

**SIBANYE GOLD LTD: EZULWINI MINING COMPANY (PTY) LTD**

**CESSATION OF PUMPING OPERATIONS AT EZULWINI AND  
CLOSURE OF UNDERGROUND MINE WORKINGS**

**FINAL BASIC ASSESSMENT REPORT AND ENVIRONMENTAL  
MANAGEMENT PROGRAMME REPORT ADDENDUM**

Report No.: JW042/17/F925 - Rev 3

OCTOBER 2017

## **SYNOPSIS**

### **Introduction**

Ezulwini Mining Company (Pty) Ltd (EMC), now a subsidiary of Sibanye Gold Limited, trading as Sibanye-Stillwater (Sibanye), owns and operated a gold and uranium mine located approximately 8 km south-east from the town Westonaria, in the Gauteng Province. The EMC operation (also known as Cooke 4) is an underground mine which mined mostly gold ore and some uranium deposits.

### **History**

Mining activities commenced in the 1960's under the control of the Western Areas Gold Mining Company Limited. The mine was subsequently acquired and further sold-on by various mining companies until Sibanye took ownership in 2013.

In 1986 a permit was obtained to dewater the Gemsbokfontein West Dolomitic Compartment (Gemsbokfontein West sub-compartment). Water pumped from the mine was then discharged into the Leeuspruit and into the Kleinwes Rietspruit via the Peter Wright Dam, which flows to the Vaal River.

The Placer Dome Western Areas Joint Venture (PDWAJV) took over the pumping operations in March 2003 to allow the completion of the construction of plugs between the two mines and to verify the competency of the barrier pillar. The purpose being that once the dewatering of the Ezulwini mining operations stopped, the necessary measures would be in place to ensure the safety and health of the South Deep Mine, where mining occurs at a lower elevation than at the Ezulwini Workings. The work was completed and the PDWAJV gave notice to Harmony that pumping operations would cease on 8 February 2005. All indications are that the plug and pillar design were accepted by all parties at that date. Please refer to **Section 31)d)** and **Appendix B.1** for further details.

### **Current Situation and Project Scope**

The current dewatering programme, or even a decelerated or phased dewatering programme, is not economically nor environmentally beneficial. Continued pumping of underground water from the workings has contributed to financial losses to the mine at an average cost of approximately R 13 million per month and with losses amounting to R 350 million for the period of January 2015 to March 2016 alone, and in circumstances where mining is no longer profitable in any event.

EMC therefore intends to cease pumping and close the underground workings of Ezulwini. The result of the termination of the underground mining activities and the cessation of pumping water from underground (approximately 68 Mℓ/day) is that the water levels in the mine workings and above-lying dolomitic compartment will recover over time. As a result of this, it is expected that the Gemsbokfontein Eye, located to the north of Ezulwini on the banks of the Wonderfonteinspruit will receive aquifer flow water after approximately 7 years, which will discharge at this point into the 1.0 m diameter pipeline. This pipeline conveys the Wonderfonteinspruit and discharges to the west of Carletonville, upstream of the Abe Bailey nature reserve. Wonderfonteinspruit Jones & Wagener (Pty) Ltd Engineering & Environmental Consultants (J&W) have been appointed by Sibanye to undertake the required environmental authorisation and licensing processes for the cessation of pumping at the Sibanye Gold: EMC operations.

### **Environmental Authorisation and Licensing Processes**

This document serves as the Final Basic Assessment Report (FBAR) and Environmental Management Programme (EMPr) to be lodged with the Department of Mineral Resources (DMR) in terms of the National Environmental Management Act 107 of 1998 (NEMA) and Government Notice (GN) Regulations 982 to 985, as amended (4 December 2014). Please note that an approved Environmental Management Programme Report (EMPR) in terms of the Mineral and

Petroleum Resources Development Act 28 of 2002 (MPRDA) exists for the Sibanye Gold: EMC operations, as follows: Amended EMP- EMC Cooke 4 operation; Ref number: GP 30/5/1/2/2 (38) MR; dated March 2015. Therefore, this BAR and EMPr will serve as an addendum to the existing EMPR in terms of section 24N of the NEMA, by making provision for the change to the Sibanye Gold: EMC operations by the termination of pumping and resultant re-watering and closure of the underground workings.<sup>1</sup> It is important to note that Harmony previously obtained authorisation to close and re-water the underground workings.

In terms of the 2014 Environmental Impact Assessment (EIA) regulations, the following activities are included in the application for authorisation from the DMR in terms of Listing Notice 1 of 2014:

Activity No	Description
<b>Activity 22 of GN 983 (as amended)</b>	<p>The decommissioning of any activity requiring -</p> <ul style="list-style-type: none"> <li>i. a closure certificate in terms of section 43 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002); or</li> <li>ii. a prospecting right, mining right, mining permit, production right or exploration right, where the throughput of the activity has reduced by 90% or more over a period of 5 years excluding where the competent authority has in writing agreed that such reduction in throughput does not constitute closure.</li> </ul>
<b>Activity 34 of GN 983 (as amended)</b>	<p>The expansion or changes to existing facilities for any process or activity where such expansion or changes will result in the need for a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the release of emissions or pollution, excluding -</p> <ul style="list-style-type: none"> <li>i. where the facility, process or activity is included in the list of waste management activities published in terms of Section 19 of the National Environmental Management: Waste Act, 2008 (Act No.59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies; or</li> <li>ii. the expansion of or changes to existing facilities for the treatment of effluent, wastewater or sewage where the capacity will be increased by less than 15 000 cubic metres per day.</li> </ul>

A Partial Closure Plan has also been developed for the partial closure of Sibanye Gold: EMC operations, i.e., the closure (decommissioning) of the underground operations, to be lodged with the DMR in terms of the NEMA and GN Regulations 982 to 985, as amended (4 December 2014). In addition to this, EMC must submit a partial mine closure application to the DMR in terms of Section 43(3)(d) of the MPRDA for the termination of underground workings at Sibanye Gold: EMC operations. Section 43(3)(d) states that a mining right holder must apply for closure on “*completion of the prescribed closing plan to which a right, permit or permission relate*” (MPRDA). EMC’s existing mining right number for the Sibanye Gold: EMC operations is **GP 30/5/1/2/2(38) MR**. This is the mining right to which this application regarding the cessation of pumping and termination of underground workings applies.

As this project consists of an integrated process, a Water Use Licence Amendment Application (WULAA) for the changes to the existing Water Use Licence (WUL) (Licence Number 08/C23D/ABEFGJ/2836) associated with the cessation of pumping, is also being prepared in terms of the National Water Act 36 of 1998 (NWA). This BAR and EMPr document will be a supporting document to the WULAA, which will be assessed by the Department of Water and Sanitation (DWS).

The CBAR, EMPr and Partial Closure Plan were submitted for authority and public review from 3 April 2017 to 7 May 2017. At the request of an Interested and Affected Party (I&AP), the public

<sup>1</sup> For the purposes of this report, the term EMPr will be used.

participation process was extended to 21 May 2017. Substantial changes were made to the reports and to the specialist studies mainly due to comments from I&APs. A request for a 50 day extension of the BA process in terms of Regulation 19(1)(b) of GN R 982 (as amended) of the 2014 EIA Regulations was applied for on 13 June 2017, to allow for new information to be added and for amendments to be made to the CBAR, EMPr and Closure Plan. The DMR granted this extension in a letter dated 28 June 2017. The updated reports were made available for a second public review period from 16 August 2017 to 15 September 2017. On 17 July 2017, further extension of the Basic Assessment process of two months in terms of Regulation 3(7) of GN R 982 of the 2014 EIA Regulations (as amended) was applied for. This extension was approved by the DMR on 7 August 2017, stating that the FBAR must be submitted by 20 October 2017.

### **Specialist Investigations/Studies – Key Findings**

Specialist investigations were conducted as part of the Basic Assessment process. These investigations studied existing information and the potential impacts that may occur with the re-watering of the underground operations. The specialists have made recommendations on mitigation and management measures to be implemented in the event of potential impacts. The following summary conclusions are drawn from the various specialist reports compiled.

#### Geohydrology (Jones & Wagener (Pty) Ltd, 2017, *Ezulwini Partial Closure Geohydrological and Geotechnical Assessment*, Report Number: JW243/16/F925)

The assessment of possible groundwater impacts due to the cessation of pumping were assessed in relation to various scenarios or alternatives. In the event of the complete cessation of pumping whereby re-watering is controlled by the mine geometry and groundwater inflow volume, the following findings are reported:

- It will take an estimated 7 years before the Gemsbokfontein Eye starts flowing again. The flow is expected to gradually increase over a period of approximately 15 years before steady-state conditions are achieved. When it starts flowing again, the long-term average flow at the Gemsbokfontein Eye will be about 13 Mℓ/day.
- The groundwater quality emanating at the Gemsbokfontein Eye after the recovery of the dolomite aquifer is unlikely to be influenced by any mining source and the groundwater quality is expected to be within recommended limits as the impacted mine water associated with the re-watered mine will be contained within the workings. However, the impact of housing, industrial and farming activities (external influences) on the quality of the dolomitic water is unknown and may influence the dolomitic water quality to some extent.
- South Deep may experience an increased flow through the boundary pillar to an estimated 7 Mℓ/day when full hydraulic head is reached. If this flow realises, the re-watering time will increase to 13 years as opposed to the approximately 7 years if no seepage occurs. South Deep is currently pumping 11 Mℓ/day, of which 2 Mℓ/day is fissure water (fissure water is expected to increase to 7 Mℓ/day, resulting in a total amount of 16 Mℓ/day to be pumped from South Deep). As per email correspondence with Mr Andre Marais of Gold Fields, South Deep can safely pump 16 Mℓ/day in the current situation, and with the installation of an additional column in the shaft, will be able to pump 38 Mℓ/day.
- The groundwater inflow into Cooke 3 can potentially increase from 8.50 Mℓ/day to 9.4 Mℓ/day when the dolomite aquifer is fully re-watered.

#### Dolomite Stability Assessment (Jones & Wagener (Pty) Ltd, 2017, *Ezulwini Partial Closure Geohydrological and Geotechnical Assessment*, Report Number: JW243/16/F925)

Due to the perception of potential renewed sinkhole activity in the Gemsbokfontein West Sub-compartment as a result of the onset of re-watering, a dolomite stability assessment was undertaken, the outcome of the assessment is as follows:

- Surface settlement is likely to be irreversible. Neither a rise in the ground level nor renewed subsidence is likely to materialise as a result of re-watering. In any event, the rate of such settlement, should any occur, will be slow and does not pose a threat to life or injury to persons provided adequate monitoring and early warning systems are in place.
- Re-establishment of the water table has the potential to destabilise existing voids in the overburden between the current (drawn down) level of the water table and the original (restored) groundwater level. Voids in the overburden above the original water level will not be affected.
- The likelihood of sinkholes of any size occurring over the bulk of the sub-compartment is low, provided no development takes place in these areas during the re-watering period. In the areas where clusters of sinkholes have already occurred, the inherent hazard category is medium.
- The Simunye development is situated in an area which is relatively stable. Most of the developed area in Simunye, the largest residential area in this sub-compartment, is considered to have a low risk of any size sinkhole formation. There are, however, zones crossing this residential area where there is a medium to high risk of large to very large size sinkholes. Re-watering of the area will have no effect on the stability of the overburden.
- As the study area consists largely of open space (91%) any possible impacts should have few consequences. Attention must be paid to the main residential areas (Simunye), Sasol gas lines, Rand Water lines (adjacent to the N12) and major transport routes (N12, R28 roads and the main railway line). Detailed monitoring (levelling) will therefore focus on these areas.

Quick re-watering of the dolomite aquifer is expected to have less of an impact than a slow re-watering rate. Although there is no evidence of this, due to the fact that full re-watering of a dolomitic groundwater compartment has not happened anywhere in South Africa before to our knowledge, the erosion of the sub-surface takes place at the groundwater level and the sooner this level stabilises the less erosion takes place. Partial re-watering of parts of the workings has taken place in the past. The re-watering rate would be influenced by continued abstraction from the compartment.

Surface Water (Jones & Wagener (Pty) Ltd, 2017, *Specialist Surface Water Report as Input to the Environmental Authorisation Process for the Closure of the Ezulwini Underground Workings*, Report Number: JW241/16/F925)

Based on the assessment of the impacts on surface water from the cessation of pumping from Ezulwini the following conclusions can be made:

- The cessation of pumping will have a very high impact on the surface water quantity in the Kleinwes Rietspruit in terms of the availability of water in the catchment. Due to pumping having taken place for the past 40 years, it is the surface water specialist's opinion that the system has re-baselined and thus the cessation of pumping will have a negative impact. However, the cessation of pumping can be seen as returning the river system to be more in line with the naturalised streamflow (i.e. prior to the permitted discharge of mine water into these watercourses).
- No impact as a result of the project has been ascribed to the Leeuspruit due to the fact that no water has been discharged into the Leeuspruit by Ezulwini since Sibanye

acquired the mine in 2013. The exception to this is discharges to Bambanani Fruits and to South Deep mine, when requested.

- The recovery of the groundwater levels in the Gemsbokfontein dolomite aquifer and the subsequent flow at the Gemsbokfontein Eye will have a moderate positive impact on the flow of the Wonderfonteinspruit. The modelled flow from the eye will increase in the order of 13 Mℓ per day.
- In terms of the adequacy of the existing 1 m pipeline to handle additional flows at the Gemsbokfontein Eye, based on the current pipe capacity of 100 Mℓ/day, the pipeline is unlikely to be sufficient to handle the additional flows expected at the Gemsbokfontein Eye. Based on this, the impact of the flowing water at the Gemsbokfontein Eye due to the re-watering of the underground workings, has been deemed to have a low negative rating but with a high degree of uncertainty (i.e. *can't know*). The negative rating is due to the potential re-watering of other underground workings, as a result of water flowing in the natural stream rather than in the pipeline. The uncertainty associated with the impact is due to the timeframes associated with water flowing at the Eye and the external influences on the flow in the Wonderfonteinspruit which are dynamic and will change with time.
- The current uranium levels in the Kleinwes Rietspruit and Leeuspruit are an area of concern regarding surface water quality. At the monitoring point at the Peter Wright Dam (i.e. the discharge location) the average uranium concentration exceeds that of the WUL limit by between 40 and 50 µg/ℓ. In the Wonderfonteinspruit the uranium levels are, in some instances, higher than the acceptable limit, however, the average concentrations are within the WUL limit.
- There is clear improvement in the water quality at the monitoring point Peter Wright Dam in the last two years. This is due to the installation of Cold Lime Softening Plant to remove uranium from the water pumped from underground. This plant became operational during the second half of 2015.
- With respect to surface water quality on the Kleinwes Rietspruit, the current water quality in the Kleinwes Rietspruit is generally acceptable, with respect to the constituents that were assessed (excluding the uranium concentration). It is expected that there will be a degradation in the water quality immediately downstream of the Peter Wright Dam, particularly with respect to uranium concentrations. This is due to the artificial wetland downstream of the plant and possible seepage from the adjacent dormant slimes dams, which may impact negatively on the water quality in overflow water from the Peter Wright Dam into the Kleinwes Rietspruit, combined with the decreased dilution effect from the underground discharge water.
- In addition, further downstream where water from urban areas is being discharged into the stream, water qualities with respect to *e.coli* may deteriorate due to the significantly reduced dilution from the water currently being discharged from the mine. However, although the impact on surface water quality further downstream on the Kleinwes Rietspruit has a high negative rating, EMC cannot be held accountable for the detrimental influences by third parties on water quality downstream of the operations. Therefore the project has been deemed to have a high negative impact with respect to the surface water quality, in terms of concentrations and dilution, in the Kleinwes Rietspruit.
- However, due to the reduction in the salt/metal load discharged into the Kleinwes Rietspruit by Ezulwini, the impact of the cessation of pumping by Ezulwini into the Kleinwes Rietspruit has also been assigned a high positive rating with respect to surface water quality.

- With respect to the impact on surface water quality on the Wonderfonteinspruit, due to the reinstatement of the flow from the Gemsbokfontein Eye, it is expected that the fountain water quality will be of a good standard and therefore it is expected to have a positive impact on the water quality of the Wonderfonteinspruit. However, the impact is only deemed to be moderate due to the small volume of water that will report to the stream, in relation to the current flows in the stream.

Wetlands and Ecology (Natural Scientific Services cc, 2017, *Closure of Sibanye Gold Ezulwini Operations: Ecological Assessment*, Report Number: 2321)

An assessment of the impacts on wetlands from the cessation of pumping drew the following main conclusions:

- The main impact, when pumping ceases, will be on the hydrology driver of the downstream systems. The flow will be reduced in the dry season by as much as 99% immediately downstream of the dam and up to a 32% reduction 38 km downstream in the dry season for the Kleinwes Rietspruit. The decrease in flow will in all likelihood result in a change in the system from one that has been perennial in nature, with fast flowing water all year around, to a non-perennial system with more wetland characteristics.
- The artificial wetland upstream of the Peter Wright Dam is a large contributor of the uranium concentrations and uranium load in the Kleinwes Rietspruit. Once pumping ceases the dilution effect from the water will be removed and the impact will be negative in terms of concentration, but not load. However, EMC has made an application to the relevant authorities in 2016 to rehabilitate the aforementioned wetland area as part of its on-going surface operations and therefore, with mitigation, the impact will not be as severe. In addition, the Peter Wright Dam should not be allowed to spill more than 1:50 years, as an additional mitigatory measure.
- In terms of wetland loss, this change in hydrology will impact on the extent and wetness regime of the Channelled and Unchannelled valley bottoms, particularly in stretches along the river where the banks are not steep. The presence of permanent wetlands will likely change to be more seasonal or temporary in nature. The change in hydrology will impact on all of the other wetland drivers: Geomorphology, Ecology and Water Quality. Specifically, any tailings or contaminants present in the watercourses which are currently being held *in situ* by the *Phragmites* reed beds may be released further downstream if the wetland vegetation reduces in extent due to a lower water flow. This may lead to increased turbidity, deposition of sediments and release of heavy metals and other particles. The Kleinwes Rietspruit system changing to a non-perennial system, as it was initially, can also potentially impact on aquatic ecology species by favouring those organisms that thrive in slow moving to stagnant water and negatively affecting the invasive species in the watercourses.
- Any impacts on the downstream Leeuspruit, after pumping ceased in 2013, have already likely occurred. The wetlands identified to be the most sensitive within the area of influence are those downstream of the South Deep mine. The sensitivity is due to the wetland dependant Conservation Important faunal species identified utilising this wetland habitat. EMC may still impact on the surface water quality due to the contaminated sediment, however this will not be assessed as part of the impact of this project.
- At the Kleinwes Rietspruit, although the cessation of pumping will potentially affect the ecological category, it should not reduce it to below an Ecological Category of D which would be in breach of the Resource Quality Objectives (RQO) for the catchment. Even though this is potentially unachievable due to the multitude of impacts on the system by a number of parties, it is recommended that reasonable management measures should be employed to minimise any additional impacts.

- The potential impact of the increased flows within the Wonderfonteinspruit will not have a negative effect on the aquatic communities. As it is already within a largely modified state (EC of D/E), the 14 % increase in water will not reduce the ecological category. The exact impact of this will depend on what the water quality from the Gemsbokfontein Eye will be. Any negative impacts associated with the increased water quantity will be mitigated by the numerous impoundments within the Wonderfonteinspruit and the Mooi River further downstream.
- Flow will occur at Gemsbokfontein Eye after approximately 7 years, which will then be piped 32 km westward and discharges into a canal system, which will then enter a series of dams in the Abe Bailey Nature Reserve. The increase in water volumes into these series of dams is not seen as a major impact on the terrestrial biodiversity. As the discharge point enters the Abe Bailey Nature reserve it is important that the natural and artificial habitats remain. Even though these large waterbodies are artificially fed by all the upstream inputs, they are important for both resident and migrant avifauna.

*Socio-Economic* (Southern Economic Development, 2017, *Socio-Economic Impact Assessment of the Proposed Cessation of Pumping and Associated Closure of the Underground Workings of the Ezulwini Operations of Sibanye Gold, Gauteng Province*)

The possible socio-economic impacts due to the cessation of pumping from Sibanye Gold: EMC operations were assessed to be the following:

- The partial mining closure motivation is the result of the need to decrease the current operation losses. Losses measured R 350 million from January 2015 to March 2016 and expected to be R 156 million in 2017, largely as a result of the cost of pumping.
- There will be a negative impact on employment (155 affected employees), who are currently involved in pumping activities at the mine.
- There is an expected decrease in external costs related to energy use (R 2 million/annum).
- The possibility of increased seismic activity during re-watering (although difficult to predict the likelihood of this occurring) may result in ground falls and loss of life (this is however predicted to be short-term, after which the usual stability risks will resume).
- There may be a high impact on local farmers (adjacent to mine), and their suppliers due to the decrease in water availability ( $\pm$ R 51 million/annum) mainly in the Kleinwes Rietspruit with a potential loss of 310 related job opportunities. On the other hand, the recovery of the dolomitic aquifer creates opportunity for abstracting more water for agricultural purposes provided they are granted water use licences for abstraction.
- The highest potential socio-economic risk (although negligible likelihood (SRK Consulting, 2017)) for the proposed closure of the underground workings of the Sibanye Gold: EMC operations is related to potential loss of life and the closure of South Deep due to seismic instability and the potential flooding of South Deep, which risk has been shown to be insignificant. The highly negative consequences, in the event of the above, underscore the need to mitigate these potential impacts effectively. The proposed mitigation measures are listed in **Section 1f)** and require the participation of South Deep. require the recommended monitoring be undertaken by the establishment and operation of a Command and Control Monitoring Centre.

*Plug Assessment* (SRK Consulting, 2017, *Assessment of the water barrier pillar and the water plugs placed between Ezulwini Shaft and South Deep shaft*, Report Number: 507589/1; SRK Consulting, 2017, *Assessment of the water barrier pillar and positioning of future plugs between*

*Cooke 3 and Ezulwini shafts, Report Number: 507589/2; SRK Consulting, 2017, Design of Ezulwini / Cooke 3 Plugs - Phase 3, Report Number: 507569/3)*

#### Water barrier pillar and plugs between South Deep and Ezulwini

- A detailed assessment of the integrity and water tightness of the water barrier pillar, seismic hazard and plug reliability has been carried out by SRK Consulting. The following conclusions were drawn:
  - The water barrier will remain stable and watertight, but some seepage may occur through a few of the many geology structures that cross the boundary pillar.
  - Fluid induced seismicity has occurred and will continue to occur, but the seismic hazard is not expected to increase significantly with increasing water pressure. The risk of damage to the plugs or failure of the water barrier is considered extremely remote.
  - The South Deep plugs have been well designed and constructed and the risk of failure is insignificant.

#### Water barrier pillar and plugs between Cooke 3 and Ezulwini

- A detailed study of the water barrier pillar was carried out by SRK Consulting, a plan assessment was completed where water plug positions were established and a seismic hazard assessment was performed. The following conclusions were drawn:
  - Three plug sites were identified, one at Cooke 3 on 140 level and two at Ezulwini on 45 and 43 levels. The plugs in the 45C and 43C haulage north (Cooke 3 Shaft) will prevent water flow into the stopes adjacent to the reduced water pillar and thereby circumvent this potential hazard.
  - Although seismicity associated with the re-watering of the Ezulwini workings is expected to occur, it is not expected to be significant in magnitude.

#### Design of plugs between Cooke 3 and Ezulwini

A plug design report has been compiled by SRK Consulting and is included in this application, for the plugs required between Cooke 3 and Ezulwini.

### **Specialist Investigations/Studies – Recommendations**

#### Geohydrology

The geohydrological assessment of potential impacts due to the cessation of pumping from Sibanye Gold: EMC operations recommends the following:

- To our knowledge, the re-watering of a dolomitic groundwater compartment has not happened anywhere in South Africa before and due to the many uncertainties, it is recommended that a dynamic groundwater monitoring programme is implemented.
- The aim of the monitoring is to verify the model predictions and to make adjustments were necessary. The monitoring network will provide an early warning system that will alert the mine to the following:
  - Unexpected changes in the groundwater levels, specifically in areas with a risk of sinkhole formation;
  - Unexpected changes in groundwater quality; and
  - Changes in the level of the ground surface.
- The groundwater levels in the revised borehole network should be monitored as follows:
  - Monthly during the lead-up to the cessation of pumping;

- Twice a month during the re-watering process; and
- Monthly after the Gemsbokfontein Eye starts flowing for a period of three years.
- It is also important that the flow meter in the pipeline be repaired and a surface water flow measuring system is in place prior to the eye starting to flow. Flow from the Gemsbokfontein Eye is likely to be diffuse and measuring the difference between water exiting the 0.75 m pipeline from Donaldson Dam and entering the 1 m pipeline, may be a way of accounting for the flow volume at the eye.
- Groundwater quality in the revised monitoring network (only new boreholes BH1-6) should be monitored as follows:
  - Twice a year during the lead-up to the cessation of pumping;
  - Twice a year during the re-watering of the mine;
  - Quarterly during the recovery of the dolomite aquifer and during the first three years after the eye starts flowing.

#### Dolomitic Stability

Due to the perception of potential renewed sinkhole activity in the Gemsbokfontein West Sub-compartment as a result of the onset of re-watering, a dolomite stability assessment was undertaken, the recommendations of the assessment are as follows:

- As it is possible that new sinkholes/subsidence could develop during re-watering of the Gemsbokfontein West sub-compartment, such events may create a variety of safety and financial impacts for EMC and various affected parties.
- Historically the mines involved in the dewatering of this, and neighbouring compartments, recorded, investigated and compensated affected parties where necessary for any adverse impacts. Such activities were managed by the FWRDWA.
- A strategy, related now to re-watering, to mitigate any potential effects to affected parties, known as a Dolomite Risk Management Strategy is required, and detailed in **Appendix C.2**. This strategy mirrors the process undertaken by the mines during dewatering. This must be implemented until the re-watering cycle is complete.

#### Surface Water

Based on the assessment of the impacts on surface water from the cessation of pumping from Sibanye Gold: EMC operations the following recommendations can be made:

- After pumping at Ezulwini ceases the mine should continue to monitor the water quality at the existing monitoring points along the Leeuspruit and Kleinwes Rietspruit to assess the impact of the remaining mine related infrastructure on the surface water regimes associated with the mine. The current water quality monitoring programme has been evaluated and it is recommended that this be continued after pumping stops. This is currently being conducted on a monthly basis and it is recommended that a full chemical suite of variables be analysed at the current frequency. This monitoring should continue for a period of three years after the cessation of pumping, subject to reassessment at the time.
- The abstraction of water from the Peter Wright Dam will need to continue, such that the dam does not overtop more than once in 50 years, until such time as the wetland upstream of the dam is rehabilitated and it can be shown that the water quality in the dam is in line with the in-stream water quality objectives. If water is abstracted from the dam at a rate of 2 000 m<sup>3</sup>/day then the dam would not be expected to spill more than once in fifty years and therefore would comply with the regulations, as stipulated in GNR 704. The effluent from the external sewage treatment plant could be diverted around the Peter Wright Dam and subsequently be made to report directly into the

Kleinwes Rietspruit, then the required abstraction rate could be reduced to 1 000 m<sup>3</sup>/day. This is provided the sewage plant effluent is of an adequate quality, in line with in-stream water quality objectives.

- At the Gemsbokfontein Eye it is recommended that the location of the flow point be monitored and the water quality of the flow water be sampled, together with groundwater monitoring. These water qualities should be assessed to ensure compliance with the Resource Water Quality Objectives for the catchment and to assess the impact of the flow water on the surface water qualities in the Wonderfonteinspruit catchment. This monitoring should continue for three years after the Eye begins to flow, subject to reassessment at the time. In addition, the flow in the 1 m pipeline should be continuously monitored in relation to its capacity within the context of the associated catchment in which it falls.

### Wetlands and Ecology

The following recommendations have been made based on the assessment of the impacts on wetlands and ecology, from the proposed cessation of pumping from Sibanye Gold: EMC operations:

- It is recommended that the Present Ecological State (PES), Ecological Importance and Sensitivity (EIS) and ecosystem services of the systems continue to be monitored annually for a period of 3 years at select sampling points on the Kleinwes Rietspruit. The monitoring of the Wonderfonteinspruit will need to continue for 3 years after flow from the Eye commences. Sampling points need to be established and assessed prior to pumping ceasing.
- Biomonitoring is currently undertaken along the Leeuspruit East by EMC, it is recommended that bio-monitoring on this system continues. Biomonitoring has been undertaken by the EMC since 2016 along the Kleinwes Rietspruit (Sibanye Gold, 2016; Sibanye Gold, 2017). NSS recommends that the bi-annual monitoring continues. In addition to the current monitoring measures, NSS recommends that a taxa list of the macroinvertebrates sampled be included in the monitoring reports. The taxa list could provide valuable information on changes after the pumping ceases; and is therefore vital to include in the baseline information for future monitoring reports.
- In addition to water quality monitoring it is recommended that sediment samples be taken and assessed. The sediment in the Kleinwes Rietspruit, downstream of the Peter Wright Dam needs to be assessed to determine the contamination levels. If contaminated, it is important that the existing vegetation is monitored as this vegetation is stabilising the sediment. If the vegetation dies back, alternative mitigation measures may need to be investigated to prevent the sediment from being transported further downstream (such as phytoremediation, bioremediation or soil washing). Tailings are to be removed and placed on existing tailings facilities. The Uranium level is likely to remain the same or increase due to lack of dilution effect if tailings are not removed. Settling ponds downstream of all contaminated areas are to be installed to prevent contaminated sludge entering the wetland systems. These settling ponds are to be cleaned on a regular basis in order to maintain capacity, with the contaminated material disposed of in an appropriate manner. An application to rehabilitate these wetlands was submitted by EMC to the DWS in 2016, however no response has been received to date. The same vegetation monitoring must take place in the Leeuspruit where it is known that the sediment samples taken by NSS (NSS, 2014) were contaminated and are currently being held *in situ* by the *Phragmites* reed beds.
- Implementation of the rehabilitation plan submitted by EMC (2016) for the wetland areas upstream of the Peter Wright Dam. Without the removal of the tailings from these wetlands it is likely that the uranium level will remain the same or increase as the pumped water will no longer create a dilution effect.

- Erosion was present along both the Leeuspruit and Kleinwes Rietspruit. As the hydrology of the system changes, the vegetation structure and composition is expected to change. This change in vegetation structure may result in times where vegetation cover is scarce and the system is more prone to erosion. Selected photographic sampling points, along both systems should be identified, prior to pumping stopping. Photographs should be taken quarterly, for a period of 3 years. Should evidence of erosion increase, the cause should be investigated and mitigation measures implemented if required. Mitigation measures could include seeding or the planting of vegetation sods to speed up the vegetation succession, or if more severe, the use of gabion structures could be investigated.

### Socio-Economic

Based on the assessment of the impacts on the socio-economic factors from the cessation of pumping from Sibanye Gold: EMC operations the following recommendations have been made:

- Prioritise affected workers for future employment in Sibanye projects.
- Keep affected suppliers informed of future contracts at Sibanye.
- The partial mining closure motivation is the result of the need to decrease the current operation losses. This is recommended to be achieved by complete cessation of pumping underground water from Sibanye Gold: EMC operations.
- A clear communication strategy to communicate socio-economic impacts of closure to the local community should be established.
- The Emergency Response Plans for Cooke 3 shaft and South Deep (**Appendix H.4** and **H.5**) must be maintained to include safety measures relating to the re-watering of Sibanye Gold: EMC operations.
- The shaft entry points must be barricaded and appropriate security measures built around the surface infrastructure to prevent illegal miners from entering the mine.
- Sibanye must continue engaging in forums in collaboration with local development agents to discuss potential impacts and mitigation measures regarding income losses for farmers and agricultural workers in the agricultural sector.
- Discussions must be held with South Deep and the Waterpan Golf Club (as well as other affected stakeholders) to discuss ways to reduce the potential impact of the activity on these stakeholders.
- A transparent communication strategy must be developed to inform the local community of seismic impact risks and events.
- The highest potential socio-economic risks (although negligible likelihood (SRK Consulting, 2017) for the proposed closure of the underground workings of the Sibanye Gold: EMC operations are related to potential loss of life and the closure of South Deep due to seismic instability and the flooding of South Deep. The highly negative consequences, in the unlikely event of the above, underscore the need to mitigate these potential impacts effectively. This must be mitigated in terms of the recommendations from the stability findings and monitoring of existing plugs and still to be constructed plugs. It is recommended that the DMR require the recommended monitoring be undertaken by the establishment and operation of a Command and Control Monitoring Centre, as described below.

### Plug Integrity, Boundary Pillar water flow monitoring and seismic monitoring

It is recommended that the DMR require the establishment and operation of a Command and Control Monitoring Centre, as a regional centre to monitor, record and respond effectively to all environmental and geomechanics safety data, including the below with regards to each mine's

plug integrity, boundary pillar water flow and seismic monitoring. The centre is proposed to be located near to South Deep mine so that access to the underground workings is feasible. This centre will be run 24/7 by an independent monitoring response team and will provide real-time linkage to South Deep, EMC and the DMR. The design of this centre must be submitted to the DMR and South Deep for approval within 30 days of authorisation for the cessation of pumping.

### South Deep

#### *Monitoring of plugs*

The following is required:

- The plug sites are inspected via CCTV cameras on a daily basis.
- All pressure gauges be read on a two-weekly basis and that graphs of pressures versus time be maintained. Records should be kept of both plug back-head pressures and piezometer pressures. Any sudden changes in pressure readings should be investigated.
- The flow rates of the drips from the pipe at Level 58 – 2 West plug and from the bolt at Level 58 – East plug be measured, on a two-weekly basis, using a measuring jug and a stop watch.
- Graphs of flow rate versus time should be measured. Any sudden increase in flow rate should be investigated.
- With the expected rise in water level behind the plugs, a specialist contractor is to be called in to do condition monitoring of the plugs and rock condition around the plugs when necessary.

#### *Maintenance of Equipment at 58 Level Plugs*

It is recommended that:

- The CCTV cameras must be maintained.
- The pressure gauges be maintained or replaced. It is not possible to tell whether the piezometer gauges are malfunctioning or whether there is no piezometric pressure. Dual piezometric gauges should be installed so that readings can be cross-referenced. All gauge casings should be engraved with a unique number for recording purposes. All gauges should have a maximum range of 2 MPa so that the indicator needle has a reasonable deflection under pressure.
- The outside closure valve on the lower pipe at 2 West Plug be checked for corrosion. This outlet is the only one carrying acidic water in the pumping operation.

#### *Installation of Equipment at 50 Level Plugs*

It is recommended that:

- Dual closure valves be installed on both the piezometer pipes and the 200 mm bore outlet pipes as a contingency against valve failure.
- Dual pressure gauges be fitted to all piezometer pipes and single pressure gauges be fitted to two of the 200 mm bore outlet pipes. All gauge casings should be engraved with a unique number for recording purposes. Gauge maintenance and calibration must be undertaken when necessary.
- CCTV cameras be installed at the two 50 Level plug sites.

#### *Seismic Activity*

South Deep should maintain a seismic activity monitoring network. Updated catalogues of seismic data recorded by the South Deep network should be analysed to check if events larger than the 2012 value of  $M_{max} = 3.4$  have been recorded.

As the Ezulwini mine rewaters, the flows across the water barrier pillar need to be monitored, and mitigation measures such as additional pumping capacity may need to be considered. The bolts, valve handles and pressure gauges at the plugs between South Deep and Ezulwini should be replaced. The pipes should also be grouted if necessary.

Cooke 3

A monitoring and maintenance programme must be developed by Sibanye for the Cooke 3 – EMC operations plugs once constructed. A seismicity monitoring programme must also be implemented.

The installed support at the potential Cooke 3 plug sites was found to be corroded. This support needs to be replaced in the excavations used to access the proposed plug positions, to prevent injury to the persons working at the plug sites. The support in the area where the plugs are to be placed must be removed and barring must be done to expose the intact rock mass. Temporary support must be placed in this area as per the requirements of the miner responsible for this area.

**Way Forward**

- The FBAR, EMPr and Partial Closure Plan are being submitted to the DMR for decision making. Stakeholders and commenting authorities will be notified of the documents availability and can also request final documents from J&W – see below:

<b>Electronic copies</b>		
Ms Anelle Lötter (public participation office)	( <a href="http://www.jaws.co.za">www.jaws.co.za</a> ) under public documents, alternatively phone and request a CD copy.	Tel: 012 667 4865 or email: anelle@jaws.co.za

- Stakeholders may submit any comments they may have directly to the DMR, copying in the public participation office.
- Stakeholders will be notified of the outcome of the DMR decision with regards to the application for an Environmental Authorisation. This will be done in accordance to the NEMA requirements and the notification received from the DMR.

## SIBANYE GOLD LTD: EZULWINI MINING COMPANY (PTY) LTD

### CESSATION OF PUMPING OPERATIONS AT EZULWINI AND CLOSURE OF UNDERGROUND MINE WORKINGS

#### FINAL BASIC ASSESSMENT REPORT AND ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

REPORT NO: JW042/17/F925 - Rev 3

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**NATIONAL ENVIRONMENTAL MANAGEMENT ACT -2014 REGULATIONS – BASIC ASSESSMENT REPORT AND ENVIRONMENTAL MANAGEMENT PROGRAMME CHECKLIST (GNR 982, as amended)**

<b>Regulation 982 December 2014</b>	<b>Description</b>	<b>Reference in report</b>
<b>BASIC ASSESSMENT REPORT</b>		
Appendix 1.3 a (i)	Details of the EAP who prepared the report	Section 3 a (i)
Appendix 1.3 a (ii)	Details of the expertise of the EAP, including curriculum vitae.	Section 3 a (ii)
Appendix 1.3 b	The location of the activity, including:	Section 3 b
Appendix 1.3 b (i)	The 21-digit Surveyor General code of each cadastral land parcel	Section 3 b
Appendix 1.3 b (ii)	Where available, the physical address and farm name	Section 3 b
Appendix 1.3 b (iii)	Where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	N/A
Appendix 1.3 c	A plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is:	Section 3 c
Appendix 1.3 c (i)	A linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken;	N/A
Appendix 1.3 c (ii)	On land where the property has not been defined, the coordinates within which the activity is to be undertaken;	N/A
Appendix 1.3 d (i)	A description of the scope of the proposed activity, including all listed and specified activities triggered and being applied for; and	Section 3 d (i)
Appendix 1.3 d (ii)	A description of the scope of the proposed activity, including a description of the associated structures and infrastructure related to the development;	Section 3 d (ii)
Appendix 1.3 e	A description of the policy and legislative context within which the development is located including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks, and instruments that are applicable to this activity and have been considered in the preparation of the report; and how the proposed activity complies with and responds to the legislation and policy context, plans, guidelines, tools, frameworks and instruments;	Section 3 e
Appendix 1.3 f	A motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred location;	Section 3 f
Appendix 1.3 g	A motivation for the preferred site, activity and technology alternative;	Section 3 g
Appendix 1.3 h	A full description of the process followed to reach the proposed development footprint within the approved site, including:	-
Appendix 1.3 h (i)	Details of all the alternatives considered;	Section 3 h (i)
Appendix 1.3 h (ii)	Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	Section 3 h (ii)
Appendix 1.3 h (iii)	A summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;	Section 3 h (iii)
Appendix 1.3 h (iv)	The environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 3 h (iv)
Appendix 1.3 h (v)	The impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;	Section 3 h (v)

<b>Regulation 982 December 2014</b>	<b>Description</b>	<b>Reference in report</b>
Appendix 1.3 h (vi)	The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;	Section 3 h (vi)
Appendix 1.3 h (vii)	Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 3 h (vii)
Appendix 1.3 h (viii)	The possible mitigation measures that could be applied and level of residual risk;	Section 3 h (viii)
Appendix 1.3 h (ix)	The outcome of the site selection matrix;	N/A
Appendix 1.3 h (x)	If no alternative development locations for the activity were investigated, the motivation for not considering such; and	Section 3 h (ix)
Appendix 1.3 h (xi)	A concluding statement indicating the preferred alternative development location within the approved site;	Section 3 h (x)
Appendix 1.3 i	A full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred location through the life of the activity, including:	Section 3 i
Appendix 1.3 i (i)	A description of all environmental issues and risks that were identified during the environmental impact assessment process;	Section 3 j
Appendix 1.3 i (ii)	An assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures;	Section 3 j
Appendix 1.3 j	An assessment of each identified potentially significant impact and risk, including- <ul style="list-style-type: none"> <li>(i) cumulative impacts;</li> <li>(ii) the nature, significance and consequences of the impact and risk;</li> <li>(iii) the extent and duration of the impact and risk;</li> <li>(iv) the probability of the impact and risk occurring;</li> <li>(v) the degree to which the impact and risk can be reversed;</li> <li>(vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and</li> <li>(vii) the degree to which the impact and risk can be mitigated;</li> </ul>	Section 3 j
Appendix 1.3 k	Where applicable, a summary of the findings and impact management measures identified in any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report;	Section 3 k
Appendix 1.3 l	An environmental impact statement which contains-	-
Appendix 1.3 l (i)	A summary of the key findings of the environmental impact assessment:	Section 3 l (i)
Appendix 1.3 l (ii)	A map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and	Section 3 l (ii)
Appendix 1.3 l (iii)	A summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	Section 3 l (iii)
Appendix 1.3 m	Based on the assessment, and where applicable, impact management measures from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr;	Section 3 m
Appendix 1.3 n	Any aspects which were conditional to the findings of the assessment wither by the EAP or specialist which are to be included as conditions of authorisation;	Section 3 n
Appendix 1.3 o	A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	Section 3 o

<b>Regulation 982 December 2014</b>	<b>Description</b>	<b>Reference in report</b>
Appendix 1.3 p	A reasoned opinion as to whether the proposed 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;	Section 3 p
Appendix 1.3 q	Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised;	Section 3 q
Appendix 1.3 r	An undertaking under oath or affirmation by the EAP in relation to: <ul style="list-style-type: none"> <li>(i) the correctness of the information provided in the reports;</li> <li>(ii) the inclusion of comments and inputs from stakeholders and I&amp;APs;</li> <li>(iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and</li> <li>(iv) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;</li> </ul>	Section 3 r
Appendix 1.3 s	Where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts	Section 3 s
Appendix 1.3 t	Any specific information that may be required by the competent authority	Section 3 t
Appendix 1.3 u	Any other matters required in terms of section 24(4)(a) and (b) of the Act.	Section 3 u
<b>ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPr)</b>		
Appendix 4.1 (a)	An EMPr must comply with section 24N of the Act and include details of <ul style="list-style-type: none"> <li>i. the EAP who prepared the EMPr; and</li> <li>ii. the expertise of that EAP to prepare an EMPr, including a curriculum vitae;</li> </ul>	Section 1 a
Appendix 4.1 (b)	A detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description.	Section 1 b
Appendix 4.1 (c)	A map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that any areas that should be avoided, including buffers.	Section 1 c
Appendix 4.1 (d)	A description of the impact management objectives, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including- <ul style="list-style-type: none"> <li>(i) planning and design;</li> <li>(ii) pre-construction activities;</li> <li>(iii) construction activities;</li> <li>(iv) rehabilitation of the environment after construction and where applicable post closure; and</li> <li>(v) where relevant, operation activities.</li> </ul>	Section 1 d
Appendix 4.1 (e)	A description and identification of impact management outcomes required for the aspects contemplated in paragraph (d).	Section 1 e
Appendix 4.1 (f)	A description of proposed impact management actions, identifying the manner in which the impact management objectives and outcomes contemplated in paragraphs (d) and (e) will be achieved, and must, where applicable, include actions to – <ul style="list-style-type: none"> <li>(i) avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;</li> <li>(ii) comply with any prescribed environmental management standards or practices;</li> <li>(iii) comply with any applicable provisions of the Act regarding closure, where applicable; and</li> <li>(iv) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;</li> </ul>	Section 1 f
Appendix 4.1 (g)	The method of monitoring the implementation of the impact management actions contemplated in paragraph (f);	Section 1 f (i)

<b>Regulation 982 December 2014</b>	<b>Description</b>	<b>Reference in report</b>
Appendix 4.1 (h)	The frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);	Section 1 f (i)
Appendix 4.1 (i)	An indication of the persons who will be responsible for the implementation of the impact management actions;	Section 1 f (i)
Appendix 4.1 (j)	The time periods within which the impact management actions contemplated in paragraph (f) must be implemented;	Section 1 f (i)
Appendix 4.1 (k)	The mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f).	Section 1 f (i)
Appendix 4.1 (l)	A program for reporting on compliance, taking into account the requirements as prescribed by the Regulations.	Section 1 l
Appendix 4.1 (m)	An environmental awareness plan describing the manner in which- (i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and (ii) risks must be dealt with in order to avoid pollution or the degradation of the environment; and	Section 1 m
Appendix 4.1 (n)	Any specific information that may be required by the competent authority.	Section 1 n

**SIBANYE GOLD LTD: EZULWINI MINING COMPANY (PTY)  
LTD**

CESSATION OF PUMPING OPERATIONS AT EZULWINI  
AND CLOSURE OF UNDERGROUND MINE WORKINGS

**FINAL BASIC ASSESSMENT REPORT AND  
ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT  
ADDENDUM**

Report No.: JW042/17/F925 - Rev 3

OCTOBER 2017

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