or for dust suppression; and
- Volumes of water in terms of the internal water flow processes.

An annual detailed water quality audit report on the surface and groundwater quality will be prepared that will analyse the water quality situation in detail to investigate trends and non-compliance. The report will be submitted to the relevant authorities as required by license conditions. Should the monitoring data indicate that the groundwater conditions are adversely affected, additional studies will be undertaken if it is deemed necessary.

Data Management

Monitoring results would be entered into an electronic database as soon as results are available, and at no less than one monthly interval, allowing:

- Data presentation in tabular format;
- Time-series graphs with comparison abilities;
- Statistical analysis (minimum, maximum, average, percentile values) in tabular format;
- Graphical presentation of statistics;
- Linear trend determination;
- Performance analysis in tabular format;
- Presentation of data, statistics and performance on diagrams and maps; and
- Comparison and compliance to South African Water Quality Guidelines and any other given objectives.

As far as possible, the same monitoring points will be used from the construction phase through the operational and decommissioning phases to after mine closure to develop a long term data record and enable trend analysis and recognition of progressive impacts with time.

7.1.1 Hydrological (Surface Water) Monitoring

It is recommended that monthly surface water samples be taken and analysed upstream and downstream of the Mine in the Merriespruit, if water is available to be sampled. The mine should also sample any discharges that may happen as well as effluents from its water treatment plants.

It is recommended that samples be tested for at least all of the elements as contained in the tests done for the baseline samples as per Section 4.8. In particular, it is recommended that lead and arsenic be monitored since the levels in the baseline water quality analyses were considered cause for concern. It is important for the mine to be able to show that it does not contribute in any way to any pollution of surface water resources.

Wits Gold will adopt a no-discharge policy, which will ensure that all dirty water on the mine property will remain within the mining area. Due to the Company's commitment on not polluting the surrounding water in the area, the mine will reuse dirty water contained within the dirty water systems (i.e. PCDs).

In order for the monitoring programme to be effectively implemented it is necessary to gather data related to the surface water component of the environment associated with the SOFS Mining Operation. Correct and sustained sampling performed at the correct times and intervals form the foundation for any monitoring programme. Sampling of the surface water resources (quality and quantity), including levels of PCDs, is the direct responsibility of Wits Gold. Any deviations from the monitoring protocol must be recorded and reported.

Table 7.2 and

Table **7.3** detail the surface water monitoring plan and monitoring parameters respectively.

Table 7.2: Surface Water Monitoring Plan.

WATER TYPE	DETAILS	MONITORING FREQUENCY
Process Water	Dirty water dams, etc	Monthly
Surface Water	Up- and down-gradient samples of all rivers in the vicinity of mining operations. As well as any springs, pans and natural dams	Monthly
Drinking Water	Any water supply used for domestic purposes should be monitored for all SANS parameters, especially bacteria, such as total and faecal coliforms.	Monthly

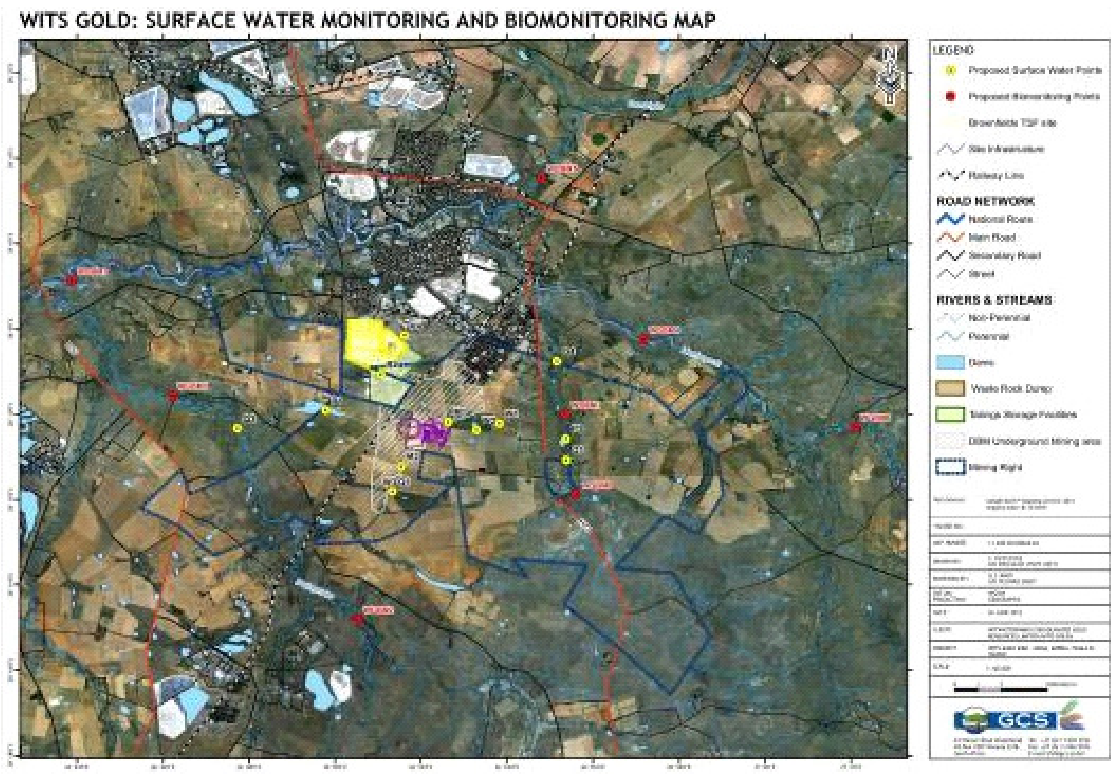
Table 7.3: Surface Water Monitoring Parameters

CONSTITUENT	CLASS 0 (IDEAL)	CLASS I (ACCEPTABLE)	CLASS II (MAX. ALLOWABLE)	CLASS III (EXCEEDING)
pH Value @ 20°C	6.0-9.0	5-6 or 9.0-9.5	4-5 or 9.5-10	<4 or >10
Conductivity mS/m @ 25°C	<70	70-150	>150-370	>370
Total Dissolved Solids	<450	450-1000	1000-2400	>2400
Calcium, Ca	<80	80-150	>150-300	>300
Calcium Hardness as $CaCO_3$	N/S	N/S	N/S	N/S
Magnesium, Mg	<30	30-70	>70-100	>100
Magnesium Hardness as $CaCO_3$	N/S	N/S	N/S	N/S
Total Hardness as $CaCO_3$*		100-200 (Fairly Hard)	200-300 (Hard)	>300 (Very Hard)
Sodium, Na	<100	100-200	200-400	>400
Potassium, K	<25	25-50	50-100	>100
Free and Saline Ammonia as NH_4	N/S	N/S	N/S	N/S
Total Alkalinity as $CaCO_3$	N/S	N/S	N/S	N/S
Bicarbonate, HCO_3	N/S	N/S	N/S	N/S
Carbonate, CO_3	N/S	N/S	N/S	N/S
Chloride, Cl	<100	100-200	>200-600	>600
Sulphate, SO_4	<200	200-400	>400-600	>600
Nitrate, NO_3	N/S	N/S	N/S	N/S
Nitrate as N	<6.0	6.0-10	>10-20	>20
Fluoride, F	<0.5	0.5-1	1-1.5	>1.5
Total Suspended Solids	N/S	N/S	N/S	N/S
Langelier Saturation Index (pH-pHs)	N/S	N/S	N/S	N/S
Sodium Absorption Ratio (SAR)	N/S	N/S	N/S	N/S
Aluminium, Al	<0.15	0.15-0.3	>0.3-0.58	>0.58
Manganese, Mn	<0.05	0.05-0.1	>0.1-1	>1
Iron, Fe	<0.01	0.01-0.2	>0.2-2	>2
Chromium, Cr	<0.01	0.01-0.1	0.1-0.5	>0.5
Phosphorus as P	N/S	N/S	N/S	N/S

Proposed water monitoring points are detailed in Table 7.4 and Figure 7.1

Table 7.4: Proposed surface water monitoring points

Surface Water Point	Co-ordinates	
	Latitude (S)	Longitude (E)
Q2	-28.1723	26.79552
P1	-28.1651	26.82967
P2	-28.1511	26.85106
M1	-28.1697	26.87721
W3	-28.1969	26.8556
Q1	-28.1969	26.8556
M2	-28.187	26.85884
W2	-28.1729	26.88824
W1	-28.1703	26.8971
P4	-28.136	26.86036
Q4	-28.146	26.91936
P3	-28.1763	26.92281
Q3	-28.1846	26.923



(Figure not to scale. Please refer to Appendix A for the A3 figure.)

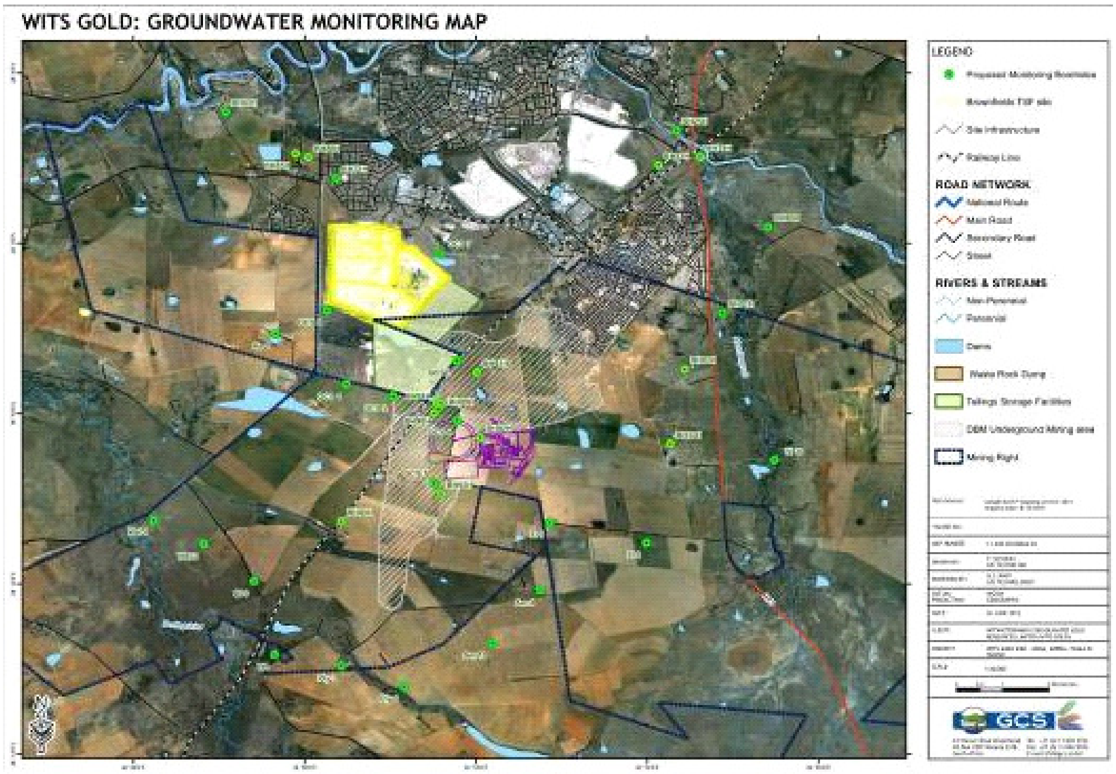
Figure 7.1: Proposed surface water monitoring points

7.1.2 Geohydrological Monitoring (Groundwater)

The objective of a groundwater monitoring program is to detect any changes that the mining activities may have on water quality and levels in the area. The area for groundwater monitoring at SOFS Mining Operation is presented in Figure 7.2 and Table 7.5. The boreholes in the monitoring network should cover the following: contaminant sources, receptors and potential contaminant plumes. Furthermore monitoring of the background water quality and levels is also required.

Table 7.5: Proposed Groundwater monitoring points

Groundwater monitoring points	Co-ordinates	
	Latitude (S)	Longitude (E)
Am 10	-28.2117	26.86983
Am 4	-28.2013	26.87915
BH25H	-28.1112	26.90568
BH31H	-28.1206	26.83948
BH37H	-28.1726	26.90449
BH79H	-28.1165	26.91032
BH80H	-28.1302	26.92351
BH81H	-28.147	26.91465
BH82H	-28.158	26.90731
BH83H	-28.1181	26.90221
BH84H	-28.1877	26.84053
BH85H	-28.1158	26.83162
BH86H	-28.1166	26.83409
BH87H	-28.1077	26.81801
BH88H	-28.1647	26.85905
BH89H	-28.1647	26.85989
BH90H	-28.1666	26.85859
BH91H	-28.1586	26.86688
BH92H	-28.1713	26.86754
BH93H	-28.1824	26.85987
Bl 3	-28.1995	26.82352
Fl 1	-28.188	26.88103
Fl 2	-28.192	26.89983
GCS 1	-28.161	26.84149
GCS 2	-28.1633	26.85054
GCS 3	-28.1563	26.863
GCS 4	-28.168	26.86301
GCS 5	-28.1804	26.85857
GCS 6	-28.1465	26.83769
GCS 7	-28.1353	26.85949
Ha 1	-28.1511	26.8276
Ni 10	-28.1757	26.92478
Ply 3	-28.2161	26.84058
Ply 6	-28.2201	26.85267
We	-28.2139	26.8275
Wel 2	-28.1922	26.8137
Wel 4	-28.1875	26.80397



(Figure not to scale. Please refer to Appendix A for the A3 figure.)

Figure 7.2: Proposed Groundwater monitoring points

The groundwater monitoring assessment should include the following:

- In addition to the monitoring boreholes that were drilled, it is suggested a minimum of two additional monitoring boreholes are drilled as indicated in Figure 7.2. The purpose of the boreholes will be to monitor potential plume migration.
- It is recommended that all monitoring boreholes be monitored on a quarterly basis. The schedule can be reviewed after a period of two years and maybe reduced to a biannual monitoring schedule – to accommodate dry and wet season monitoring at least. The quarterly chemical analyses must include: As, CN, EC, pH, SO4, Ca, Mg, Na, Cl, NO3, K, F, T-Alk, Fe, Al As and Cn.
- Cyanide (CN) monitoring should be conducted within the International Cyanide Management Code for the gold mining industry. All the cyanide species should be included in the groundwater monitoring program including free cyanide, total cyanide and Weak Acid Dissociable (WAD) Cyanide. Cyanide should be monitored in the groundwater surrounding the TSF and the processing plant where it is used and stored.
- It is recommended that the data is stored in a dedicated database and that quarterly and annual reports are generated for mine management.

Groundwater monitoring will be undertaken to SABS and DWA requirement according to the schedule provided in Table 7.6.

Table 7.6: Groundwater Monitoring Schedule

MONITORING POSITION	SAMPLING INTERVAL	ANALYSIS	WATER QUALITY STANDARDS
All monitoring boreholes	Monthly: measuring the depth of groundwater levels	N/A	N/A
All monitoring boreholes	Monthly: sampling for water quality analysis	• Full analysis in April and October, January and July • Groundwater levels	South African Water Quality Guidelines: Domestic Use, livestock watering
Rainfall	Daily at the mine	N/A	N/A

The identification of the monitoring parameters is crucial and depends on the chemistry of possible pollution sources. They comprise a set of physical and/or chemical parameters (e.g. groundwater levels and predetermined organic and inorganic chemical constituents). Once a pollution indicator has been identified it can be used as a substitute to full analysis and therefore save costs. The use of pollution indicators should be validated on a regular basis in the different sample position. The parameters should be revised after each sampling event; some metals may be added to the analyses during the operational phase, especially if the pH decreases.

The following parameters must be assessed:

- Physical Parameters:
  - Groundwater levels.
- Chemical Parameters:
  - Field measurements: pH, EC;
  - Laboratory analyses: Anions and cations (Ca, Mg, Na, K, NO3, Cl, SO4, F, Fe, Mn, Al, & Alkalinity) and other parameters (pH, EC, TDS);
  - Petroleum hydrocarbon contaminants (where applicable, near workshops and petroleum handling facilities); and
  - Sewage related contaminants (E.Coli, faecal coliforms) in borehole in proximity to septic tanks or sewage plants.

Laboratory analysis techniques will comply with the South African Bureau of Standards (SABS) guidelines. The groundwater monitoring database will be updated on a monthly basis as information becomes available. The database will be used to analyse the information and evaluate trends noted.

An annual compliance report will be compiled and submitted to the authorities for evaluation and comment. This report will be submitted annually for the construction, operational and decommissioning phases as well as for two years after mining ceases. The mine will develop a monitoring response protocol after the completion of the construction phase of the project. This protocol will describe procedures in the event that groundwater monitoring information indicates that action is required.

7.2 Dust Monitoring

A dust monitoring program has been underway at the site since November of 2011. Refer to the CD (Annexure K) for the copies of all the dust monitoring reports to date.

The location of the existing and proposed dust buckets is provided in Figure 7.3 and Figure 7.4, and **Table 7.7**.

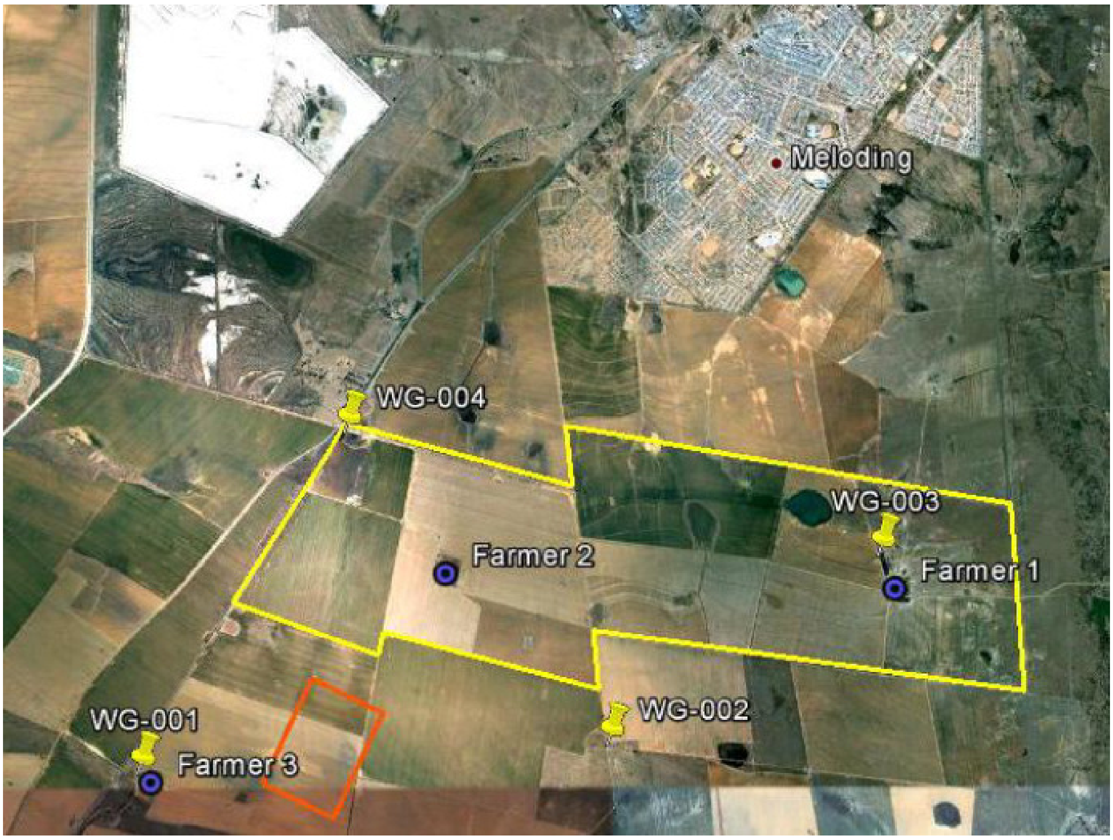
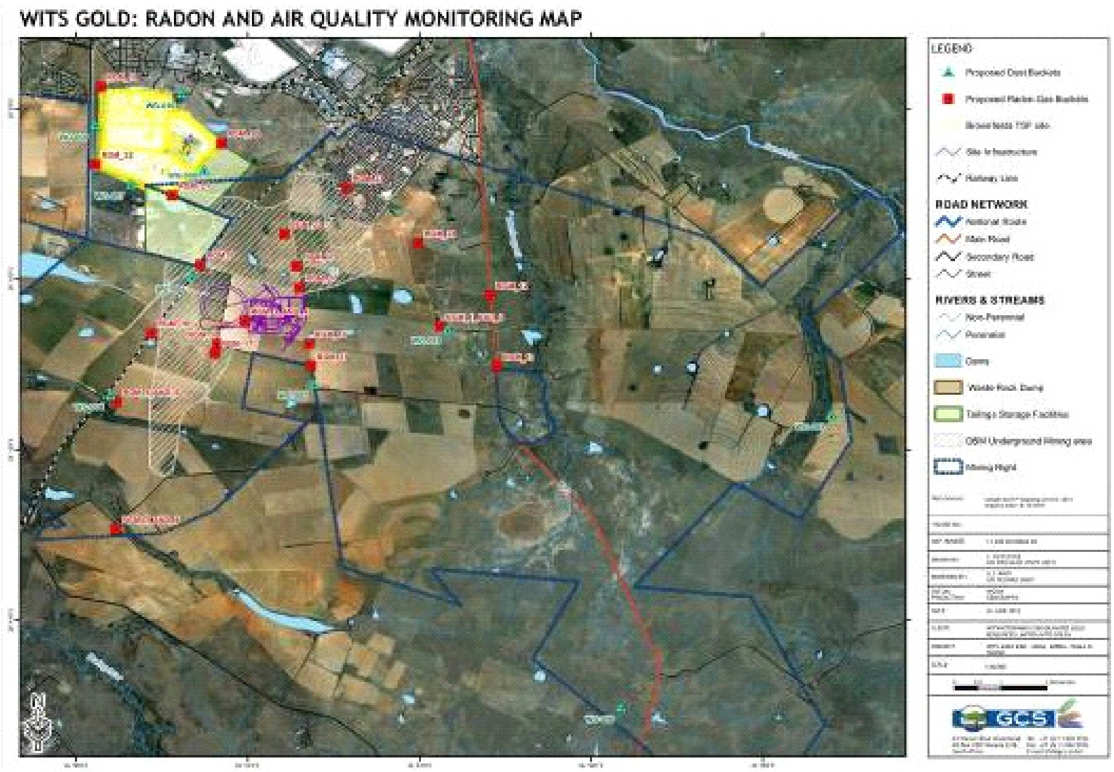


Figure 7.3: Location of existing dust bucket network for Wits Gold DBM (after Rayten, 2011)

Table 7.7: Existing and proposed Dust bucket locations

Dust Buckets	Co-ordinates	
	Latitude (S)	Longitude (E)
WG-001	-28.18923	26.83995
WG-002	-28.18701	26.87941
WG-003	-28.17634	26.90537
WG-004	-28.16616	26.85564
WG-005	-28.193116	26.97988
WG-006	-28.250223	26.93914
WG-007	-28.148056	26.84394
WG-008	-28.145261	26.85809
WG-009	-28.136457	26.83698
WG-010	-28.130329	26.85375



(Figure not to scale. Please refer to Appendix A for the A3 figure.)

Figure 7.4: Dust and Radiation monitoring points

7.3 Aquatic Ecology (Bio-monitoring)

The bio-monitoring programme will include the following River Health Indices: Invertebrate Habitat Assessment System (IHAS) and the latest SASS (South African Scoring System). The bio-monitoring investigations will be undertaken bi-annually to establish the current status of the rivers and surrounding tributaries that transects the mining area.

In terms of site selection for bio-monitoring, the following river biotopes need to be present within a perennial river in order to be suitable for bio-monitoring:

- Stones biotope;
- Vegetation biotope; and
- Gravel, Sand and Mud (GSM) biotope.

Bio-monitoring is recommended to determine the impact of the mine on the natural environment. The baseline information of the aquatic health of the rivers will be used for comparison during the investigation and future bio-monitoring studies/surveys. The bio-monitoring investigation will fulfil several roles including:

1. Determine the Present Ecological State of the various affected river system/s;
2. Define areas of aquatic ecological sensitivity; and
3. Provide recommendations for the maintenance/improvement of the present ecological state of the river system.

7.3.1 Methodology

The fieldwork will be based on the following indices:

- Monitoring and assessing of freshwater macro-invertebrate communities, both diversity and abundance. Assessment will be based on the SASS5 index according to the protocol of Dickens & Graham (2001);
- Assessing the condition and availability of invertebrate habitats of the site being sampled according to the protocol of Kleynhans (1999). This assessment is referred to as the IHAS;
- In situ water quality parameters will be measured, i.e. pH, electrical conductivity, dissolved oxygen and temperature;
- Raw water will be collected from the monitoring sampling sites for Whole Effluent Toxicity (WET) testing; and
- Grab water samples of 2 litres will be collected at each sampling site. A grab sample represents a “snap shot view” of the effluent present at the sampling sites.

7.3.2 Lab Analysis

Concomitant laboratory screening toxicity tests will be conducted to determine any possible problems with the water samples. With the screening test the organisms are directly exposed to the effluent (100%) and to one dilution of the effluent (50%). At various times during the exposure period the response of the organisms in each test concentration will be observed and recorded and the number of responses in relation to the test concentrations analysed.

7.3.3 Bi-Annual Bio-monitoring Report

The bi-annual bio-monitoring reports will cover the following aspects:

- Baseline information;
- Fieldwork data analysis and interpretation;
- Comparative analysis of previous bio-monitoring data (if available); and
- Data interpretation of toxicity test analysis.

The proposed biomonitoring points are detailed in Figure 7.1 and Table 7.8.

Table 7.8: Proposed biomonitoring points

Biomonitoring Points	Co-ordinates	
	Latitude (S)	Longitude (E)
WGBM1	-28.1594	26.77006
WGBM2	-28.2468	26.84216
WGBM3	-28.1147	26.73124
WGBM4	-28.1374	26.95297
WGBM5	-28.0744	26.91329
WGBM6	-28.1716	27.03492
WGBM7	-28.1668	26.92271
WGBM8	-28.1982	26.9268

7.4 Radiation Monitoring

The proposed radon fallout points are detailed in Figure 7.4 and

Table 7.9. The current radon monitoring programme requires that the radon cups be removed/replaced on a quarterly basis. The removed cups are sent to the NECSA laboratory for assessment.

Table 7.9: Proposed Radon cup locations

Radon Cup points	Co-ordinates	
	Latitude (S)	Longitude (E)
RGM_1_AND_2	-28.1759	26.90403
RGM_3_AND_4	-28.1749	26.86616
RGM_5_AND_6	-28.1906	26.84116
RGM_7_AND_8	-28.2155	26.84105
RGM_9	-28.1638	26.85756
RGM_10	-28.1684	26.87672
RGM_11	-28.164	26.87619
RGM_12	-28.1698	26.91377
RGM_13	-28.1837	26.91506
RGM_14	-28.1793	26.87858
RGM_15	-28.1836	26.87895
RGM_16	-28.1794	26.8608
RGM_17	-28.1811	26.86029
RGM_18	-28.1771	26.84797
RGM_19	-28.1829	26.85463
RGM_20	-28.1854	26.86071
RGM_21	-28.1933	26.85652
RGM_22	-28.1907	26.8504
RGM_23	-28.1578	26.87376
RGM_24	-28.1596	26.89976
RGM_25	-28.1488	26.88583

7.5 Mine Environmental Audits

A register of environmental monitoring and auditing results will be available for inspection. This will also include compliance with environmental legislation.

In order to ensure compliance with the environmental management programme and to assess the continued appropriateness and adequacy of the environmental management programme, Wits Gold commits to:

- Conduct the monitoring on an ongoing basis;
- Conduct the performance assessments of the environmental management programme every two years or as agreed by the Minister in writing;
- Compile and submit a performance assessment report to the Director: Mineral Development of the environmental management programme; and
- The above will be undertaken according to the Regulations (No.26275) of the MPRDA.

The mine further undertakes to:

- Appoint a responsible person(s), in writing, who will monitor all environmental aspects of the site on a regular basis. A copy of this letter of appointment including the relevant emergency numbers will be supplied to the Regional Manager: Mineral Regulation of the DMR: Free State Region; and
- The appointed person will communicate, on a regular basis, with the local interested and affected parties identified with regards to the project and will report on the progress made with regards to implementation of the mitigation measures. Any complaints, with regards to the mining activity, will be reported to the appointed person and be recorded in the complaint register.

In addition the mine commits to compiling a report with regards to the following issues, which will be submitted to the DMR on a yearly basis:

- Quantities processed to be recorded on a monthly basis;
- Percentage of disturbed area rehabilitated (rehabilitation figures) – recorded on a three monthly basis. A six monthly report to be compiled;
- Water quality results;
- Water levels of identified boreholes; and
- A copy of the complaints register.

8 ENVIRONMENTAL EMERGENCY RESPONSE PLAN AND ENVIRONMENTAL AWARENESS PLAN

This chapter of the EIA/EMP Addendum Report relates to the following sections of the MPRDA and Regulation 527 (GNR 527) of 23 April 2004 promulgated in terms of the MPRDA:

In accordance with Regulation 51(b)(vi) of the MPRDA, 2004), an EA Plan is needed which states that an EMP3 contemplated in Section 39(1) of the MPRDA4, 2002 must include an EA Plan as contemplated in Section 39(3)(c) of the Act. According to Section 39(3)(c) of the MPRDA, 2002 (Act 28 of 2002), "an applicant who prepares an environmental management programme or an environmental management plan must develop an environmental awareness plan describing the manner in which the applicant intends to inform his or her employees of any environmental risks which may result from their work and the manner in which the risks must be dealt with in order to avoid pollution or the degradation of the environment".

The purpose of this part of this EMP is to anticipate the occurrence of environmental crises, which may occur due to unforeseen circumstances. Since these events can never be predicted, a procedure has been prepared that must be followed in the event of such an incident, which will assist in the mitigation, remediation and conservation of the environment and contribute to the safety of workers and I&APs.

The Environmental Emergency Response Plan and Environmental Awareness Plan for the SOFS Mining Operation is attached as Appendix G.

9 FINANCIAL PROVISION

Financial provision for the environmental rehabilitation and closure requirements of mining operations forms an integral part of the MPRDA. Section 41 of the MPRDA and Regulations 53 and 54 promulgated in terms of the MPRDA deal with financial provision for mine rehabilitation and closure. The holder of a Mining Right, as described in the relevant sections of the MPRDA and its regulations, must provide the DMR with sufficient information pertaining to the necessary financial provision required to address closure and monitoring related environmental liability.

Wits Gold are required to develop a detailed closure cost assessment based on the DMR guideline document, Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provision Provided by a Mine, published in 2005. The guideline document provides a generic approach to the determination of the quantum for financial provision by the DMR. This approach (**Figure 9.1**) aims to avoid a situation of applying non-aligned empirical approaches and interpretations between DMR regional offices.

The detailed Closure Cost Determination for the SOFS Mining Operation is attached as Appendix H.

The closure cost estimate (clean closure) was determined for the SOFS Mining Operation in accordance with the DMR guidelines and based on a CPIX increase and actual contractor rates. The closure costs are as follows:

Sub-Total 1:	R 18 399 044.12 (excluding VAT)
Sub-Total 2:	R 22 410 035.74 (excluding VAT)
Sub-Total 3:	R 25 547 440.74 (including VAT)

In accordance with the DMR guidelines, the closure costs (clean closure) include the following:

- Preliminary and General (P&G)
    - 6% if Subtotal 1 is greater than R 100 million; and
    - 12% if Subtotal 1 is less than R 100 million (not applicable).
- 10% Contingency; and
- 14% Vat.

The existing rehabilitation liabilities associated with the Brownfields TSF site will be taken over by the applicant, if agreement to make use of this site is reached. This will only be undertaken after a full assessment of the current rehabilitation liabilities pertaining to the Brownfields TSF site has been undertaken by an independent assessor and a full reconciliation of the fund completed.

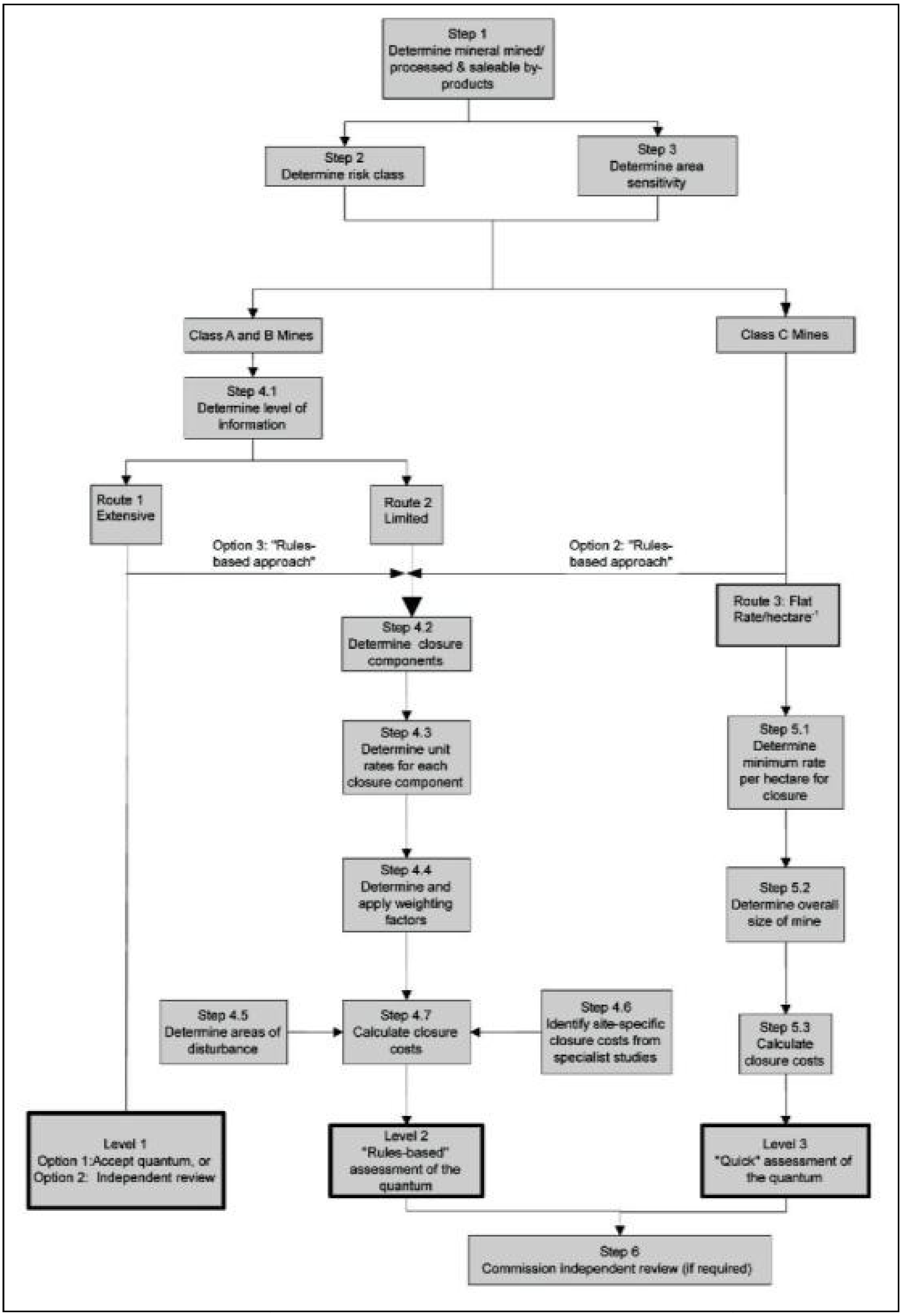


Figure 9.1: Proposed Methodology for Determining the Closure-Related Financial Provision for the SOFS (Phase 1) DBM Mine.

10 ENVIRONMENTAL REHABILITATION PROGRAMME

The overall land use vision for the proposed SOFS area is to ensure the operations are safe, stable and non-polluting over the long-term in order to be integrated into the current agricultural, eco-tourism and economic activities of the area in which the mine will be located.

10.1 Aim of Rehabilitation Plan

The aim of the rehabilitation plan is to:

- Return the disturbed areas to an acceptable post mining state;
- Ensure all areas are stable, and there is not risk of erosion;
- Prevent alien plant invasion on the site until the site is in a stable state; and
- Ensure that all areas are free-draining and non-polluting.

The general project area includes areas of commercially cultivated land. The continuous rehabilitation program will attempt to restore the area to an acceptable standard as close to its baseline environmental state as possible.

10.2 Rehabilitation Objectives

The overall rehabilitation objectives for SOFS (Phase 1) DBM Mine are the following:

- Visual impacts of rehabilitated areas should be minimised by recreating natural landforms and ensuring that reshaped areas are visually suited to surrounding landscapes;
- Natural landforms such as drainage lines, undulating areas and ridges, which have been damaged during activities, must be restored;
- Soil integrity is the most important aspect of rehabilitation as it forms the base from which rehabilitation proceeds. If soils are not correctly prepared, suitable conditions for re-vegetation will not be achieved;
- Alien floral invasion poses a threat both during and post-rehabilitation activities. Adequate alien and invasive species control measures will contribute towards an effective rehabilitation effort; and
- Infrastructure will be removed and the area restored to as much of the natural state it was before the construction phase.

The closure involves the rehabilitation of all areas disturbed as a result of the operations during all of the project phases.

The minimum objectives for the closure and rehabilitation of the TSF must be to prevent air and water pollution in accordance with the requirements of the relevant regulations and with good international practice. The intended end-use should take into consideration the prior land-use and the location with respect to current and potential future socio-economic development.

The closure plan for the TSF will be developed during the life of the facility. The purpose of preparing a closure plan is to ensure that the design, construction and operation procedures are compatible with the achievement of final closure and rehabilitation to acceptable environmental standards and at a reasonable cost. It is anticipated that the closure plan will be updated periodically before the preparation of the final closure plan. The closure plan will be prepared in accordance with “best practice” and the requirements of the environment.

In view of the above, the principles of the closure considerations can be summarised as follows:

- The segregated tailings materials are expected to have a low permeability with the result that seepage from rainwater infiltration will be very limited.
- The required final side slope and top surface geometries will be achieved during the operation phase. The top surfaces will either be divided into smaller compartments and/or the water will be allowed to drain in a controlled fashion to the historical pool areas from where the runoff will be allowed to evaporate.
- The side slopes will be vegetated. The top surfaces will be covered with a vegetated engineered layer (waste rock and topsoil). The purpose of the covers is to stabilise the tailings surfaces (erosion and dust generation) and to minimize the infiltration of water and oxygen.
- The floating penstocks will be sealed.
- Emergency spillways will be included in the final closure design.
- The water storage dams will remain in place.
- Generally all surface structures (i.e. pumps, pump stations, pipelines, power lines etc.) will be removed.

10.3 Management Criteria for the Rehabilitation of Land

The following management measures are required:

- The area will be fenced, and all animals i.e. cattle, kept off the area until the vegetation is self sustaining;
- Newly seeded/planted areas will be protected against compaction and erosion;
- Traffic will be limited until vegetation is self-sustaining;
- Vegetation will be watered, if required, and weeded at least once in six months;
- Ongoing monitoring for pests and diseases will be undertaken at least once in six months and vegetation will be treated in accordance with identified accepted procedures if necessary;
- Unhealthy or dead plant material will be removed and replaced if necessary;
- A general application of potassium, nitrate and phosphorous fertilizer should be applied, where self succession does not establish within 18 months. Small quantities should be applied at regular intervals (to be determined at rehabilitation onset) across the site so as not to affect the surface and groundwater environments;
- Any damage caused by erosion will be rehabilitated and the necessary erosion control measures will be maintained; and
- Annual inspections of rehabilitated areas will be undertaken for the first three (3) years after rehabilitation or until such time that the areas are self-sustaining.

The final plans for active rehabilitation of the shafts (vertical incline and ventilation) as well as the Brownfields TSF facility have not yet been finalised. The final placement and approach to rehabilitation will be determined during the Bankable Feasibility Study (BFS) for the proposed operation, due for completion in July 2013. It is anticipated that, as a minimum, the shaft area will require fencing around the shafts and capping to make them safe. With regard to the Brownfields TSF site it is anticipated that the slopes will have to be shaped and sloped and vegetation cover established to be self-sustaining. In addition a detailed stormwater management plan will have to be developed for the Brownfields TSF site post operation.

10.3.1 Removal of Infrastructure

Following cessation of mining and processing, it is planned that all infrastructures will be decommissioned and removed from site in a systematic and regulated manner. The following activities will be conducted during the decommissioning and closure phase of the project:

Buildings

- All infrastructure will be removed and rehabilitated, should no alternative use be found for the structures;
- Foundations will be removed to a depth of 1 m below surface;
- An alternative use for the brick structures will first be sought, i.e. they can either be sold/donated to the post-mining landowner on sale of the land. If an alternative use cannot be found, the buildings will be demolished; and
- All material recovered from the demolition of buildings and/or structures will either be transported to a permitted disposal site, sold as scrap or made available to the local community as building materials (provided they are in a satisfactory condition following demolition).

Linear Infrastructure

- Linear infrastructure constructed by the mine (i.e. roads, conveyors and power lines) will be removed if it proves to inhibit land use at decommissioning. Where possible infrastructure will remain for future mining operations as determined by Wits Gold or for social investment opportunities, this will be decided in conjunction with the IDP of the area and the local authorities (i.e. municipality);
- The soils and land capability will be rehabilitated to near pre-mining conditions;
- All roads will be rehabilitated by ripping these structures to a depth of 500 mm; and
- All fences erected around the mine and linear infrastructure will be dismantled and either disposed of at a permitted disposal site or sold as scrap (provided these structures will no longer be required by the post-mining land owner). Fences erected to cordon-off dangerous excavations will remain in place and will be maintained as and when required.

Pollution Control Dams

- All PCDs will be maintained to ensure that no leakages occur;
- Overflow pipes will be kept clean;
- Sumps will be kept clean and all pumps will be maintained; and
- The PCDs will only be demolished should the area prove to be free draining with no pollution potential after rehabilitation.

10.3.2 Active Rehabilitation - Landscaping

Landscaping activities will involve the active rehabilitation of the area with the following activities taking place:

- Recovery of all saleable infrastructure;
- Demolition and removal of all buildings and structures;
- Ripping of all compacted areas, which will be followed with amelioration and vegetation;
- Ensure that all remaining piles and slopes are sufficiently shaped to blend in with the surrounding environment;
- Amelioration and vegetation of all disturbed areas;
- Maintenance of all re-vegetated areas up until such areas initiate succession and create a sustainable cover;
- Monitoring of key environmental variables (i.e. soils, vegetation, groundwater and surface water) in order to demonstrate stability of rehabilitated areas; and
- Weed management after closure, limited to areas disturbed by mining or included as infrastructure related to the mine.

The final plans for active rehabilitation of the shafts (vertical incline and ventilation) as well as the Brownfields TSF facility have not yet been finalised. The final placement and approach to rehabilitation will be determined during the Bankable Feasibility Study (BFS) for the proposed operation, due for completion in July 2013. It is anticipated that, as a minimum, the shaft area will require fencing around the shafts and capping to make them safe. With regard to the Brownfields TSF site it is anticipated that the slopes will have to be shaped and sloped and vegetation cover established to be self-sustaining. In addition a detailed stormwater management plan will have to be developed for the Brownfields TSF site post operation.

10.3.3 Infrastructure Removal and Rehabilitation

Rehabilitation of all disturbed land surfaces will include the following and will be completed within a period as specified in the appropriate closure document:

- Photographs of the infrastructure, before, during and after rehabilitation will be taken at selected fixed points and kept on record for the Environmental Coordinator and the DMR purpose;
- All vehicles, treatment plants and workshop equipment will be removed for salvage or resale;
- All fixed assets that can be profitably removed will be removed for salvage or resale;

- Any item that has no salvage value to the mine but could be of value to individuals will be treated as waste;
- All structures will be demolished, terracing removed and foundations demolished to –500 mm below the original ground level;
- Dismantle and remove redundant fencing for salvage;
- Demolish all concrete fence foundations to 500 mm below the original ground level;
- All services like the water supply line and the power line will be demolished only for the section on the mine’s property; and
- The contractor laydown area will be demolished and rehabilitated.

10.3.4 Rehabilitation of Surfaces

Rehabilitation of all disturbed surfaces will include the following and will be completed within a period as specified in the appropriate closure document:

- Where sites have been denuded of vegetation or where soils have been compacted or covered with concrete, these sites will be ripped and ploughed. The topsoil shall be appropriately fertilized to allow vegetation to grow rapidly;
- All disturbed and exposed surfaces will be covered with at least 0.15 m of topsoil and re-vegetation must be allowed to take place naturally;
- If a reasonable assessment indicates that the re-establishment of vegetation is unacceptably slow, the soil will need to be analysed and any deleterious effects must be corrected and the area be seeded with a seed mix to specification;
- Appropriate erosion control measures (i.e. contour banks) must be taken when required; and
- All illegal invader plants and weeds shall be dealt with as required in terms of the relevant legislation.

10.3.5 Disposal of material

The disposal of material will include the following and will be completed within a period as specified in the appropriate closure document:

- No building rubble or any other types of waste shall be dumped in the surrounding environment. In cases where it has already happened the sites shall be cleaned up and the waste and/or rubble removed to appropriate sites in consultation with the Environmental Coordinator;
- All types of waste shall be removed entirely from the area and appropriately dealt with in respect of the general waste handling procedure;
- All foreign matter shall be removed from the site;

- Inert ceramics such as bricks, concrete, gravel etc. will be used as backfill or disposed of in a licensed waste disposal site;
- Inert waste, which is more than 500 mm underground, such as pipes will be left in place; and
- Inert ceramic and buried waste with a salvage value to individuals such as scrap metal, building materials, etc. will be removed and disposed of at a licensed facility.

10.3.6 Water Pollution Control Structures

Water pollution control structures will remain until the completion of all demolition and associated rehabilitation activities where after these will be rehabilitated.

10.3.7 Maintenance

The aim of the maintenance measures are to ensure that the area affected by the mining operations is rehabilitated according to the closure plan and to apply for closure. The objective is for the area to be rehabilitated sustainability, ensuring self-succession of plants and the associated return of natural wildlife; as well as the improvement of the natural watercourses and groundwater systems.

The following maintenance measures will be implemented as part of the post-closure process:

- All natural physical, chemical and biological processes for which a closure condition has been specified must be monitored for three (3) years after closure or as long as deemed necessary at the time. Such processes include erosion of the rehabilitated surfaces, surface water drainage, surface water quality, groundwater quality, vegetative re-growth, weed encroachment and colonization by animals;
- Measures must be implemented to curb environmental impacts and to ensure that they do not worsen/cumulate over time;
- The closure plan will be reviewed every three (3) years; and
- All rehabilitated areas will be monitored and maintained until such time as required to enable the mine to apply for closure of these different areas.

The following activities will be included during the maintenance phase:

- The closure costs (demolition, removal, re-shaping and rehabilitation quotes per key quantity) for each facility must be included in the database so that the total closure cost can be determined;

- All facilities that become redundant during the life of mine must be rehabilitated concurrently to lighten the rehabilitation process at the end of the mine's life;
- Attention must be paid to the latest developments in mine rehabilitation sciences;
- Rehabilitation should be done as soon as possible, to ensure that the rehabilitation work required is kept to a minimum at the end of the life of the mine;
- Ensure that the area is free draining;
- Ensure that self-succession has been attained;
- Ensure that all slopes are safe in the long term;
- Submission of closure report and application for closure to the authorities; and
- Environmental monitoring and maintenance for three years after closure.

10.4 Submission of Information

The following applies to the submission of information:

- All procedures (emergency, environmental awareness, rehabilitation strategies, etc.) must be included into the mine's Environmental Management System (EMS). The mine's EMS will monitor and assess the performance of the EMP on an ongoing basis. Formal audit of the performance assessment of the EMP will take place every year as stipulated by law, or at any other period if required by government;
- All information as required by the various government departments should be captured and be readily available for submission when required;
- An annual Performance Assessment Report (PAR) will be submitted to the DMR;
- Groundwater monitoring occurs on a quarterly basis and is undertaken by outsourced specialists. Annual groundwater reports will be submitted to the DWA;
- The groundwater levels will be monitored on a quarterly basis and will be presented in the form of piezometric maps, from which changes can be determined through time. Annual groundwater reports will be submitted to the DWA;
- Surface water monitoring will be undertaken monthly and annually reports will be submitted to the DWA together with the groundwater reports;
- The financial provision for closure (quantum and method) will be updated annually as part of the Environmental Programme Performance Assessment; and
- The closure plan must be reviewed every three (3) years, and must always keep pace with the current best practices.

10.5 Rehabilitation

The final rehabilitation plan and the phases applicable thereto will be developed during the BFS. Only once the BFS is complete can the final rehabilitation plan be detailed.

It is proposed, however, that all proposed rehabilitation be undertaken in accordance with the relevant legislative requirements of the Republic of South Africa as well as in accordance with Best Practise Guidelines for rehabilitation. As a starting point for the rehabilitation it is proposed that the following three (3) phases be assessed and implemented:

10.5.1 Phase 1

Phase 1 of the rehabilitation plan will involve the dismantling and removal of the following infrastructure:

- Administration buildings, workshops, change houses, related buildings and ancillary infrastructure;
- Plants;
- Conveyor and related infrastructure;
- Power line; and
- Access roads.

PCDs and silt traps must be left with the clean and dirty water system through to Phase 2 and 3.

10.5.2 Phase 2

Phase 2 of the rehabilitation plan will involve the active rehabilitation of compacted areas.

Landscaping of the surface infrastructure area where the mining activities took place. The area has been cleared of infrastructure, now all soft berm, waste rock berms and the top soil stockpiles will be used to fill the access to the underground mining area.

Where sites have been denuded of vegetation or where soils have been compacted or covered, these sites will be ripped and ploughed. The topsoil shall be appropriately fertilized to allow vegetation to grow rapidly. If a reasonable assessment indicates that the re-establishment of vegetation is unacceptably slow, the soil will be analysed and any deleterious effects must be corrected and the area be seeded with a seed mix to specification.

All stockpiles on the mine property will be removed. All residual material will be removed from the footprint area. The surface areas will be rehabilitated by ripping these areas to a depth of 500 mm. The area will be shaped to be free draining.

Culverts will be maintained and be kept clean to ensure that no obstructions occur should a 1:100 year flood occur. The culverts will only be demolished should the area prove to be free draining with no pollution potential after rehabilitation.

All pollution control dams will be maintained to ensure that no leakages occur. Overflow pipes will be kept clean. Sumps will be kept clean and all pumps will be maintained. The dams will only be demolished should the area prove to be free draining with no pollution potential after rehabilitation.

10.5.3 Phase 3

Phase 3 of the rehabilitation plan will involve the following activities:

- Two to three years of maintenance and aftercare; and
- Removal of boundary fencing once the site is sustainable and in a stable state.

10.6 Rehabilitation Responsibilities

Table 10.1 indicates the various responsibilities and responsible parties for the rehabilitation activities.

Table 10.1: Responsibilities and Responsible Parties for Rehabilitation Activities

RESPONSIBLE PARTY	RESPONSIBILITY
Environmental Manager	Planning of rehabilitation projects Initiating rehabilitation projects Compilation of closure plans with regard to rehabilitation areas/sites
Environmental Coordinator	General monitoring/surveillance and reporting and coordination Implementation/coordination with regard to particular environmental measure/action plans Audits (Closure Costs, Environmental, EMP Performance Assessment Reports, etc.) and surveillance
General Manager	Authorisation of all rehabilitation projects

11 IDENTIFICATION OF GAPS

11.1 General

Information contained in this EIA/EMP Report is based on technical information received from the Applicant, as well as the outcomes of the Specialist Studies undertaken. The Specialist Studies undertaken were conducted on the basis of the information available at the time. The Specialist Studies undertaken only took into account the area identified for infrastructure placement (**Figure 2.2**). The actual infrastructure placement is not envisaged to take up the entire identified area, and the footprint may require a much smaller area when finalised.

The option to switch from a Greenfields TSF option to that of a Brownfields TSF option occurred after the majority of the studies had been completed. A change in the assessment criteria would have resulted in additional cost time being required for the Specialists to address these changes. Due to the nature of this project and the fact that the identified impacts associated with the Greenfields TSF would be less significant than that of the Brownfields TSF, it was determined by the client in agreement with the EAP that sufficient information regarding the Brownfields TSF site is available. The monitoring programme as presented in the EMP has to be implemented to determine whether this assumption proves to be correct, if not, detailed studies will have to be initiated.

11.2 Specialist Studies

11.2.1 Geohydrological (Groundwater) Assessment

Groundwater levels in the Witwatersrand Supergroup aquifer are currently unknown. Monitoring boreholes (deep core boreholes) should be drilled and equipped with pressure gauges. Infill drilling/exploration boreholes may be used for this purpose. Regular pressure readings must be taken to monitor changes in the groundwater table. If possible, these boreholes should be placed throughout the mine to assess the regional groundwater table. It is initially envisaged that 4 boreholes be drilled to mining depth. Deep boreholes must be drilled in strategic areas such as the shaft or decline area, into the De Bron Fault and proposed underground workings. Flow logging should also be performed on the newly drilled boreholes. The purpose of performing flow logging is to determine aquifer parameters (T-values), identify preferential flow paths and depth of major water strikes that are intersected. Testing of boreholes sections must take place as drilling proceeds, prior to casing installation and/or grouting. Once all the data has been collected, the site conceptual model should be verified and updated using the new information. The numerical groundwater model should then also be update with the newly collected data.

11.2.2 Visual Impact Assessment

No visual impact assessment and modeling has been undertaken to date as infrastructure placement has not yet been finalized. As such the visual impact assessment can only be undertaken once the exact location of the project related infrastructure has been confirmed.

To evaluate the impacts of the proposed activity, the inherent scenic value of the landscape first needs to be determined. Data collected during a site visit would allow for a comprehensive description and valuation of the receiving environment. The following method should be used for the project:

- Site visit - one field survey should be undertaken and the study area scrutinized to the extent that the receiving environment can be documented and adequately described;
- Project components - the physical characteristics of the project components must described and illustrated;
- Determine the setting, visual character and land use of the area surrounding the proposed tailings facility, and the sense of place;
- Define the extent of the affected visual environmental, the viewing distance and the critical views/visual receptors that may be affected by the proposed project;
- Determine the Visual Absorption Potential (ability of the landscape to accommodate the proposed project from a visual perspective);
- The significance of the visual impacts and landscape impacts must be assessed;
- Rate the impact on the visual environment of the proposed development; and
- Suggest measures that could mitigate the negative impacts of the proposed SOFS (DBM) Mining Operation.

11.2.3 Noise Impact Assessment

No noise impact assessment has been undertaken to date as infrastructure placement has not yet been finalized. As such the noise impact assessment can only be undertaken once the exact location of the project related infrastructure has been confirmed.

A noise survey should be carried out in order to:

- Determine the prevailing ambient noise levels in and around the SOFS project area;

- Project the noise impact of the proposed mining method and activities on the environment and identified noise sensitive areas; and
- Recommend engineering control measures to minimise the projected noise impact into the environment and the abutting residential areas.

11.2.4 Blasting and Vibration Assessment

No blast and vibration assessment has been undertaken to date due to the stage of development of the project.

Specific aspects that need to be addressed prior to any construction and/or mining activities being initiated on site include the following:

- Potential for property damage as a result of blast and vibration events;
- Pre-blasting and post-blasting crack surveys need to be undertaken; and
- Additional issues that need to be assessed include the potential impact of blasting and vibration impacts on the existing underground operations and associated infrastructure.

11.2.5 Socio-Economic Assessment

An assessment of property values of surrounding properties/small holdings must be undertaken prior to any construction and mining activities. This is essential in addressing the concerns raised by the I&APs in the public meetings.

12 ENVIRONMENTAL IMPACT STATEMENT

This section of the report is compiled in accordance to the National Environmental Management Act, 1998 (Act No. 107 of 1998) Environmental Impact Assessment Regulation 543 of 2010, Section 31 (2) (n) and (o) as this application must fulfil the requirements of the relevant legislation, including the NEMA and NWA.

The EAPs and environmental consultants responsible for the compilation of this document, and PPP feel that the SOFS Phase 1 (DBM Project) Mining Operation should be approved for mining, on condition that the mine implements all identified management measures, implements the monitoring and rehabilitation plan, as well as address all identified information gaps. In addition the applicant must implement the social and labour plan as approved by the DMR.

In addition, the Applicant must continue with public consultation in order to ensure that the communities surrounding the operation are informed of developments on site throughout the life of mine. A detailed communication strategy must be developed and implemented together with the development of a complaints register to be kept on site for the life of mine.

13 CONCLUSION

Pre-Construction Phase

During the pre-construction phase, the following activities need to be undertaken:

- Environmental authorisations;
- Applicable permitting;
- Additional specialist baseline assessments; and
- Baseline monitoring (key environmental variables).

Construction Phase

During the construction phase, the following activities could impact on the bio-physical environment and the cultural/social setting:

- Stripping of vegetation;
- Stripping of topsoil and subsoil as construction activities start on site;
- Impact on water system and associated wetlands due to the construction activities;
- Construction of the clean and dirty water systems;
- Possible compaction of soils by the establishment of topsoil stockpiles and berms;
- Dust dispersion from infrastructure construction and shaft construction activities; and
- Baseline monitoring (key environmental variables).

Operational Phase

During the operational phase, the following activities could impact on the bio-physical environment and the cultural/social setting:

- Underground mining activities;
- Possible compaction of soils and erosion of soil stockpiles and berms by wind and water;
- Impact on surface- and groundwater system due to the operational activities;
- Dust dispersion from workings;
- Clean and dirty water control and maintenance;
- Sewage management;
- Ancillary activities (workshops, offices, etc); and
- Baseline monitoring (key environmental variables).

Decommissioning and Closure Phase

When the decision is taken to decommission the mine, the following objectives and proposed actions for the decommissioning and closure phase of the mine could be considered:

- Recovery of all saleable infrastructure;
- Demolition of structures;
- Ripping of all compacted areas, which will be followed with amelioration and vegetation;
- Ensure that all remaining dumps, stockpiles and slopes are sufficiently shaped to blend in with the surrounding environment and remaining infrastructure;
- Amelioration and vegetation of all disturbed areas;
- Maintenance of all re-vegetated areas up until such areas initiate succession and create a sustainable cover;
- Monitoring of key environmental variables (i.e. soils, vegetation, groundwater and surface water) in order to demonstrate stability of rehabilitated areas;
- Weed management after closure, limited to areas disturbed by mining, mining infrastructure or included in the mining right area; and
- Monitoring will be undertaken for a specific period after closure or up until such time that all areas create a sustainable cover and ecosystem.

The main issues raised during the consultation process thus far include the following impacts:

ISSUE / CONCERN	SECTION REFERENCE
Public Participation Process	➢ Refer to Section 4, 5 and 6 of the Environmental Impact Assessment and Environmental Management Plan. ➢ Refer to Appendix F-1 for the I&AP Database
Security • Squatters and their cattle are also a major concern. • Theft and crime of crops and livestock; • Trespassing on property and the safety concerns.	➢ Refer to Section 4.14 and Section 6 of the EIA/EMP ➢ Refer to Appendix D-10
Health	➢ Refer to Section 4, 6, 7 and Section 11 of the EIA/EMP. ➢ Refer to Appendix D-10 ➢ Refer to Appendix C
Cultural	➢ Refer to Section 4.12 and 6. ➢ Refer to Appendix D-8 ➢ Refer to Appendix I

ISSUE / CONCERN	SECTION REFERENCE
Socio-Economic • Measures for local procurement; • Valuation of the farm and affect income and profits; • Job Creation and Opportunities ; • Labour Plan, Mining Charter and Enterprise Development; • Transport, catering, building construction, railway, pipes and painting; • Equity shareholding, social responsibility'; • The value of neighbouring farms will drastically reduce as a result of mining activities; • Connectivity between farms are broken; • Due to the mine, no livestock farming will be able to take place.	➢ Refer to Section 4.14 and 6. ➢ Refer to Appendix D-10 ➢ Refer to Section Appendix C ➢ Refer to Appendix F-1 for the CV's received.
Environmental • Noise and dust	➢ Refer to Section 4, 6, 7 and Section 11 of the EIA/EMP. ➢ Refer to Appendix D-10 ➢ Refer to Appendix C

Identified Impacts and Recommended Mitigation Measures

GCS evaluated the SOFS Phase 1 (DBM Project) Mining Operation in terms of the identified activities related to the following phases:

- Pre-Construction Phase;
- Construction Phase
- Operational Phase; and
- Closure and Decommissioning Phase.

The following impacts were anticipated as per the studies completed:

Geology

The alteration of localized geology will be permanent and unavoidable due to the extraction process.

Topography

The surrounding natural relief will be altered through the placement of mining infrastructure. Mining operations in the area have and will continue to alter the natural topography. This alteration will be of permanent nature.

Soil, Land Use and Land Capability

The soil, land use and land capability within the mining area will be compromised through the presence of tailings dams, rock dumps, associated mine infrastructure, and ancillary infrastructure. Environmental legislation advocates the return of mining land to some form of sustainable land use as per the closure and decommissioning plan for the operation. The land use and land capability pre-mining is arable and grazing and these should be considered post-closure.

Fauna and Flora

Mining footprint and infrastructure development invariably results in clearing of vegetation on site, both naturally occurring and established vegetation, potential changes in drainage patterns, and destruction of habitat for wildlife. The clearing of vegetation could in itself destabilise soils, change local water balances, and encourage the spread of alien/invasive vegetation. Infrastructural and solid waste development could result in water pollution that may affect a range of organisms and ecosystems. Major negative impacts would be associated with species of conservation importance as well as impacts on migratory habits of fauna within the project area.

Wetlands

The majority of the wetland types within the project area have been disturbed by cultivation and alien invasive species. Potential impacts are the loss of wetland habitat, increased sediment movement into adjacent wetlands, altered run-off characteristics leading to hydrology changes of wetlands on site and water quality deterioration. The wetlands in the project area can provide islands for significant flora and fauna species.

Hydrology (Surface Water)

The potential for surface water contamination exists if the operation does not employ adequate and appropriate storm water control measures and if clean and dirty water separation is not implemented on site. Impacts would not be limited to the site area and would thus require monitoring and management throughout the life of the mine.

Hydrogeology (Groundwater)

The potential exists that significant ground water impacts, both direct and cumulative, could materialise due the nature and scale of the operation. Impacts associated with groundwater quality changes and impacts to the water table due to dewatering activities could be significant if not adequately managed. Further impacts associated with the potential for acid mine drainage are also possible. Impacts would not be limited to the site area and would thus require monitoring and management throughout the life of the mine.

Air Quality

The impact of the proposed operation on the air quality would be related directly to dust generation and liberation. Impacts would not be limited to the site area and would thus require monitoring and management throughout the life of the mine.

Heritage

No significant impacts are applicable at this stage. Further clarity is required in respect of the infrastructure location and ancillary infrastructure identification to determine the exact nature of the impact on the two identified sites of potential importance. All graves are considered of high significance.

Social Impacts

The construction, development and operation of a new mining operation with the creation of new jobs will lead to high levels of expectation and possibly result in an influx of job-seekers. Potential negative impacts are associated with the influx of job-seekers to the area, informal housing development, potential safety and security issues for existing land owners, crop and infrastructure theft, and potential impacts on property values for directly and indirectly affected land owners. Potential positive impacts associated with the project include job creation and economic development (local and regional).

In addition the cumulative impacts were assessed and evaluated. Based on the findings of the impact assessment, a number of management measures and action plans were proposed and the identified impacts re-assessed to determine whether mitigation would change the overall significance of the identified impact.

In order for the anticipated impacts to be managed effectively, Wits Gold must adhere to the proposed management and action plans proposed in order to ensure that the anticipated impacts associated with the SOFS Phase 1 (DBM Project) Mining Operation are, indeed, minimised.

Information Gaps, Assumptions and Limitations

Information contained in this EIA/EMP Report is based on technical information received from the client, as well as the outcomes of the Specialist Studies undertaken. The Specialist Studies undertaken were conducted on the basis of the information available at the time. The Specialist Studies undertaken only took into account the area identified for infrastructure placement.

The option to switch from a Greenfields TSF option to that of a Brownfields TSF option occurred after the majority of the studies had been completed. A change in the assessment criteria would have resulted in additional cost time being required for the Specialists to address these changes. Due to the nature of this project and the fact that the identified impacts associated with the Greenfields TSFwould be less significant than that of the Brownfields TSF, it was determined by the client in agreement with the EAP that sufficient information regarding the Brownfields TSF site is available. The monitoring programme as presented in the EMP has to be implemented to determine whether this assumption proves to be correct, if not, detailed studies will have to be initiated.

The following gaps in information were identified:

Geohydrological (Groundwater) Assessment

Groundwater levels in the Witwatersrand Supergroup aquifer are currently unknown. Monitoring boreholes (deep core boreholes) should be drilled and equipped with pressure gauges. Infill drilling/exploration boreholes may be used for this purpose. Regular pressure readings must be taken to monitor changes in the groundwater table. If possible, these boreholes should be placed throughout the mine to assess the regional groundwater table. It is initially envisaged that 4 boreholes be drilled to mining depth. Deep boreholes must be drilled in strategic areas such as the shaft or decline area, into the De Bron Fault and proposed underground workings. Flow logging should also be performed on the newly drilled boreholes. The purpose of performing flow logging is to determine aquifer parameters (T-values), identify preferential flow paths and depth of major water strikes that are intersected. Testing of boreholes sections must take place as drilling proceeds, prior to casing installation and/or grouting. Once all the data has been collected, the site conceptual model should be verified and updated using the new information. The numerical groundwater model should then also be update with the newly collected data.

Visual Impact Assessment

No visual impact assessment has been undertaken to date, as shaft and tailings positions have not yet been finalised.

To evaluate the impacts of the proposed activity, the inherent scenic value of the landscape first needs to be determined. Data collected during a site visit would allow for a comprehensive description and valuation of the receiving environment. The following method should be used for the project:

- Site visit - one field survey should be undertaken and the study area scrutinized to the extent that the receiving environment can be documented and adequately described;

- Project components - the physical characteristics of the project components must described and illustrated;
- Determine the setting, visual character and land use of the area surrounding the proposed tailings facility, and the sense of place;
- Define the extent of the affected visual environmental, the viewing distance and the critical views/visual receptors that may be affected by the proposed project;
- Determine the Visual Absorption Potential (ability of the landscape to accommodate the proposed project from a visual perspective);
- The significance of the visual impacts and landscape impacts must be assessed;
- Rate the impact on the visual environment of the proposed development; and
- Suggest measures that could mitigate the negative impacts of the proposed SOFS (DBM) Mining Operation.

Noise Impact Assessment

No noise survey has been undertaken to date.

A noise survey should be carried out in order to:

- Determine the prevailing ambient noise levels in and around the SOFS project area;
- Project the noise impact of the proposed mining method and activities on the environment and identified noise sensitive areas; and
- Recommend engineering control measures to minimise the projected noise impact into the environment and the abutting residential areas.

Blasting and Vibration Assessment

No blast and vibration assessment has been undertaken to date.

Specific aspects that need to be addressed prior to any construction and/or mining activities being initiated on site include the following:

- Potential for property damage as a result of blast and vibration events;
- Pre-blasting and post-blasting crack surveys need to be undertaken; and
- Additional issues that need to be assessed include the potential impact of blasting and vibration impacts on the existing underground operations and associated infrastructure.

Socio-Economic Assessment

An assessment of property values of surrounding properties/small holdings must be undertaken prior to any construction and mining activities. This is essential in addressing the concerns raised by the I&APs in the public meetings.

Benefits of the Project

Local Market

Rand Refinery (South Africa) is one of the largest gold refineries globally and is currently refining 100% of newly mined gold and silver in South Africa, and 75% of all the gold mined in Africa. The product from the SOFS Mining Operation will thus be sold to Rand Refinery.

Regional and International Markets

All gold produced locally will be sold to the Rand Refinery. No gold will be sold to other regional or international markets.

Local Municipalities

Following initial consultation with the Matjhabeng and Masilonyana Local Municipalities, regarding needs and priorities, as identified by their Integrated Development Plans (IDPs), the following projects will receive further investigation:

- Virginia Farm; and
- Tikwe Lodge to be turned into Eco Tourism, Events Hosting and Agricultural Training.

Wits Gold is also investigating the possibility of taking over projects that are currently being phased out by Harmony Gold.

The DMR has offered to co-ordinate the prioritisation of Local Economic Development (LED) projects with Wits Gold, the relevant municipalities and existing mines in the area. Once the DMR has, in principle, approved of the selected (LED) projects, further consultation with the Local Municipalities and relevant stakeholders will take place to finalise the project implementation requirements as well as the way forward.

Small, Micro and Medium Enterprises (SMME) development

Wits Gold will contribute towards mine community economic development by using mainly Black Economic Empowerment (BEE) compliant companies for the provision of goods and services to the mine. Wits Gold is committed to awarding procurement contracts to companies which demonstrate suitable Historically Disadvantaged South Africans (HDSAs) participation in Management (and general employment) as well as local companies.

Wits Gold intends to support Small, Micro and Medium Enterprises (SMMEs), which will be able to provide them with the relevant services. These SMMEs will be appointed on a contractual basis, on the condition that their services are relevant and the quality thereof, acceptable.

Housing and living conditions

In order to decrease single sex accommodation and to prevent the establishment of hostel accommodation, Wits Gold proposes to use local labour. Housing allowances will be provided to staff and local housing within the towns of Virginia, Theunissen, Meloding and Welkom will be used as far as possible.

The applicant will promote home ownership; therefore employees will be afforded the opportunity to participate in wealth accumulation through the ownership of property. It is believed that this will in the long term ensure that housing is sustainable even after mine closure. The applicant will facilitate housing development in the host municipality area to ensure adequate and acceptable housing and living conditions of the employees. It is believed that this will build a sustainable economy and quality of life of the host community through integration of employees housing needs into the host municipality's housing and settlement plans.

The Company aims to improve the quality of life of all employees and restore the self-respect and dignity of employees in line with the Mining Charter and the aspirations of employees through:

- Conducting individual assessments with employees to determine their current and aspired housing conditions;
- Encouraging employees to take home ownership in existing sustainable areas;
- Establishing an open communication process whereby employees may communicate any problems and suggestions with regards to their housing needs;
- Facilitating the development of housing options that will accommodate employees housing needs;
- Providing programmes to educate employees with regard to home ownership and budgeting education; and
- Facilitating private investment from developers and/or banks for home owners.

Provision will be made for a R 10,000,000.00 investment over 5 years to improve on the housing conditions of mine workers.

Nutrition

In order to ensure that employees are aware of the advantages of a balanced diet, nutrition awareness will be promoted through a Wellness programme.

The Company will adopt a comprehensive approach to address nutrition and this will be addressed in the employee Wellness Programme, which will be developed as part of the implementation plan of the Social and Labour Plan (SLP). It is envisaged that the employee Wellness Programme will enhance the standard of living of all employees.

The employee Wellness Programme will focus on:

- Nutrition, where staff will be advised on healthier eating habits which will include:
    - Measures to improve nutrition, which will be done in accordance with the standards set out by the Chamber of Mines and the South African Health Standards Authorities;
    - Inducting and informing all employees on the National food based dietary guidelines. The intention will be that employees themselves acknowledge that each one has a role to be conscious of healthy eating habits;
- Educating employees and their families with regard to nutrition and wellness programmes with emphasis on HIV/AIDS and Tuberculosis, and provide information on common injuries that cause back pains;
- Wellness workshops which will include nutrition, exercise, stress management etc;
- Wellness incentive programme: Reward employees for making positive choices; and
- Providing health supplements to employees.

The Company will retain the services of a specialist healthcare services provider in order to compile a comprehensive wellness strategy which will integrate with community health issues. The strategy will include a health improvement programme that will address nutritional wellness, body wellness, emotional wellness and social issues.

No-Go Principle

If the no-go principle were applied, then the area in which the proposed SOFS Phase 1 (DBM Project) Mining Operation is located would continue with the land use and activities that are currently in place, namely commercial agriculture activities. The potential job creation benefit of the project (±1,635 jobs over the life of mine) would not materialise and the opportunity to employ women in mining, as per the requirements of the MPRDA, would also not occur. In addition the potential loss of contribution to economic development in the project area as well as compliance with the regions IDP, based on the SLP developed for the project, would be limited.

The no-go option would ensure that there would be significantly less environmental impacts in the area as a result of mining operations. Impacts would only be related to the existing mining operations within the Virginia area, specifically the Harmony gold mining operation located to the north west of the proposed project area. In addition to this, the existing Harmony Merriespruit TSF would remain as is, with minimal rehabilitation potential.

The continuation of commercial agriculture activities, as are currently taking place, would ensure that the current status quo in terms of revenue, economic contributions, employment and housing would continue. The potential expansion of these commercial agriculture enterprises would be limited to the areas currently being used specifically since the establishment of informal housing within the area is already evident.

If mining was not undertaken in the project area, the area could be utilised for housing developments and, potentially, other small, medium and large scale commercial opportunities. Alternatively, small-scale agricultural developments could take place (i.e. crop and livestock farming).

Motivation for Project

The SOFS Phase 1 (DBM Project) Mining Operation will ensure:

- Provision of sustainable employment (retention);
- Ongoing economic input into the area; as older mines in the vicinity are in a closure phase;
- Provision of a regional socio-economic benefit;
- Economic injection into the region in terms of small business enterprises (e.g. community services); and
- Ongoing supply of gold to the local and international markets.

The EAPs and environmental consultants responsible for the compilation of this document, and PPP is of the opinion that the SOFS Phase 1 (DBM Project) Mining Operation should be approved for mining, on condition that the mine implements all identified management measures, implements the monitoring and rehabilitation plan, as well as address all identified information gaps. In addition the applicant must implement the social and labour plan as approved by the DMR.

In addition, the applicant must continue with public consultation in order to ensure that the communities surrounding the operation are informed of developments on site throughout the life of mine. A detailed communication strategy must be developed and implemented together with the development of a complaints register to be kept on site for the life of mine.

14 REFERENCES

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15 UNDERTAKING BY CLIENT

An undertaking of agreement to the management strategies as proposed in the EIA/EMP as well as an undertaking of approval of the EIA/EMP is provided on the following page.

UNDERTAKING

(to be completed upon the final submission)

I, ____ the undersigned and duly authorised thereto by Witwatersrand Consolidated Gold Resources Limited (Wits Gold), have studied and understand the contents of this Environmental Impact Assessment and Environmental Management Programme (EIA/EMP) and duly undertake to adhere to the conditions as set out therein, unless specifically or otherwise agreed to.

Signed at ____ on this_____________ day of ____________________________________ 20 ________________.

____

Signature of Applicant

I, ____ the undersigned and duly authorized thereto by the DEPARTMENT OF MINERAL RESOURCES: FREE STATE REGION have studied and approved the contents of this Environmental Impact Assessment and Environmental Management Programme (EIA/EMP).

Signed at ____ on this_____________ day of ____________________________________ 20 ________________.

____

Signature of Regional Manager: Mineral Regulation