mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

# Environmental Impact Assessment
# And
# Environmental Management Plan

## Listed Activities Associated with Blyvoor Gold Mining Project, near Carletonville, West Rand, Gauteng

## DMR Reference Number: GP 30/5/1/2/2 (143) MR (EA)

*SUBMITTED FOR ENVIRONMENTAL AUTHORIZATIONS IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 AND THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT, 2008 IN RESPECT OF LISTED ACTIVITIES THAT HAVE BEEN TRIGGERED BY APPLICATIONS IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (MPRDA) (AS AMENDED).*

| | |
|---|---|
| **Name of Applicant:** | Blyvoor Gold Capital (Pty) Ltd |
| **Tel no:** | 011-4862842 |
| **Fax no:** | 011-4861520 |
| **Postal Address:** | P O Box 1136, Houghton, 2041 |
| **Physical Address:** | 9 5th Street, Houghton Estate, 2198 |
| **File Reference Number SAMRAD:** | GP 30/5/1/2/2 (143) MR (EA) |

This document has been prepared by Digby Wells Environmental.

| | |
|---|---|
| **Report Type:** | **Environmental Impact Assessment and Environmental Management Plan Report** |
| **Project Name:** | **Environmental Authorisation for the Blyvoor Gold Mining Project near Carletonville, Gauteng** |
| **Project Code:** | **BVG4880** |

| **Name** | **Responsibility** | **Signature** | **Date** |
|---|---|---|---|
| Xanthe Taylor | Report Compilation | | October 2018 |
| Stephanie Aken | First Review | | October 2018 |
| Barbara Wessels | Final Review | BWessels | October 2018 |

# IMPORTANT NOTICE

In terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 as amended), the Minister must grant a prospecting or mining right if among others the mining "will not result in unacceptable pollution, ecological degradation or damage to the environment".

Unless an Environmental Authorisation can be granted following the evaluation of an Environmental Impact Assessment and an Environmental Management Programme report in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA), it cannot be concluded that the said activities will not result in unacceptable pollution, ecological degradation or damage to the environment.

In terms of section 16(3)(b) of the EIA Regulations, 2014, any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority and in terms of section 17 (1) (c) the competent Authority must check whether the application has taken into account any minimum requirements applicable or instructions or guidance provided by the competent authority to the submission of applications.

**It is therefore an instruction that** the prescribed reports required in respect of applications for an environmental authorisation for listed activities triggered by an application for a right or a permit are submitted in the exact format of, and provide all the information required in terms of, this template. Furthermore, please be advised that failure to submit the information required in the format provided in this template will be regarded as a failure to meet the requirements of the Regulation and will lead to the Environmental Authorisation being refused.

**It is furthermore an instruction that** the Environmental Assessment Practitioner must process and interpret his/her research and analysis and use the findings thereof to compile the information required herein. (Unprocessed supporting information may be attached as appendices). The EAP must ensure that the information required is placed correctly in the relevant sections of the Report, in the order, and under the provided headings as set out below, and ensure that the report is not cluttered with un-interpreted information and that it unambiguously represents the interpretation of the applicant.

# OBJECTIVE OF THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

The objective of the environmental impact assessment process is to, through a consultative process: -

- determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;
- describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;
- identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;
- determine the: -
  - nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
  - degree to which these impacts: -
  - can be reversed;
  - may cause irreplaceable loss of resources, and
  - can be avoided, managed or mitigated.
- identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;
- identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;
- identify suitable measures to manage, avoid or mitigate identified impacts; and
- identify residual risks that need to be managed and monitored.

# EXECUTIVE SUMMARY

## Introduction

Exploration started at Blyvooruitzicht Gold Mine Company Limited (BGMC) in the 1930s and mining activities continued until the mine went into liquidation in 2013. Blyvoor Gold Capital Proprietary Limited (Blyvoor Gold) is returning the mine to operation and will continue with the existing underground mining accessed through the No. 5 Shaft. Gold will be recovered through a metallurgical plant to be re-constructed on a previous plant site at No. 5 Shaft (No. 5 Shaft Treatment Plant) located on the Remaining Extent of Portion 24 of the farm Doornfontein 118 IQ.

In addition, it is the intention to return the tailings retreatment facilities to an operational state. The gold contained in the various tailings storage facilities (TSFs) resulting from the historical operation of BGMC will be recovered through a second metallurgical plant to be re-constructed on a previous plant site immediately to the east of the Golf Course (Tailings Treatment Plant) on Portion 10 of the farm Blyvooruitzicht 116 IQ

Digby Wells Environmental (Digby Wells) has been appointed by Blyvoor Gold as the independent Environmental Assessment Practitioner (EAP) to conduct an Environmental Impact Assessment (EIA) and the associated specialist studies for the Blyvoor Gold Mineproject (the Project). Blyvoor Gold (Pty) Ltd is the umbrella company for two separate companies, namely Blyvoor Gold Capital (Pty) Ltd, and Blyvoor Gold Operations (Pty) Ltd. The Mining Right relevant to the former BGMC operation was acquired by Blyvoor Gold Capital (Pty) Ltd through the transfer and cession in terms of Section 11 of the Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA).

The purpose of this application is to approve the existing operations of the Project and to align the existing documentation pertaining to the operations to the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and the Environmental Impact Assessment (EIA) Regulations, dated 2014 (as amended in 2017). Furthermore, two metallurgical processing plants are required to be authorised as part of this application, as well as the reclamation of TSFs.

## Project applicant

Blyvoor Gold Capital (Pty) Ltd is the Project Applicant and holder of the Mining Right for the Blyvoor Gold Mine, reference number GP 30/5/1/2/2/143 MR.

| | |
|---|---|
| **Company name:** | Blyvoor Gold Capital (Pty) Ltd |
| **Contact person:** | Alan Smith |
| **Physical address:** | 9 5th Street, Houghton Estate, 2198 |
| **Telephone:** | 011 4862842 |
| **Cell phone:** | 082 559 7532 |
| **Email:** | alan@blyvoorgold.com |

## Project overview

Blyvoor Gold (the Applicant) recently purchased the gold mining operation which was commissioned by the BGMC in 1937. The mine changed ownership many times until its liquidation in 2013. Due to the operation's long-standing history, Blyvoor Gold is able to reinstate the mine utilising the infrastructure footprints and infrastructure that is mostly still in place. During the period of liquidation, some of the mining and plant infrastructure was removed for resale, vandalised or stolen. Blyvoor Gold will be required to repair and reconstruct certain infrastructure that has been affected to reinstate the underground and tailings operations. The infrastructure on site had mostly been assessed and included in environmental applications made by previous owners and contained within the Environmental Management Programme (EMP) dated 2000 and approved in 2001. However; amendments submitted thereafter were not approved by the Department of Mineral Resources (DMR), and this application therefore seeks to include required authorisation for infrastructure on site that may not be approved, and two metallurgical plants on site require an Atmospheric Emissions Licence (AEL) in terms of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004). The list of previous EMPs is tabulated below.

**Historical EMPs Associated with BGMC**

| Year | Status | Author | EMP Title |
|---|---|---|---|
| 2000 | Approved | Pulles Howard & De Lange | Environmental Management Programme Blyvooruitzicht Gold Mining Company |
| 2007 | Not approved | Fraser Alexander Tailings Technical Division | Environmental Management Programme for the Activities of Blyvooruitzicht Gold Mining Company Ltd in Accordance with Section 39 of the Mineral and Petroleum Resources Development Act, 2002, (Act No. 28 of 2002) |
| 2012 | Not approved | Eco Partners | Environmental Impact Assessment and Environmental Management Programme Submitted in Support of Mining Right Conversion Application |
| 2017 | Not approved | Golder Associates | EMP Update for Tailings Reclamation & Underground Mining at Blyvooruitzicht Gold Mine |

In accordance with Transitional Provisions as stated in Regulation 54(A)(1) of the NEMA Regulation 982, as amended in 2017, the approved EMP (2000) is regarded as fulfilling the requirements of the Act (NEMA).

## Purpose of this report

The Mining Right; GP 30/5/1/2/2/143 MR, was transferred and ceded to Blyvoor Gold in 2017. The DMR issued Blyvoor Gold with a Section 93 Directive in terms of the MPRDA, which, amongst other matters, required the holder to apply for amendment of the Environmental Authorisation.

The purpose of the EIA process is to ensure that potential environmental and social impacts associated with the construction and operation of the Project are identified, assessed and appropriately managed. There are two primary phases of an EIA process, namely the Scoping Phase and the Impact Assessment Phase. Identification of potential impacts occurs during the Scoping Phase, whilst the assessment and mitigation of those impacts occurs during the Impact Assessment Phase.

This report also serves to encapsulate the history of processes undertaken related to the transfer of ownership of the Mining Right, address legacy issues associated with the former BGMC operation, provide an overview of the current environmental state on site, as well as provide relevant management and mitigation measures to address legacy issues as well as future impacts related to the Project.

## Environmental consultants

Digby Wells has been appointed as the EAP by Blyvoor Gold to undertake the Environmental-Legal Applications relevant to this Project.

| | |
|---|---|
| **Company name:** | Digby Wells and Associates (South Africa) (Pty) Ltd |
| **Contact person:** | Xanthe Taylor |
| **Physical address:** | Digby Wells House, Turnberry Office Park, 48 Grosvenor Road, Bryanston |
| **Telephone:** | +27 11 789 9495 |
| **Email:** | xanthe.taylor@digbywells.com |

## Approach and methodology for the Public Participation Process

A Public Participation Process (PPP) was initiated during the Scoping phase, which is central to the investigation of environmental and social impacts, as it is important that stakeholders who are affected by the project are given an opportunity to identify concerns and to ensure that local knowledge, needs and values are understood and taken into consideration as part of the impact assessment process.

During the Scoping Phase, the following core stakeholder engagement activities were undertaken:

- Stakeholders (including Government Departments, landowners, land occupiers, communities, Non-Governmental Organisations, agricultural organisations, Parastatals and businesses) have and will continue to be identified and captured in a stakeholder database;
- To announce the Project, information was distributed in a Background Information Document (BID) and letter to the identified I&APs, together with a newspaper

advertisement being published in the Carletonville Herald on 01 February 2018 and site notices being placed around the Project area;

- The environmental Scoping Report and associated documentation was available for public comment for a period of 30 days from 02 February to 06 March 2018;
- Consultation with I&APs was undertaken during the Scoping Phase Public Meeting held on 21 February 2018; and
- Suggestions and concerns obtained from I&APs has been recorded in this report and provided to the DMR.

## Project alternatives

Potential alternatives considered for this Project included investigating the following:

- Utilising either one of the metallurgical plants or both (separating surface and underground operations);
- Constructing new plants or reinstating the remains of plants used prior to liquidation;
- Trucking ore along haul roads versus conveyor belts; and
- The No-Go Alternative (option of the Project not going ahead).

## Conclusions and recommendations

It is the opinion of the EAP that Environmental Authorisation be granted for the Project, as the current uncontrolled environmental degradation on site and impacts to surrounding communities cannot be addressed until Blyvoor Gold recommences operations. Furthermore, the impacts assessed during this application process can be mitigated to a satisfactory level, provided the Applicant adheres to the mitigation measures and recommendations provided herein. The recommendations are contained in this report (Part A Section 17).

Overall, the impact assessment undertaken has provided quantified impacts as currently observed on site, proposed mitigation measures, and the resulting impacts are assessed as mostly negligible. The gap pertaining to the impact assessment is mostly with regards to the lack of data available to develop a conceptual model to predict groundwater flow and potential decant (once all mining activities in the area are decommissioned). A groundwater monitoring programme has been developed for Blyvoor Gold and has been included as a condition of authorisation (Part A, Section 23.2). After sufficient data has been collected, an amendment to the EMPr has been recommended to update the mitigations, monitoring programmes and rehabilitation plan to include this data.

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# LIST OF ABBREVIATIONS

| | |
|---|---|
| **AMD** | Acid mine drainage |
| **CD:NGI** | Chief Directorate: National Geo-Spatial Information |
| **CIL** | Carbon-In-Leach |
| **DMR** | Department of Mineral Resources |
| **DWA** | Department of Water Affairs |
| **DTSF No. 1** | Doornfontein No. 1 TSF |
| **DTSF No. 2** | Doornfontein No. 2 TSF |
| **DTSF No. 3** | Doornfontein No. 3 TSF |
| **EMPA** | Environmental Management: Protected Areas Act |
| **EIA/EMP** | Environmental Impact Assessment and Environmental Management Programme |
| **EIS** | Ecological Importance and Sensitivity |
| **GDARD** | Gauteng Department of Agriculture and Rural Development |
| **g/t** | Grams per tonne |
| **ha** | hectares |
| **IBA** | Important Bird Area |
| **IUCN** | International Union for Conservation of Nature |
| **IWUL** | Integrated Water Use Licence |
| **LoM** | Life of Mine |
| **m/s** | Metres per second |
| **MAE** | Mean Annual Evaporation |
| **mamsl** | Metres above mean sea level |
| **MAP** | Mean annual precipitation |
| **MAR** | Mean annual runoff |
| **MPRDA** | Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002) |
| **MRA** | Mining Right Application |
| **Mt** | Million tonnes |
| **MWP** | Mine Work Programme |
| **NEMA** | National Environmental Management Act, 1998 (Act 107 of 1998) |
| **NEM:BA** | National Environmental Management: Biodiversity Act,2004 (Act 10 of 2004) |
| **NEM:WA** | National Environmental Management: Waste Act, 2008 (Act 59 of 2008) |

| | |
|---|---|
| **NFEPA** | National freshwater ecosystem priority areas |
| **PES** | Present ecological state |
| **PM** | Particulate matter |
| **RDP** | Reconstruction and Development Programme |
| **RWD** | Return water dam |
| **RMF** | Regional maximum flood |
| **SAHRA** | South African Heritage Resources Agency |
| **SANBI** | South African National Botanical Institute |
| **SANS** | South African National Standard |
| **SLP** | Social and Labour Plan |
| **TSF** | Tailings storage facility |
| **TSF No. 1** | Blyvooruitzicht No. 1 TSF |
| **TSF No. 4 & 5** | Blyvooruitzicht No. 4 & 5 TSFs |
| **TSF No. 6** | Blyvooruitzicht No. 6 TSF |
| **TSF No. 7** | Blyvooruitzicht No. 7 TSF |
| **VAC** | Visual absorption capacity |
| **WHO** | World Health Organisation |
| **WMA** | Water Management Area |
| **WML** | Waste Management Licence |

# Part A: Scope of Assessment and Environmental Impact Assessment Report

# 1 Introduction

Exploration started at Blyvooruitzicht Gold Mining Company Limited (BGMC) in the 1930s and mining activities continued until the mine went into liquidation in 2013. Blyvoor Gold Capital Proprietary Limited (Blyvoor Gold) is returning the mine to operation and will continue with the existing underground mining accessed through No. 5 Shaft. Gold will be recovered through a metallurgical plant re-constructed on a previous plant site at No. 5 Shaft (No. 5 Shaft Treatment Plant) on the Remaining Extent of Portion 24 of the Farm Doornfontein 118 IQ. In addition, it is the intention to return the tailings retreatment facilities to an operational state. The gold contained in the various tailings retreatment facilities (TSFs) resulting from the historical operation of BGMC will be recovered through a second metallurgical plant to be re-constructed on a previous plant site immediately to the east of the Golf Course (Tailings Treatment Plant) on Portion 10 of the farm Blyvooruitzicht 116 IQ

The TSFs are located on various portions of the farms Blyvooruitzicht 116 IQ, Doornfontein 118 IQ and on Twyfelvlakte 105 IQ.

Digby Wells Environmental (hereafter Digby Wells) was appointed in 2017 by Blyvoor Gold to manage the Environmental Legal application processes pertaining to the Blyvoor Gold Mining Project (Project) and the requirement for Blyvoor Gold to make application for an environmental authorisation for the Project in terms of the Section 93 Directive handed down from the Department of Mineral Resources (DMR). This Section 93 is in terms of the Mineral Resources and Petroleum Development Act, 2002 (Act No. 28 of 2002). The Mining Right (reference number GP 30/5/1/2/2 (143) MR) relevant to the former BGMC operation was acquired by Blyvoor Gold via a Section 11 transfer and cession approved by the Minister of Mines and is attached in Appendix 1.

Digby Wells initially proposed to undertake an amendment process to update the EMP compiled by Golder Associates Africa (Pty) Ltd (Golder) submitted with the Section 11 transfer, as well as address comments made by Interested and Affected Parties (I&APs) during that process. To initiate the Project, Blyvoor Gold provided the historical EMPs related to the BGMC mining operations which are dated 2000, 2002, 2007, 2012, and 2017. A review of information provided by Blyvoor Gold determined that, *inter alia*, the application needed to follow a Scoping and Environmental Impact Assessment (EIA) process in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) and the EIA Regulations, dated 2014 (as amended in 2017). Also noted was the fact that very few specialist investigations have ever been undertaken for the BGMC operation.

Digby Wells initiated the Application process in early 2018 by submitting an Application for Environmental Authorisation to the DMR, as well as undertaking the required Scoping Phase process. The Scoping Report was approved by the DMR in a letter dated 27 March 2018, which disclosed/requested the following:

- The 2017 EMP was not approved as part of the Section 11 transfer; and

- All listed activities not previously authorised must be included in this application process.

Digby Wells met with the DMR on 23 May 2018 to discuss the implications of the dated EMP on the current application process, where it was confirmed that the current process can continue without having to redo the Scoping Phase. The validity of the baseline and impact assessment information contained in the 2000 EMP was also discussed and it was determined that specialist studies will be required to compensate for the lack of specialist investigations, meet the legal requirements to complete the EIA process, and facilitate thorough responses to the I&AP comments.

The purpose of this application is to approve the existing operations at the Blyvoor mine and to align the existing documentation pertaining to the operations to the NEMA and the EIA Regulations, dated 2014 (as amended in 2017). Furthermore, two metallurgical processing plants are required to be authorised as part of this application, as well as the reclamation of TSFs which are considered to be new activities for the mine.

## 1.1 Various Blyvoor Gold Entities and the Infrastructure Associated with Each

After liquidation, Blyvoor Gold purchased various infrastructure, but not all, associated with the Mining Right. These purchases were also made by separate entities associated with Blyvoor Gold these being divided into the underground operations and the tailings operations. Furthermore, certain infrastructure associated with the prior BGMC, and which is not owned by Blyvoor Gold, is categorised separately, known as The Orphans. Each of the three separate entities is defined in Table 1-1 below. A detailed breakdown of infrastructure, ownership and the liability thereof is provided in the Financial Provisioning contained in the Rehabilitation and Closure Report attached in Appendix 13.

**Table 1-1: Infrastructure per Entity**

| Ownership / Entity | Infrastructure |
|---|---|
| Blyvoor Gold Capital (Pty) Ltd – Underground operations | Blyvoor Gold Capital (Pty) Ltd is the owner of the Mining Right but is also the company which purchased the infrastructure associated with the underground mining operations:<br>▪ Shaft 5 Complex; and<br>▪ No. 5 Shaft Treatment Plant. |
| Blyvoor Gold Operations (Pty) Ltd – Surface Operations | ▪ Blyvooruitzicht TSFs No.1 (TSF No. 1), No. 4 & No. 5 (TSF No. 4 & 5), No.6 (TSF No. 6), No.7 (TSF No. 7);<br>▪ Doornfontein TSF No.1 (DTSF No. 1), No.2 (DTSF No. 2), No.3 (DTSF No. 3); and<br>▪ Tailings Treatment Plant. |

| Ownership / Entity | Infrastructure |
|---|---|
| The Orphans | ▪ 4 Shaft and 6 Shaft operated by Anglo Gold;<br>▪ Waste Rock Dumps (WRD) being reclaimed by third party companies; and<br>▪ All other surface infrastructure not directly associated with the underground or tailings operations of the Project. |

# 2 Item 3: Project Applicant

Blyvoor Gold Capital Proprietary Limited is the Project Applicant and holder of Mining Right for the Project, reference number GP 30/5/1/2/2/143 MR. As described in Section 1.1 above, Blyvoor Gold (Pty) Ltd is the umbrella company for two separate companies, namely Blyvoor Gold Capital (Pty) Ltd, and Blyvoor Gold Operations (Pty) Ltd. Blyvoor Gold Capital (Pty) Ltd is the owner of the underground mining operations and associated infrastructure, and Blyvoor Gold Operations (Pty) Ltd is the owner of the tailings mining operations which includes the TSFs and associated infrastructure.

**Table 2-1: Details of the Applicant**

| | |
|---|---|
| **Company name:** | Blyvoor Gold Capital (Pty) Ltd |
| **Contact person:** | Alan Smith |
| **Physical address:** | 9 5th Street, Houghton Estate, 2198 |
| **Telephone:** | 011 4862842 |
| **Cell phone:** | alan@blyvoorgold.co.za |

## 2.1 Item 3(a)(i): Details of the EAP

Digby Wells Environmental has been appointed by Blyvoor Gold to undertake the Environmental-Legal applications for the proposed Project. The details of the EAP for this Project are contained in Table 2-2

**Table 2-2: Contact details of the EAP**

| | |
|---|---|
| **Name of Practitioner:** | Xanthe Taylor |
| **Telephone:** | 011 789 9495 |
| **Fax:** | 011 069 6801 |
| **Email:** | xanthe.taylor@digbywells.com |

## 2.2 Item 3(a)(ii): Expertise of the EAP

Ms Xanthe Taylor is the appointed Environmental Assessment Practitioner (EAP) representing Digby Wells. Xanthe has been working as an Environmental Consultant since 2012 and joined the Digby Wells' Environmental Legal Services Department in 2015. The EAP's curriculum vitae and qualifications are attached in Appendix 2.

### 2.2.1 The Qualifications of the EAP

Xanthe Taylor attained her Honours Degree in Environmental Management from the University of South Africa in 2013. Recently, Xanthe attended and completed a SETA-accredited Project Management course for the duration of 2017.

### 2.2.2 Summary of the EAP's Past Experience

Xanthe Taylor has been employed as an Environmental Consultant since 2012, consulting almost exclusively to the mining industry and has experience with various commodities including gold, coal, and platinum. She has worked with South African and international environmental legislation, and has experience in multiple processes including Basic Assessments, Scoping/EIAs, EMPs, Water Use Licencing, amendment applications, exemption applications, appeals processes, public participation, environmental awareness training, environmental auditing, and project management.

# 3 Item 3(b): Description of the Property

Table 3-1 contains the description of the farm portions relevant to this application.

**Table 3-1: Property Details**

| | |
|---|---|
| **Farm Name:** | Tailings Treatment Plant: Portion 10 of the Farm Blyvooruitzicht 116 IQ;<br>No. 5 Shaft and No. 5 Shaft Treatment Plant: Remaining extent of Portion 24 of the Farm Doornfontein 118 IQ<br>DTSF No.1 Portion 26 of the Farm Varkenslaagte 119 IQ<br>DTSF No.2 Portion 27 of the Farm Varkenslaagte 119 IQ<br>DTSF No.3 Portion 28 of the Farm Varkenslaagte 119 IQ:<br>TSF No.1: Portion 26 and Remaining Extent of Portion 15 of the Farm Blyvooruitzicht 116 IQ<br>TSF No. 4 & 5: Remaining Extent of Portions 2 of the Farm Blyvooruitzicht 116 IQ<br>TSF 6: Remaining extent of Portion 1 of the Farm Blyvooruitzicht 116 IQ<br>TSF No. 7: Remaining Extent of Portion 70 and Portion 66 of the Farm Blyvooruitzicht 116 IQ |
| **Application Area (Ha):** | Approximately 32 ha for both treatment plants being:<br>• 3.5 ha for No. 5 Shaft Treatment Plant; and<br>• 28 ha for the Tailings Treatment Plant |

| | |
|---|---|
| | Approximately 70 ha for the reclamation and deposition of TSF No. 4 & 5<br>Approximately ha for the deposition of TSF 6<br>Approximately 80 ha for the reclamation of TSF No. 7 |
| **Magisterial District:** | West Rand District Municipality |
| **Distance and direction from nearest town:** | The project area is approximately 6km from Carletonville |
| **21-digit Surveyor General Code for each farm portion:** | Tailings Treatment Plant: T0IQ00000000011600010<br>No. 5 Shaft and No. 5 Shaft Treatment Plant: T0IQ00000000011800024<br>DTSF 1: T0IQ00000000011900026<br>DTSF 2: T0IQ00000000011900027<br>DTSF 3: T0IQ00000000011900028<br>TSF No. 1: T0IQ00000000011600026 and T0IQ00000000011600015<br>TSF No. 4 & 5: T0IQ00000000011600002<br>TSF No. 6: T0IQ00000000011600001<br>TSF 7: T0IQ00000000011600070 and T0IQ00000000011600066 |

# 4 Item 3(c) of Appendix 3: Locality Map

The locality map is shown in Figure 5-1 below and attached as Plan 1 in Appendix 3.

# 5 Item 3(d) of Appendix 3: Description of the Scope of the Proposed Overall Activity

A plan of the proposed application area in relation to the approved mining areas is shown in Figure 5-3 in Section 5.2.5 below, as well as attached as Plan 2 in Appendix 3. The land tenure map, showing all farm portions associated with the Mining Right GP 30/5/1/2/2 (143) MR is attached as Plan 3 in Appendix 3.


**Figure 5-1: Locality of the Project**

## 5.1 Item 3(d)(i): Listed and Specified Activities

This section provides the list of activities which require Environmental Authorisation for the recommencement of mining. However, the DMR requested Digby Wells to also include activities and infrastructure that were approved in the EMP, dated 2000. Several EMPs were submitted to the DMR thereafter but none were approved (refer to Table 5-1). The purpose of this section is to provide an understanding of what has been approved (Section 5.1.1) and what still requires Environmental Authorisation (Section 5.1.2)

**Table 5-1: EMPs Associated with the Mining Operation**

| Year | Status | Author | EMP Title |
|---|---|---|---|
| 2000 | Approved | Pulles Howard & De Lange | Environmental Management Programme Blyvooruitzicht Gold Mining Company |
| 2007 | Not approved | Fraser Alexander Tailings Technical Division | Environmental Management Programme for the Activities of Blyvooruitzicht Gold Mining Company Ltd in Accordance with Section 39 of the Mineral and Petroleum Resources Development Act, 2002, (Act No. 28 of 2002) |
| 2012 | Not approved | Eco Partners | Environmental Impact Assessment and Environmental Management Programme Submitted in Support of Mining Right Conversion Application |
| 2017 | Not approved | Golder Associates | EMP Update for Tailings Reclamation & Underground Mining at Blyvooruitzicht Gold Mine |

### 5.1.1 Infrastructure and Activities Approved in 2000 EMP

Underground mining commenced at the mine in the 1930s and therefore the approval of the overall operation would have taken place prior to the 2000 EMP being compiled. This section provides the list of infrastructure and associated activities which were authorised as part of the approval of the 2000 EMP:

- Shaft complexes providing offices, accommodation, changing facilities, workshops, timber yard, stores yard, and ancillary equipment to allow access to the underground workings;
- Metallurgical plant including crushing, milling and processing of gold-bearing rock;
- Slimes dams and rock dumps for residue product disposal;
- Residential areas which provide employee accommodation within close proximity to the mining operations;
- Employee recreational facilities;
- Surface workshops for repairs and maintenance of mining equipment;

- Main office complex which provides office space for management and administrative employees;
- Linear infrastructure which includes roads, railways and power lines;
- Slimes dams for residue deposition including TSF No.1, TSF No. 4 & 5, TSF No. 6 and TSF No. 7;
- Waste Rock Dumps at Annan Shaft and at Shafts 1, 2, 4 and 6;
- Water pollution management facilities including the No. 5 Shaft sewerage plant, the No.2 sewerage plant and No.1 sewerage plant (out of commission at the time of the 2000 EMP being written), unlined paddocks surrounding the TSFs, lined return water dam (RWD) south of the Tailings Treatment Plant and unlined RWD at TSF No. 6;
- 8 Ml of potable water obtained from Rand Water daily;
- Pumping water from underground operations; and
- Process water supply including 2 773m$^2$/day for irrigation, 5 167m$^2$/day for the metallurgical plant, 9 060m$^3$/day of discharge water into the Wonderfonteinspruit.

### 5.1.2 Listed and Specified Activities Applied For

Table 5-2 shows the Listed Activities, as identified in the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) Environmental Impact Assessment (EIA) Regulations, 2014 (as amended) applicable to the Project as well as the associated aerial extent of the activity. Table 5-2 shows the project activities required for the Construction, Operational and Decommissioning Phases.

**Table 5-2: Listed and Specified Activities for this Application**

| Name of Activity | Aerial extent of the activity | Listed Activity | Applicable Listing Notice |
|---|---|---|---|
| Vegetation clearance | Limited to refurbishment areas – no new areas to be cleared | Not Listed | Not Applicable |
| Storage of cyanide and other dangerous goods | Approximately 170 m$^3$ | Activity 14 | GNR 983 |
| Reclamation activity (TSF No. 4 & 5, TSF No. 6 and TSF No. 7) | Approximately 150 ha | - Activity 17<br>- Activity 4 (11) Category B | - GNR 984<br>- GN R 921: Waste Activities |
| Pipelines will be reconstructed for the transportation of tailings and process | Approximately 20 km | Activity 10 | GN R 983 |

| Name of Activity | Aerial extent of the activity | Listed Activity | Applicable Listing Notice |
|---|---|---|---|
| water from the TSFs to the metallurgical plants | | | |
| Booster pump stations and surface water management of clean and dirty water will be implemented throughout the operations as required by GN 704 | Approximately 5 ha | Activity 12 (ii) | GN R 983 |
| Refurbishing mining-related infrastructure | Approximately 510 ha | Activity 34 | GN R 983 |
| Treatment plants being an activity requiring a permit or licence (Air Emissions Licence) | Approximately 32 ha (being 28.5 ha for the Tailings Treatment Plant and 3.5 ha for the No. 5 Shaft Treatment Plant) | Activity 6 | GNR 984 |

**Table 5-3: Project Activities per Phase for New Activities**

| Project Phase | Project Activity |
|---|---|
| Construction Phase | ▪ Site clearing where vegetation has since re-established in the refurbishment areas, if any;<br>▪ Reconstruction of metallurgical plants and other mining infrastructure;<br>▪ Temporary storage of hazardous products, including fuel, and<br>▪ Storage of waste and sewage. |
| Operational Phase | ▪ Operation of the underground mine, conveyors, processing plants, haulage, etc.;<br>▪ TSF reclamation (TSF No. 4 & 5, TSF No. 6 and TSF No. 7);<br>▪ Deposition onto TSF No 4 & 5 and TSF No. 6 (thereafter onto the available footprint of the reclaimed TSF No. 7);<br>▪ Operational activities: Underground mining, reclaiming of tailings, operation of treatment plants and conveyors;<br>▪ Mine water management; and<br>▪ TSF care and maintenance activities for the duration of this current application (TSF No. 1, DTSF 1, DTSF No. 2 and DTSF No. 3 will be held in care and maintenance for the 15-year Life of Project). |
| Decommissioning Phase | ▪ Demolition and removal of all infrastructure, including transporting materials off site;<br>▪ Storage, handling and treatment of hazardous products (including fuel, explosives and oil) and waste; and<br>▪ Rehabilitation, including spreading of soil, re-vegetation and profiling or contouring, and post-closure monitoring. |

## 5.2 Item 3(d)(ii): Description of the Activities to be Undertaken

This section provides a synopsis of the scope of the proposed activities.

### 5.2.1 Authorisations Applied For and Approved Areas

Blyvoor Gold applied to include the reclamation of six TSFs as part of the Section 11 Transfer. Since the Transfer, Blyvoor Gold has negotiated the purchase of TSF No. 4 & 5, which have been partially reclaimed and will be used for future deposition sites. As noted in the EMPr compiled by Golder in 2017 for the purpose of the Section 11 Transfer, an application for an AEL to operate two gold recovery plants is required. An AEL requires Environmental

Authorisation in terms of the NEMA and the Listed Activities contained in the NEMA EIA Regulations, 2014 (as amended).

Further to this, the proposed reclamation of TSFs and most of the infrastructure associated therewith has not expressly been documented or sufficiently been detailed in the EMP dated 2000. As a result, it is not possible to determine whether this infrastructure is approved, although these activities, the TSFs, the treatment plants and related infrastructure were most likely undertaken prior to the EMP of 2000 being written, which could explain the lack of detail in this regard in the EMP of 2000. This application has identified the Listed Activities in terms of the NEMA EIA Regulation, 2014 (as amended) applicable to the reclamation of the TSFs, the treatment plants, associated infrastructure as well as the pipelines and other ancillary infrastructure under Blyvoor Gold's current ownership, to ensure future compliance.

### 5.2.2 Proposed Mining Schedule

The estimated Life of Mine (LOM) for the Blyvoor Gold underground operation exceeds 30 years and tailings reclamation will be staggered within the 30-year LOM. However; current mine planning has been detailed for 15 years and therefore Blyvoor Gold is only applying for Environmental Authorisation for the first 15 years of operation, although production levels for both underground and tailings operations are anticipated to continue for a period of 30 years. The schedule includes commencing with underground mining and deposition onto TSF No. 6, and the reclamation of TSF No 4 & 5 and TSF No. 7.

### 5.2.3 Underground Mining, Crushing and Milling of Ore

Blyvoor Gold Mine has an estimated underground mineral resource of approximately 169 million tonnes (Mt) containing 26.4 million ounces (Moz) of gold, at an average grade of 4.85 grams per tonne (g/t). The underground project requires \$62 to \$65 million to re-commission the hoists, shaft facilities, ventilation fans, compressors, offices, and to reinstate services at No.5 Shaft. Initial production is targeted at 30 000 tonnes per month (tpm), with a growth plan to 40 000 tpm. The recovered grade from underground ore is expected to be over 6.1 g/t. This shaft has an installed capacity of some 100 000 tpm and consistently achieved recovered grades exceeding 5.2 g/t during its 30-year history.

The mine has an existing layout of underground developed tunnels and stopes, which will be accessed via No. 5 Shaft. The non-utilisation of the installed infrastructure during the period since liquidation of BGMC has resulted in some degradation of the shaft infrastructure together with some vandalism of the assets situated on surface. Once access to underground has been secured, including all safety and licensing approvals, a comprehensive clean-up and vamping operation will be implemented to recover easily accessible gold, together with re-establishing the readily accessible existing production stopes in high grade areas close to the No. 5 Shaft Complex infrastructure. Ore will be excavated in the stope areas underground and will be separated into waste rock and gold ore (unprocessed). The waste rock will be transported to surface separately and deposited on the existing WRD at No. 5 Shaft, while the ore will be transported to the surface for crushing and screening followed by metallurgical treatment in the No. 5 Shaft Treatment Plant situated on the existing treatment plant footprint at No. 5 Shaft. Refer to Figure 5-2.

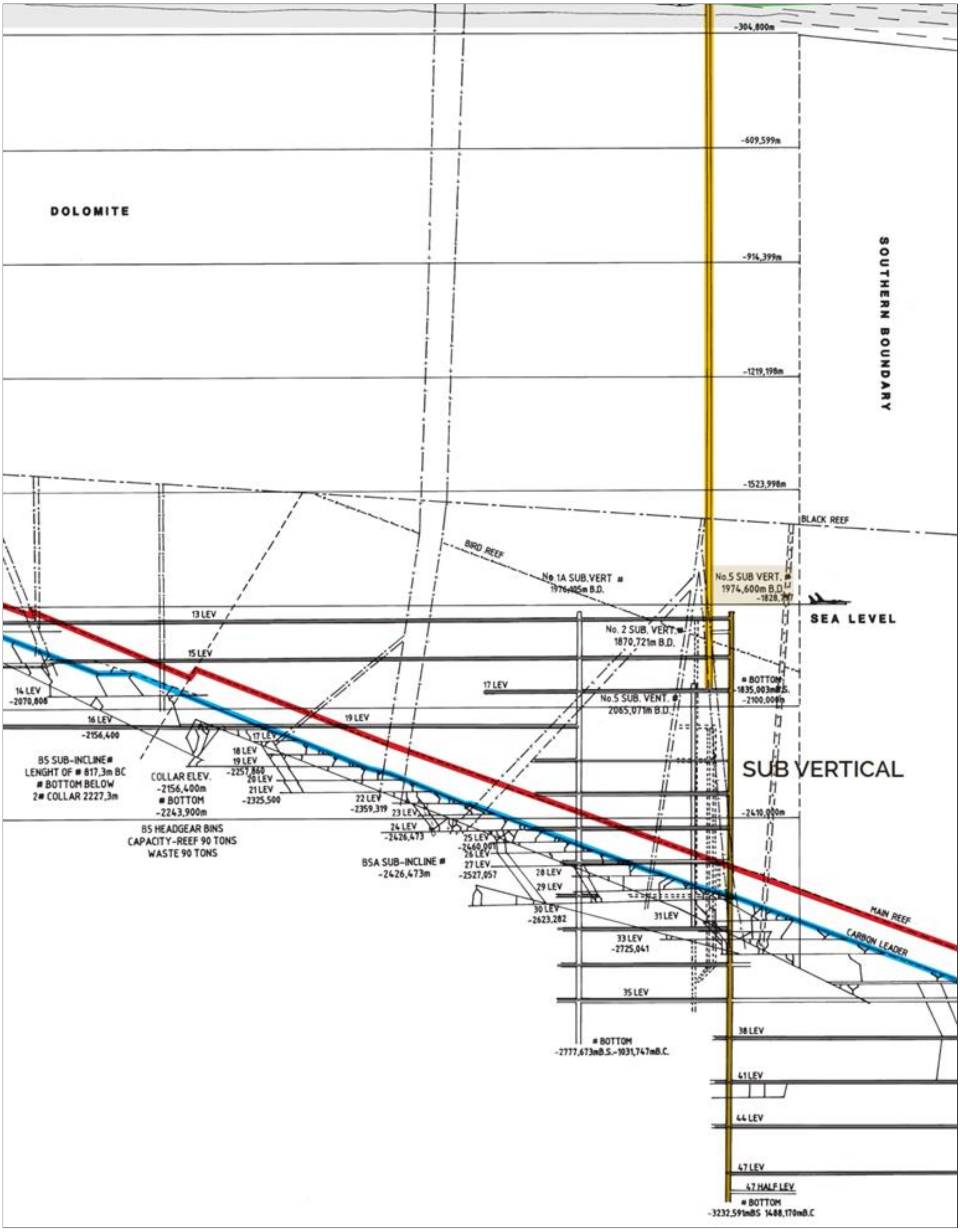


**Figure 5-2: Schematic of No.5 Shaft and No.5 Sub-vertical Shaft Showing Production Levels and Reefs (Blyvoor Gold)**

Underground mining will commence in the shallow reaches of the deposit above 29-Level and will allow approximately nine years of mining before dewatering of the areas below 30 level are required. From approximately year 10 the deeper deposit, below the water level will be mined for the remainder of the life of mine, along with the balance of the resource above 29 level.

No. 5 Shaft and the No.5 Sub-vertical Shaft provide access to the mineral resources on the Carbon Leader Reef and on the Middelvlei Reef. The production levels that have been developed above 30-Level (the current water level) are accessible and provide access to some 18 Moz of resources. The remaining 9 Moz are below the water level and a dewatering program is planned to be initiated in year nine of the underground plan. Dewatering will allow the refurbishment of the infrastructure below 29-Level, to provide access to the remaining five levels of the No.5 Sub-vertical Shaft.

The ore will be hoisted up the existing No. 5 Shaft system, discharged into an existing ore bin in the shaft headgear, and loaded onto the existing conveyor belt (Conveyor 1) and delivered to the existing ore coarse ore storage silo (Silo 1). From Silo 1 the ore will be fed by apron feeder into a jaw crusher via a static grizzly, where after it will be fed onto sizing screens with the oversized material being routed into the secondary cone crushers, before being loaded onto a second conveyor (Conveyor 2). Conveyor 2 delivers the crushed and screened ore to the second bank of two silos (Silo 2), allowing for further storage capacity between the mine and the treatment plant.

The ore is then fed into one of two mills, followed by a gravity circuit to remove free gold, after thickening the material is delivered to a carbon in pulp (CIP) circuit. Thereafter the gravity product is fed into a gravity elution circuit, and the CIP product is fed into a separate elution circuit to strip the gold off the carbon and to recover the carbon for reuse. Finally, the gold bearing concentrates will be smelted on site to produce dore bars for delivery and refining at Rand Refinery. The treatment plant will have a maximum capacity of some 40 000 tpm of underground ore. The aforementioned infrastructure is further explained in Table 5-4.

**Table 5-4: Existing Underground-Related Infrastructure Processes**

| | |
|---|---|
| Conveyor 1 | Minor electrical cabling has been stolen from this conveyor but it is otherwise intact. Conveyor 1 is designed to convey ore at approximately 175 tph from the No.5 Shaft ore bin to the jaw crusher above Silo 1. The No.5 Shaft installed production capacity was of the order of 100,000 tpm. The plan is to recommission Conveyor 1 at a maximum capacity of 50,000 tpm. This means that Conveyor 1 will be operating at around 75 tph, less than half of the original designed capacity. The conveyor will discharge directly into the jaw crusher above Silo 1. |

| | |
|---|---|
| Silo 1 | Silo 1 will be used to accommodate the primary crushed ore and will provide some 68 hours/5,000 tonnes of storage capacity between the mine and the processing plant. This silo is made of steel, on top of a substantial concrete foundation containing feeders that were designed to feed the ore onto a conveyor directly into the treatment plant. The treatment plant was dismantled and the feeders were subsequently used to feed ore onto a conveyor belt and into tipper trucks for transport by road to the alternate treatment plant located approximately 8 km to the east. Silo 1 will be rehabilitated and brought back up to specification as part of the proposed Project. |
| Jaw Crusher | A jaw crusher will be installed on top of Silo 1 as a primary crusher for the plant and the crushed product will be dropped directly into Silo 1. |
| Cone Crusher and Screens | From Silo 1, the ore will be fed onto sizing screens to direct oversized material into the secondary crushing circuit. The oversize material will be crushed using cone crushers. The product from the cone crusher will once again be screened with the oversize back to the cone crushers in a closed circuit. The correctly sized material from the screens will be directed to Conveyor 2. The screens and the cone crusher will be situated on ground level directly under and around Silo 1. Screening and crushing activities are positioned some distance from both the remaining plant operations and the No.5 Shaft operations due to dust generation in these processes. |
| Conveyor 2 | Conveyor 2 conveys the sized ore to one of two silos (Silo 2). This silo was sold by the liquidator and removed by the purchaser, and therefore it has been decided to replace same with two silos. |
| Silo 2 | These two silos are planned to be steel constructions and used as further storage capacity between the mine and the treatment plant. These silos will have a storage capacity of 70 hours. A lime silo will be erected next to Silo 2 to allow discharge of lime onto the mill feed belt for pH control. |
| Mill | The mill foundations exist. Two new mills will be mounted on these foundations, fed by the mill feed conveyors, which originate at the base of Silo 2. The mills will include the mill tube, the mill trunnions, mill gear boxes, and two large electric mill motors. These mill motors use substantial electrical current so the motors will be accompanied by appropriate electrical reticulation and will include all the required safety protections. It is planned that each mill will have a design throughput of around 20,000 tpm, allowing for a treatment plant throughput of 40,000 tpm for the two mills. The mills will receive crushed ore of -10 mm, and will mill the ore to 75% passing a 75 micron screen size to allow for optimum liberation of the gold. The milling operation is anticipated to be a standard operation, much as it was before the plant was dismantled. |
| Cyanide Storage | Cyanide storage will be on site and will be operated in accordance with strict cyanide control requirements. Cyanide consumption will be an absolute maximum of 45 tons per month and we will have a maximum of two truckloads (2 x 30 tonnes) in dry cyanide stock at any time or alternatively 2 x 30 tonnes tanks of liquid cyanide. (refer to Section 5.2.3.1). |

#### 5.2.3.1 *Cyanide*

Cyanide consumption will be an absolute maximum of 45 tonnes per month and will have a maximum of two truck-loads (2 x 30 tonnes) in dry cyanide stock at any time or alternatively two 30-tonne tanks of liquid cyanide. The cyanide storage and liquid delivery area will be as per the DMR Mine Health and Safety Inspectorate *Guideline for the Compilation of Mandatory Code of Practice for Cyanide Management* (document reference number DMR 16/3/2/4/-A4). The cyanide storage yard will be next to the cyanide make-up area and will be bunded and any rain or wash water flow will be directed to the cyanide bund spillage pump, which directs spillage to the leach tank or the detox tank in absolute emergencies. The cyanide make-up bund has a capacity of 125% of the total make-up and storage tank capacity. In addition, the cyanide bund will be directly uphill from the leach tank bund thereby providing extra safety in case of an overflow in excess of the make-up tank capacity (water valve left on, tanks drain completely, and spillage pump does not function). This will contain cyanide spillage which will again be pumped to the leach tank before proceeding to tailings through detox. The complete cyanide storage, makeup and truck offloading area will be fenced and kept locked at all times.

#### 5.2.3.2 *Hydrochloric Acid*

Hydrochloric consumption will be a maximum of 5 tpm and we will have a maximum stock of 10 tonnes. Hydrochloric acid will be stored in an acid resistant bund, at a sufficient distance from the cyanide bund area, with the caustic and lime make-up areas in between. The hydrochloric acid bund will have at least twice the capacity of the maximum stockholding and the spillage pump will have the option of pumping to an emergency tanker or to the tailings pumps post detox.

#### 5.2.3.3 *Caustic Soda*

Caustic soda consumption will be a maximum of 10 tpm and we will have a maximum stock of 20 tonnes stored in an alkali resistant bund under cover. The caustic soda make-up bund will have a capacity of at least twice that of the caustic soda make-up tank.

### 5.2.4 Proposed Underground Ore Metallurgical Plant at No. 5 Shaft

Details pertaining to the reconstruction of the No. 5 Shaft Treatment Plant are tabulated below.

**Table 5-5: Underground Ore Metallurgical Plant**

| Infrastructure | Reconstruction |
|---|---|
| Gravity Circuit | From the mills, all milled ore will discharge into a gravity separator with a capacity of 400 tph located immediately at the base of the mill discharges. The gravity separator is a new addition to the treatment circuit but it has a small footprint and operates as an in-line addition to the standard treatment circuit. The gravity separator will remove all the fine gravity gold from the milled product, which is anticipated to be around 40% of the contained gold. From here, the gravity gold product will be routed directly to a gravity gold elution plant, whilst the balance of the material from the gravity separator will be routed to the CIP tanks. The gravity plant is an automatic continuous plant and will treat 100% of the milled ore. |
| CIP Tanks | The CIP tanks will receive the remaining milled ore discharged from the gravity circuit. The first three CIP tanks are anticipated to be 10 m in diameter, and the next five CIP tanks to be smaller in size; around 8 m in diameter. The civil foundations for these tanks exist and will be re-used. No new civil works are anticipated for the tank foundations, although some minor modifications to accommodate the new tanks may be required and the operation thereof is anticipated to be standard in its design, construction and operation. |
| Elution Circuit | There will be two elution circuits, quite separate; one for the gravity concentrate and one to treat the CIP concentrate and to recover the carbon. The elution circuits are of standard design, and will use the existing civil foundations with some minor modifications. |
| Induction Smelter | The smelting will be done using an induction smelter. The civil works and concrete foundations exist and will be used to accommodate the induction smelter. The electrical requirements to power the induction smelter are relatively low, of the order of 250 KVA. |

#### 5.2.4.1 *Tailings from the Underground Ore Treatment*

The tailings from the treatment of the underground ore will initially be deposited onto TSF No.6, which has sufficient capacity to store up to 15 years of underground production tailings. Once the Tailings Retreatment Plant has been commissioned, the tailings from the underground ore treatment will be fed directly into this treatment circuit to avoid double handling costs.

### 5.2.5 Tailings Retreatment Operation

Several TSFs were included in the cession of the Mining Right to Blyvoor Gold which include TSF No. 1, TSF No. 6, TSF No. 7, DTSF No. 1, DTSF No. 2 and DTSF No. 3. TSF No.4 & 5 have recently been purchased and will be utilised for future deposition. Refer to Figure 5-3 for the layout of the TSFs.

The retreated tailings will initially be deposited on TSF No. 6 and or onto TSF No. 4 & 5, followed by the reuse of the TSF No. 7 after its retreatment. TSF No.7 is intended to be reclaimed first and the remainder of the TSFs will remain in care and maintenance until they are reclaimed. The planned method of reclamation is hydraulic mining and processing at the Tailings Treatment Plant. Once reclaimed, the slurry will be gravity fed to the plant for processing.

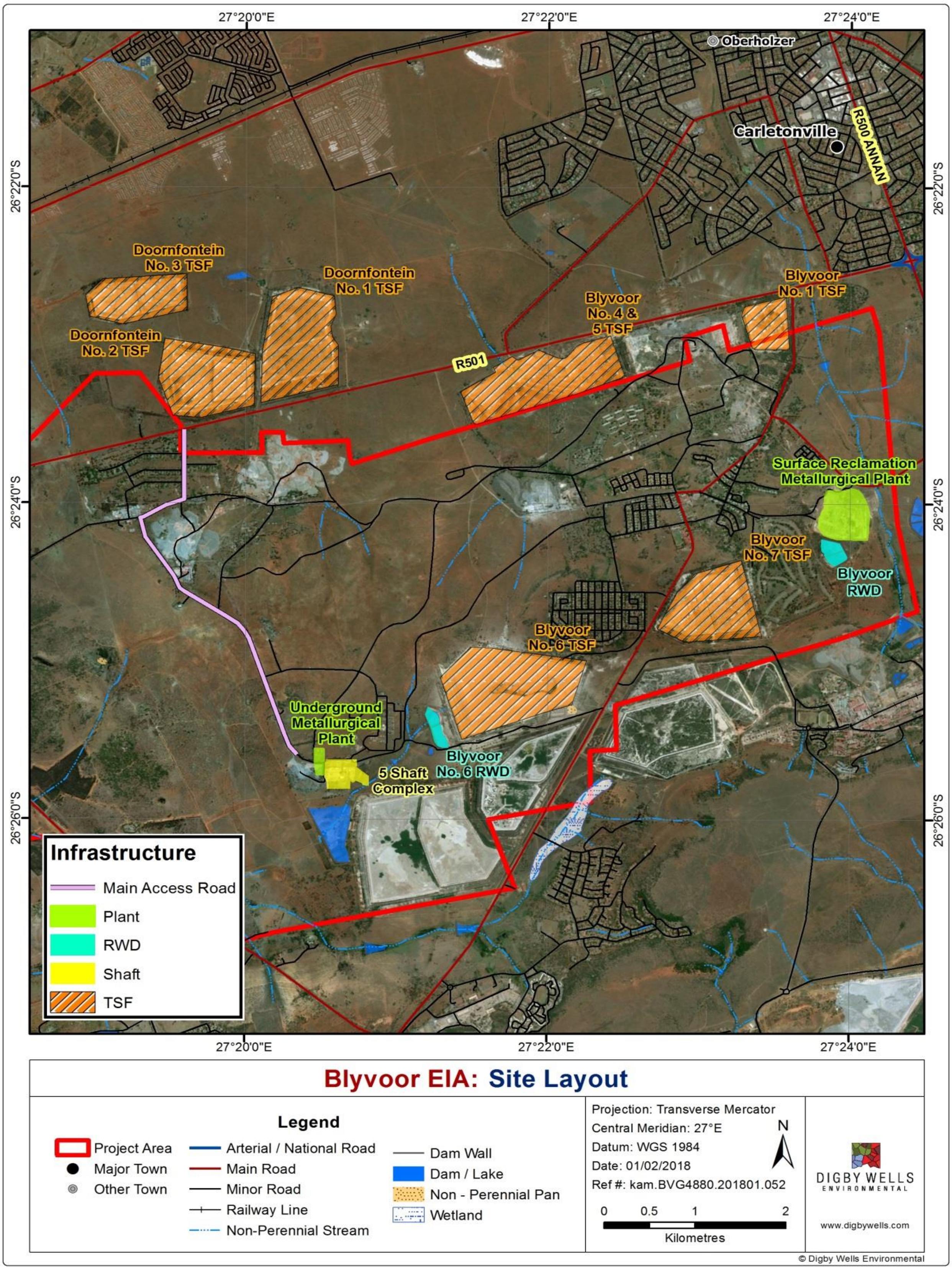


**Figure 5-3: Site Layout and TSF Configuration**

#### 5.2.5.1 *Tailings Treatment Plant*

The Tailings Treatment Plant is located to the east of the former Blyvooruitzicht Golf Club. This plant will require major reconstruction to be operational again. The water pipeline servitude which runs from the plant to both TSF No. 7 and TSF No. 6 will need to be reconstructed due to being vandalised, as shown in Figure 5-4 and Figure 5-5.

**Figure 5-4: Current State of Surface Metallurgical Plant**

**Figure 5-5: Current State of Surface Metallurgical Plant**

The previously existing gold plant will be returned to operation and will be used to process the reclaimed tailings. The reclaimed tailings do not require a milling process. The plant process for the retreatment of tailings consists of thickening and leaching of slurry, gold absorption by a pump cell, carbon treatment, gold recovery (elution/smelting) and finally, residue disposal. The tailings after retreatment at the plant will be disposed on TSF No. 6 initially and thereafter onto the area vacated by the reclamation of either TSF No. 4 & 5 or TSF No.7. The water recovered from the tailings' deposition will be returned to the treatment plant in an HDPE lined open channel for re-use. The return water will pass through a sediment trap with the clear water discharged to the TSF No. 7 RWD. Water will be fed under gravity from TSF No. 7 RWD to the plant. In total, Blyvoor Gold Operations purchased eight TSFs that can be retreated, which are divided into five TSFs known as the Blyvooruitzicht TSFs, and three TSFs known as the Doornfontein TSFs. These TSFs are shown in the Layout Plan attached in Plan 2 and discussed in detail below.

#### 5.2.5.2 *Blyvooruitzicht TSFs*

Five TSFs are associated with the Blyvooruitzicht operation namely; TSF No.1, TSF No.4 & 5, TSF No. 6, and No. 7 are detailed in Table 5-6. Due to the historic nature of the TSFs, these TSFs are not lined. As mentioned, deposition will take place on TSF No. 6 and potentially on

TSF No.4 & 5 footprints, TSF No. 7 will be reclaimed and deposited on TSF No. 6. The remainder of the TSFs associated with the Mining Right will be under care and maintenance until these resources are reclaimed. Reclamation of these remaining TSFs will only commence after the current Project and will remain in care and maintenance for the current 15-year Project.

**Table 5-6: Blyvooruitzicht TSFs**

| TSF | Description | Footprint | Height | Volume | Tonnes |
|---|---|---|---|---|---|
| Blyvooruitzicht No.1 (TSF No. 1) (Care and Maintenance) | TSF No. 1 was operated as an emergency dam and because of its relatively small top surface area. Deposition could only take place for a few hours per day. This TSF is a paddock dam. | 29 ha | 20 m | 4,633,829 | 6,797,827 |
| Blyvooruitzicht 4 5 (TSF No. 4 & No. 5) (Active) | Mostly reclaimed but unlined | 69 ha | N/A | N/A | 435, 500 |
| Blyvooruitzicht No.6 (TSF No. 6) (Active) | TSF No. 6 was used for tailings placement during the reclamation of Blyvooruitzicht TSFs No.4 and 5 and underground operations. This ended in August 2013 when BGMC liquidated. Tailings were placed in a cyclone upstream deposition method. Prior to the reclaiming of TSFs No. 4 & 5 TSF No. 6 was divided into two daywall operated compartments. The cyclone placed material from TSFs No. 4 & 5 covered the total surface area of TSF No. 6, combining it into a single storage facility. The total capacity of the existing RWD is 143,000 $m^3$, this excludes the volume which has been allowed for the regulatory freeboard of 800 mm. | 132 ha | 26 m | 2,9019,056 | 44,399,156 |

| TSF | Description | Footprint | Height | Volume | Tonnes |
|---|---|---|---|---|---|
| Blyvooruitzicht No.7 (TSF No. 7) (Active) | TSF No. 7 is a paddock dam. The dam is the highest TSF and, as indicated in the EMP, dated 2012, the TSF started showing signs of depression on the western flank of the upper compartment. | 75 ha | 48 m | 26,741,680 | 40,460,161 |

### 5.2.5.3 *The Doornfontein TSFs*

The three Doornfontein TSFs formed part of the sale to Blyvoor Gold and all three of these TSFs will remain in Care and Maintenance for the current Project. Details of these TSFs are provided in Table 5-7 below. Due to the historic nature of the TSFs, these dumps are not lined.

**Table 5-7: Doornfontein TSFs**

| TSF | Description | Footprint | Height | Volume | Tonnes |
|---|---|---|---|---|---|
| Doornfontein No. 1 TSF (DTSF No. 1) | This TSF was mothballed when it attained its maximum designed height. The dam is characterised by steep side slopes with no step-ins. The dam was rehabilitated by the construction of cross walls and perimeter walls on the top surface.<br>Catchment paddocks have been constructed around the toe of the dam to prevent the migration of eroded material. The dam is situated on gently sloping ground and is not near to any watercourses. The area is fenced. The dam is situated on dolomite; as indicated in the EMP, dated 2012, no sign of instability had been noted. | 54 ha | 36 m | 15,546,000 | 22,479,516 |
| Doornfontein No. 2 TSF (DTSF No. 2) | The TSF is characterised by fairly steep side slopes (1:2) with no step-ins. The dam is situated on gently sloping ground. Catchment paddocks have been constructed around the toe of the dam to contain eroded material. Rehabilitation | 37 ha | 12 m | 6,641,000 | 9,496,630 |

| TSF | Description | Footprint | Height | Volume | Tonnes |
|---|---|---|---|---|---|
| | of the dam was implemented by the construction of cross walls and perimeter walls on the top surface. The area is fenced. The dam is situated on dolomite; as indicated in the EMP, dated 2012, no sign of instability has been noted. | | | | |
| Doornfontein No. 3 TSF (DTSF No. 3) | This TSF is situated on gently sloping ground and consists of a tow paddock construction. Tailings were delivered *via* an in-wall piping system into a day wall operation. Surface water was decanted off the top surfaces of the paddocks *via* a penstock decant system. The penstock decant pipes conveyed the water by gravity to two RWDs approximately 500 m from the tailings dam. Catchment paddocks have been constructed around the toe of the tailings dam to contain eroded material. The area is fenced and there are no structures or services nearby. | 73 ha | 32 m | 11,487,000 | 17,127,117 |

## 5.2.6 Support Infrastructure

All support infrastructure necessary for the operation was approved in the 2000 EMP and includes power supply, roads, water resources and management, as well as waste management on site. This is discussed in more detail below.

### 5.2.6.1 *Power supply*

Electricity supply to the surface and underground infrastructure will be a 132 kV Eskom supply to the existing Doornfontein main substation, which will be refurbished. Electricity for the Tailings Treatment Plant will be obtained from an existing 22 kV supply located at the existing Eskom pump substation.

### 5.2.6.2 *Roads*

All road infrastructure required for operation is in place and approved.

#### 5.2.6.3 *Water use and resources*

Blyvoor Gold has a Water Use Licence No 08/C23E/AEFGJ/1000 and water for hydraulic reclamation will be sourced from underground. Potable water will be supplied by the Merafong Municipality.

#### 5.2.6.4 *Stormwater Management*

The polluted runoff from the plant areas used to be collected in trenches and directed to a sump and pumped back into the plant. Perimeter berms preventing clean stormwater runoff from entering the site were also in place. Optimisation of the clean and dirty water separation system at the plant areas will take place during the refurbishing of the plants.

The stormwater management measures that will be required for the re-mining of TSF No. 7 and TSF No. 6 are a berm and channel system around the perimeter of the tailings dams to prevent clean water from entering the re-mining area and polluted runoff from leaving the re-mining area. The stormwater runoff from the re-mining area (for TSF No. 7) will be captured in a pollution control dam and re-used in the re-mining process or managed in the control dam if not possible to use in re-mining. The stormwater management system will be sized to comply with Regulation 704 of the National Water Act, 1998 (Act No. 36 of 1998) (NWA). The clean stormwater runoff diversion system constructed around the perimeter of the tailings dams will be sized to convey the flood peak generated from a 50-year 24-hour storm on the clean catchments.

The RWD at TSF No. 6 has the capacity to store the runoff from a 50-year, 24-hour storm event. The RWD capacity must be confirmed and the sediment removed from the RWD if required. Similarly, the perimeter berm will be sized to prevent the flood peak from a 50-year, 24-hour storm falling on the re-mining area from entering the clean water system. The polluted runoff will be directed to the pollution control dam. The pollution control dam will be sized so as to spill on average once in 50 years as per Regulation 704. Consideration must also be given to integrating the clean water runoff system with the current diversion channel system preventing runoff from reporting to the Wonderfonteinspruit to reduce the risk of sinkhole formation.

#### 5.2.6.5 *Waste Management*

The polluted runoff from the plant areas used to be collected in trenches and directed to a sump and pumped back into the plant. Perimeter berms preventing clean stormwater runoff from entering the site were also in place. Optimisation of the clean and dirty water separation system at the plant areas will take place during the refurbishing of the plants.

The stormwater management measures that will be required for the re-mining of TSF No. 7 and TSF No. 6 are a berm and channel system around the perimeter of the tailings dams to prevent clean water from entering the re-mining area and polluted runoff from leaving the re-mining area. The stormwater runoff from the re-mining area (for TSF No. 7) will be captured in a pollution control dam and re-used in the re-mining process or managed in the control dam if not possible to use in re-mining. The stormwater management system will be sized to comply

with Regulation 704 of the National Water Act, 1998 (Act No. 36 of 1998) (NWA). The clean stormwater runoff diversion system constructed around the perimeter of the tailings dams will be sized to convey the flood peak generated from a 50-year 24-hour storm on the clean catchments.

The RWD at TSF No. 6 has the capacity to store the runoff from a 50-year, 24-hour storm event. The RWD capacity must be confirmed and the sediment removed from the RWD if required. Similarly, the perimeter berm will be sized to prevent the flood peak from a 50-year, 24-hour storm falling on the re-mining area from entering the clean water system. The polluted runoff will be directed to the pollution control dam. The pollution control dam will be sized so as to spill on average once in 50 years as per Regulation 704. Consideration must also be given to integrating the clean water runoff system with the current diversion channel system preventing runoff from reporting to the Wonderfonteinspruit to reduce the risk of sinkhole formation.

### 5.2.7 Employment

The updated Social and Labour Plan (SLP) dated 31 July 2017 submitted to the DMR as part of the Section 93 Directive, proposes targets of employment from surrounding areas and further afield. The SLP proposed that a target of 70% of the workforce on the mine be from Merafong Local Municipality, and the remaining 30% be employed from within the Gauteng Province. The projected employment requirements for the first five years of operation are estimated between 729 and 732 employees as defined in the SLP for this period. After the first five years, employment of approximately 842 workers is projected.

# 6 Item 3(e): Policy and legislative Context

**Table 6-1: Policy and Legislation Considered for Application**

| Applicable legislation and guidelines used to compile the report | Reference where applied |
|---|---|
| <u>Constitution of the Republic of South Africa Act, 1996 (Act No. 108 of 1996)</u><br>Under Section 24 of the Constitution of the Republic of South Africa, 1996 (the Constitution) it is clearly stated that:<br>*Everyone has the right to (a) an environment that is not harmful to their health or well-being; and*<br>*(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that -*<br>*(i) Prevent pollution and ecological degradation;*<br>*(ii) Promote conservation; and*<br>*(iii) Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development* | Current and previous mitigation measures aim to ensure the mining impacts are managed to acceptable levels to support the rights enshrined in the Constitution. |

| **Applicable legislation and guidelines used to compile the report** | **Reference where applied** |
|---|---|
| <u>National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA)</u><br>The Environmental Management Act, 1998 (Act No 107 of 1998) (NEMA), as amended was set in place in accordance with Section 24 of the Constitution. Certain environmental principles under NEMA have to be adhered to, to inform decision making for issues affecting the environment.<br>Section 24 (1)(a) and (b) of NEMA state that:<br>*The potential impact on the environment and socio-economic conditions of activities that require authorisation or permission by law and which may significantly affect the environment, must be considered, investigated and assessed prior to their implementation and reported to the organ of state charged by law with authorizing, permitting, or otherwise allowing the implementation of an activity.*<br>The Minister published the EIA Government Notice Regulations (GN R on 4 December 2014, comprising of the EIA Regulations GN R 982, and three Listing Notices GN R 983 (Listing Notice 1), GN R 984 (Listing Notice 2) and GN R 985 (Listing Notice 3) in terms of Sections 24(2) and 24D of the NEMA, as amended.<br>The EIA Regulations were amended in April 2017. The amended Regulations are:<br>▪ EIA Regulations GN R 982 (as amended by GN R 326);<br>▪ GN R 983 Listing Notice 1(as amended by GN R 327);<br>▪ GN R 984 Listing Notice 2 (as amended by GN R 325)<br>▪ GN R 985 Listing Notice 3 (as amended by GN R 324) | The Listed Activities, as contained in the NEMA Regulations Listing Notices, identified the necessity to undertake a Scoping and EIA investigation.<br>The appendices of GN R 982 (as amended) stipulate the contents of a report for which the DMR prescribed templates. Appendix 3 of GN R 982 (as amended) prescribes the scope of assessment and content of EIA reports. Appendix 4 prescribes the content of the EMP report. The DMR provided a template which combines the EIA and EMP into a single document. The EIA is contained in Part A of this report and the EMP is contained in Part B. |

| Applicable legislation and guidelines used to compile the report | Reference where applied |
|---|---|
| National Environmental Management: Air Quality Act, 2004 (Act 39 of 2004)<br>The prevailing legislation in the Republic of South Africa with regards to the Air Quality field is the National Environment Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEM: AQA). According to the Act, the DEA, the provincial environmental departments and local authorities (district and local municipalities) are separately and jointly responsible for the implementation and enforcement of various aspects of NEM: AQA. | An Air Emissions Licence is required for the operation of the plants. |
| National Water Act, 1998 (Act No. 36 of 1998)<br>The NWA provides for the sustainable and equitable use and protection of water resources. It is founded on the principle that the National Government has overall responsibility for and authority over water resource management, including the equitable allocation and beneficial use of water in the public interest, and that a person can only be entitled to use water if the use is permissible under the NWA. | Blyvoor has an approved Water Use Licence which has been transferred into Blyvoor's name (**Appendix 1**). |
| National Environmental Management: Waste Act, 2008 (Act 59 of 2008)<br>On 29 November 2013, the list of waste management activities published under GN R718 of 3 July 2009 (GN R718) was repealed and replaced with a new list of waste management activities under GN R921 of 29 November 2013. Included in the new list are activities listed under Category A, B and C which require authorisation if triggered. | Reclamation activities require a licence in terms of the NEM:WA |

| Applicable legislation and guidelines used to compile the report | Reference where applied |
|---|---|
| National Heritage Resources Act, 1999 (Act No. 25 of 1999)<br>The National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) is the overarching legislation that protects and regulates the management of heritage resources in South Africa. The Act requires that Heritage Resources Agency's in this case the South African Heritage Resources Agency (SAHRA) and Provincial Heritage Resources Authority of Gauteng (PHRA-G), be notified as early as possible of any developments that may exceed certain minimum thresholds. This act is enforced through the National Heritage Regulations GN R 548 (2000) | Since the mine was established in 1937, some of the mine buildings will be older than 60 years and as such are considered as heritage sites in terms of the National Heritage Resources Act (No. 25 of 1999). Blyvoor does not intend to demolish any of the unused buildings. |
| National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)<br>The NEM:BA regulates the management and conservation of the biodiversity of South Africa within the framework provided under NEMA. This Act also regulates the protection of species and ecosystems that require national protection and also takes into account the management of alien and invasive species | Considered in previous approved applications and the metallurgical plants requiring an AEL will be reconstructed on previously-disturbed operational areas. |
| National Nuclear Regulatory Act, 1999 (Act No. 46 of 1999)<br>Provides radiation protection for practices associated with a nuclear installation, which may include a mine or ore processing facility. | Considered in previous approved applications. |

| Applicable legislation and guidelines used to compile the report | Reference where applied |
|---|---|
| Mineral and Petroleum Resource Development Act. 2002 (Act No. 28 of 2002)<br>The MPRDA sets out the requirements relating to the development of the nation's mineral and petroleum resources. It also aims to ensure the promotion of economic and social development through exploration and mining related activities. The MPRDA requires that mining companies assess the socio-economic impacts of their activities from start to closure and beyond. Companies must develop and implement a comprehensive Social and Labour Plan (SLP) to promote socio-economic development in their host communities and to prevent or lessen negative social impacts. | Blyvoor Gold holds a Mining Right and is bound by the conditions of the approved EMPs related to the mining operation. |
| Mine Health and Safety Act, 1996 (Act No. 29 of 1996) | Cyanide management on site must be in adherence to this legislation and the associated guidelines. |
| International Cyanide Management Code for the Manufacture, Transport and Use of Cyanide in the Production of Gold, commonly referred to as the Cyanide Code | Blyvoor Gold will be handling cyanide on site and the company must therefore adhere to this code. |
| West Rand District Municipality Integrated Development Plan 2016/2017 to 2020/2021 as revised in 2017/2018 | To be included for the EIA Phase |

# 7 Item 3(f): Need and Desirability of the Proposed Activities

The recommissioning of the tailings and underground operations will contribute greatly to the Blyvooruitzicht mining town. This town used to be managed by the mining operation but since liquidation in 2013, Blyvooruitzicht has been devoid of municipal services such as waste collection, steady potable water supply, electricity supply and sewage services. Reinstating the mining operation will facilitate the re-employment of many former employees currently residing in Blyvooruitzicht. Blyvoor Gold's SLP has also committed funding to Local Economic Development (LED) plans.

The proposed activities will result in the Project being able to:

- Recover gold and operate a profitable business, which in turn will result in economic benefits to the local community, local municipality and district municipality;
- Unlock land for further development by property owners; and

- Removal of sources of wind-blown dust and water pollution and consolidating the material into fewer controlled areas.

In addition, through the implementation of Blyvoor Gold's SLP, Blyvoor Gold will provide skills development courses and awareness training. Community development initiatives for the local community, in conjunction with the local municipality, will also be commenced.

# 8 Item 3(g) & (h): Motivation for the Preferred Development Footprint within the Approved Site including a Full Description of the Process followed to reach the Proposed Development Footprint within the Approved Site

The preferred development footprint is to utilise the existing mining and treatment plant footprints and to refurbish infrastructure that has been damaged or demolished. No alternatives, apart from the No-Go alternative, have been assessed due the nature of the Project. The site plan is appended hereto as Plan 2 of Appendix 3.

## 8.1 Item 3(h)(i): Details of the Development Footprint Alternatives Considered

The following sections contain the alternatives to be assessed. As this application pertains to an existing infrastructure, few of the alternatives to be assessed are applicable to this process.

### 8.1.1 Proposed Location of Activities

The Listed and project activities are to be located within the existing infrastructure footprints established by previous mine operators.

### 8.1.2 Type of Activity to be Undertaken

The underground and tailings mining operations were established prior to the liquidation of BGMC and will continue to operate in the same fashion. No alternatives have been considered as a result.

### 8.1.3 The Design or Layout of the Activity

Due to the operation having two sites for metallurgical plants; one derelict plant and the other with the foundations having been preserved, Blyvoor Gold considered the costs associated with reinstating both plants at separate locations versus the capital and operational cost of only reconstructing one plant to process both the underground and tailings materials. The scenarios considered included reinstating only the Tailings Treatment Plant, reinstating only the No. 5 Shaft Treatment Plant, or to reinstate both plants and process underground ore at the No. 5 Shaft Treatment Plant and retreat the tailings at the Tailings Treatment Plant. The preferred alternative is to reinstate both metallurgical plants as each plant has the necessary infrastructure in place to accommodate the separate processes. For instance, the No. 5 Shaft

Treatment Plant has the conveyor to transport ore to the existing silo (Silo 1) and the crushers that are to be installed alongside the proposed plant. The Tailings Treatment Plant has the pipeline servitudes in place to transport slurry for processing. To combine the two treatment plants at one location would result in the additional construction of associated infrastructure (pipelines, conveyors, additional servitudes, etc…) which is deemed unnecessary due to all of this infrastructure already being in place. Furthermore, surface operations are owned by Blyvoor Gold Operations (Pty) Ltd and the underground operations are owned by Blyvoor Gold Capital (Pty) Ltd and thus it makes good sense to have two metallurgical plants operating; one plant to manage TSF reclamation, and the other dedicated to managing underground ore processing.

### 8.1.4 Technology to be Used

Technology alternatives considered were limited to the method of reclamation of the TSFs, which considers hydraulic reclamation (wet process) versus mechanical truck-and-shovel reclamation (dry process). All other existing mining-related technology on site will be utilised as a result of the refurbishment of the mining operation. Due to the state of the operation, it is cost effective and less time-consuming to refurbish what is currently on site than to introduce new infrastructure. This will allow for operations to commence in a shorter timeframe as the operation was abandoned “over night” and sufficient infrastructure remains for operations to recommence based on refurbishing what remains.

#### 8.1.4.1 *Reclamation Technology Alternatives*

The preferred method to reclaim the TSFs is through hydraulic monitoring. This technology entails spraying the working face of the TSF with water and generating slurry from the tailings which is then pumped to a processing plant. Alternatives in terms of the method and technology used to reclaim TSFs are limited based on the type of material being reclaimed and the size of the TSF. Given that the TSF consist of quartzite and slimes (as opposed to sand dumps), these TSFs will more easily convert into slurry. As a result, the truck and shovel mining method of reclaiming tailings is not viable. The truck and shovel method will also generate increased noise for a longer period of time and is likely to generate more dust during the reclamation process due to the movement of vehicles on the dumps. Mechanical reclamation is therefore expected to have greater impacts to the surrounding environment and sensitive receptors as opposed to the hydraulic reclamation; the use of water to reclaim the TSFs will act as a natural dust suppressor during reclamation.

### 8.1.5 Operational Aspects of the Activity

Due to the mine being previously operational, the alternatives for operations are mostly limited given that the infrastructure which is already in place which can be utilised. During the prefeasibility stage, Blyvoor Gold also considered refurbishing the conveyor at No. 5 Shaft versus trucking ore to be processed. Trucking the ore such a short distance would create congestion within the No. 5 Shaft complex and refurbishing the conveyor would prove more economical in the long-term.

### 8.1.6 The No-Go Alternative (Not Proceeding with the Project)

The No-Go option would result in continued unemployment and poor living conditions for the community of Blyvooruitzicht. If the status quo is maintained, the underground operations will continue to pollute groundwater, the available gold resources would be wasted, Blyvoor Gold would not have an income from mining to maintain security at the mine therefore allowing the mine to be vandalised once more, and if the mine is not secure this could lead to safety risks for people entering into the property and accessing the underground workings. The positive socio-economic benefit of the Project being approved to allow the mine to become operational once again is within the best interest of the public and the environment, as the mine will become economically viable throughout the LOM, and once mining ceases the area will be rehabilitated.

## 8.2 Item 3(h)(ii): Details of the Public Participation Process followed

This section details the Public Participation undertaken during the Scoping Phase, as well as the proposed Public Participation Process to be undertaken for the EIA Phase. Refer to Appendix 4 for proof of documentation sent to I&APs.

### 8.2.1 Scoping Phase Public Participation

During the Scoping Phase, the following core stakeholder engagement activities were undertaken:

- Stakeholders (including Government Departments, landowners, land occupiers, communities, Non-Governmental Organisations, agricultural organisations, Parastatals and businesses) have and will continue to be identified and captured in a stakeholder database;
- A Background Information Document (BID) and letter was distributed to the identified Interested and Affected Parties (I&APs) together with the placement of adverts and site notices around the Project area to announce the Project;
- The environmental Scoping Report and associated documentation was made available for public comment for a period of 30 days from 02 February to 06 March 2018;
- Consultation with I&APs was undertaken throughout the Scoping Phase and a Public Meeting was held on 21 February 2018; and
- Suggestions and concerns were obtained from I&APs.

Table 8-1 provides more detail regarding the Stakeholder Engagement activities undertaken thus far, together with referencing materials included as Appendix 4.

**Table 8-1:Public Participation Scoping Phase Activities**

| Activity | Details |
|---|---|
| Identification of stakeholders | A stakeholder database was developed which includes I&APs from various sectors of society, including directly affected and adjacent landowners, in and around the proposed Project area. |
| Distribution of announcement letter and Background Information Document (BID) | A BID, announcement letter with Registration and Comment Form was emailed and posted to stakeholders on **26 January 2018**. |
| Placing of newspaper advertisement | An English advert was published in the Carletonville Herald on **01 February 2018**. |
| Putting up of site notices | English site notices were put up at and around the proposed Project site, on **01 February 2018** at seven different locations. |
| Announcement of Scoping Report | Announcement of availability of the Draft Scoping Report was emailed to stakeholders together with the formal Project announcement on **26 January 2018**. Copies of the Scoping Report were available at:<br>▪ The Carletonville Public Library;<br>▪ Blyvooruitzicht Time Office, and<br>▪ The Fochville Public Library.<br>An SMS was also sent to stakeholders on **29 January 2018** announcing availability of the Scoping Report.<br>The Scoping Report was also available on www.digbywells.com (Public Documents) and was made available at the Public Meeting.<br>***(30-day comment period for the Scoping Report:02 February to 06 March 2018)*** |
| Stakeholder Meeting | A Public Meeting for the Scoping Phase was held at the NG Kerk Blyvooruitzicht on **21 February 2017** from 10:00 to 13:00. |
| Obtained comments from stakeholders | Comments, issues of concern and suggestions received from stakeholders to date have been captured in the Comments and Responses Report. |

## 8.2.2 EIA Phase Public Participation

Table 8-2 provides more detail about the public consultation activities to be undertaken during the Impact Assessment phase, together with referencing materials appended.

**Table 8-2: Public Participation Impact Assessment Phase Activities**

| Activity | Details |
|---|---|
| Announcement of Scoping Report | A notification and SMS was sent on **29 November 2018** to all registered I&APs to announce the availability of the Draft EIA/EMP Report for public comment.<br>Copies of the Draft EIA Report will be available at:<br>▪ The Carletonville Public Library; and<br>▪ Khutsong South Library.<br>▪ www.digbywells.com (Public Documents) and will be made available at the Public Meeting.<br>**30-day comment period for the Draft EIA/EMP Report from 30 November 2018 to 22 January 2019.** |
| Stakeholder Meeting | A Public Meeting for the EIA Phase will be held at the NG Kerk Blyvooruitzicht on **12 December 2018** from 10:00 to 13:00. |
| Obtained comments from stakeholders | Comments, issues of concern and suggestions received from stakeholders will be captured in the Comments and Responses Report. |

## 8.3 Item 3(h)(iii): Summary of Issues Raised by I&APs

All comments raised by I&APs during the Scoping Phase public review are included in Table 8-3. This table will be updated after the public comment period for the EIA Phase is complete.

### Table 8-3: Comments and Responses Received During the Scoping Phase

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| Mariette Liefferink | Written Response | 28/09/2016 | In order to address residual and latent liabilities, the FSE recommends that BG adopts the precautionary approach to determine the proven impacts of their current operations.<br>We respectfully request that our comments be included unabridged in the Comments and Response Report. | Included. |
| | | | The FSE, in principle, supports the project and transferral of the above-mentioned mining right subject to the following recommendations:<br>The reclamation operations should involve the removal of the entire residue deposits of TSFs that are reclaimable and the required rehabilitation of the remaining footprints, unless the footprint/s are employed for the re-establishment of future deposition. The FSE recommends the consolidation of tailings in a regional TSF. | This recommendation is noted and matches the objectives of Blyvoor Gold in respect of the residue deposits. |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| | | | The location and operation of the expansion/re-establishment of a deposition site will need to comply with legislation, in terms of environmental and land-use planning and public consultation and involvement. | At the public meeting on 21 February 2018, it was indicated that TSF No. 6 can accommodate deposition of underground material for approximately eight to ten years. This has recently been adjusted to show TSF No. 6 can accommodate 15 years of deposition from underground. As indicated, no new deposition facilities are being applied for in this Application process for any new facilities (which are not anticipated at this juncture) will be addressed by Blyvoor Gold in future if and when required.<br>Plant tailings will be deposited on the existing No. 6 TSF. A technical report detailing the conversion of the TSF was completed by JS Davel in 2015. The study details the modifications required to operate a daywall dam to deposit 26 ktpm for a period of 10 years (3.1 Mt) on top of TSF No. 6. The average rate of rise for the operation is expected to range from 1.1 m to 1.5 m per year. This is the optimal rate of rise that will ensure sufficient drying and consolidation time is allowed for the deposited tailings to meet with structural strength requirements. |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| | | | | However, Blyvoor Gold is planning to treat underground ore at a steady rate of 40 ktpm (after four years ramp up phase). The capacity of TSF No. 6 should be sufficient and is deemed a low risk. The available area on TSF No. 6 is estimated to have a capacity of between 16 Mt and 20 Mt of tailings deposition. This will be sufficient for the planned tonnes of approximately 6.5 Mt (Minxcon 43-101 Independent Technical Report June2018).<br><br>The footprints of TSF No. 4 & 5 are available for deposition of the tailings from the retreatment operation when this commences.<br><br>Once the retreatment of tailings commences, it is the intention that the tailings from the underground ore treatment plant will be routed directly to the retreatment plant for further processing. |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| | | | A portion of the value of the gold which is extracted should be ploughed back into rehabilitation of the mining area. It must be accepted that the reprocessing of certain areas of a TSF will not be economically viable and that these will need to be transported to the deposition site, if this is not too costly or rehabilitated in situ. | Blyvoor Gold is required by law to provide closure costs (refer to Part B Section 6) the Closure and Rehabilitation Report attached in Appendix 13) which include the TSFs.. |
| | | | Radiometric surveys over previously reprocessed mine residue deposit footprints have, in some cases, shown elevated levels of residual radioactivity in the soils. In these cases, it must be accepted that some areas will never be suitable for unrestricted development and that these areas will need to be demarcated as such, and appropriate land-uses proposed and implemented. | The final end land use is currently set at grazing for certain areas and others will remain wilderness. All rehabilitation efforts adopted should rehabilitate the site to a grazing and wilderness land capability and NNR clearance. |
| | | | A sustainable solution be investigated, in collaboration with the Department of Mineral Resources, to address the impacts and risks of the un-rehabilitated footprints of the previously processed Blyvoor TSFs No 4 and 5, albeit that these TSFs are not in ownership of BG. | Blyvoor Gold has purchased these assets and these form part of the application. |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| | | | An assessment of the associated contribution to ingress into the underground basin as old tailings are hydraulically mined using high-pressure cannons containing partially treated acid mine drainage water (Winde et al. 2011) since this practice introduces air and water into anaerobic tailings, which may contribute to acid mine drainage formation and the remobilization of contaminants such as uranium and cyanides during disturbance of old tailings deposits (Sutton & Weiersbye 2007). In order to address residual and latent liabilities, the FSE recommends that BG adopts the precautionary approach to determine the proven impacts of their current operations which could include: The near certainty of contaminated water, which will require some form of decontamination treatment, decanting from the closed underground mines, or from lower-lying interconnected neighbouring mines. The near certainty of sulphate, chloride, metal and naturally occurring or technologically enhanced radioactive material | Certain boreholes identified for sampling during the hydrocencus were found to be inaccessible or dry. This EIA has recommended boreholes be drilled in strategic locations to enable long-term monitoring of the contamination associated with the TSFs. This monitoring data will be utilised to generate a conceptual groundwater model which will then be utilised for more accurate mitigation and rehabilitation plans. |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| | | | (NORM/TENORM) contamination of soils and sediments by seepage from unlined tailings storage facilities, tailings spillages and plant discharges, and the potential for contamination of downstream /downwind soils and sediments. The near certainty of sulphate, chloride, metal and NORM/TENORM contamination of surface water bodies and their sediments, and ground water, by seepage from unlined tailings storage facilities, tailings spillages, plant discharges and underground works. In addition, the potential contamination of surface soils overlying shallow polluted groundwater via evaporative pathways during dry seasons. The potential for sulphate, chloride, metal and NORM/TENORM contamination of crop soils irrigated with contaminated surface water of contaminated groundwater. The concomitant loss of genetic / biodiversity, and potentially ecosystem goods and services on disturbed, fragmented or polluted properties. The potential for bioaccumulation of some metals and | |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| | | | NORMs/TENORMs by flora and fauna. The potential for exposure of fauna and humans to bioaccumulated pollutants. | |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| | | | The potential for acute and latent toxicity impacts of bioaccumulated pollutants on humans and the potential for radioactivity impacts from NORMs/TENORMs on humans. The potential for health impacts as a result of exposure to windblown dust from TSFs. The potential for structural damage to buildings and other structures and human injury by mining exacerbated seismicity. The potential for structural damage to buildings and other structures, and human injury, by mining-exacerbated sink-hole formation. | Digby Wells and Blyvoor Gold are aware of the impacts from windblown dust and Blyvoor Gold can only commence dust suppression once mine water is accessible, i.e., when the mine is operational.<br><br>There is little recorded history of seismicity related damage to buildings and other surface infrastructure over the 80 years of mining at BGMC.<br>The Golder EMP (2017) notes the potential impact for sinkhole formation or earth movement and this was rated as moderate with mitigation. The following mitigations were recommended by Golder (2016):<br>“The mine will implement these measures as standard operating practice:<br>▪ Responsible underground blast management<br>▪ Routine monitoring of seismic events<br>▪ Water management (runoff, ponding, pipe leaks) pertaining to the Project |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| | | | | ▪ Investigation of ground movement events and sinkhole development as a result of mining activities<br>▪ Submit Investigation Reports to Far West Rand Dolomite Water Association, and implement any agreed remedial actions.” |
| | | | With reference to the rehabilitation objectives the FSE requests that the "Guidelines for the Rehabilitation of Mined Land" (Chamber of Mines/Coaltech, November 2007) be implemented. The guidelines apply to all forms of mining, both surface and underground, and all mineral extraction industries (page 4 of the Guidelines). The Guidelines include inter alia aspects of rehabilitation such as soil replacement, soil amelioration, dealing with metal toxicities, acidity and radioactivity, revegetation and biodiversity re-establishment, infrastructure removal and landform re-creation. | The Rehabilitation Report is attached in Appendix 13 and adheres to the Guidelines. |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| | | | It is essential that the closure of Blyvoor Gold's operations incorporates a process which must start at the commencement of the operation and continued throughout the life of the operations. Furthermore, that the land is rehabilitated, as far as is practicable, to its natural state, or to a predetermined and agreed standard or land use which conforms with the concept of sustainable development. This implies that, before a decision is taken on which measures to implement for remediation and closure, the objectives that need to be achieved with the implementation of such measures must be established and agreed upon. Since they are they are the ultimate recipients of potential, ongoing and historical pollution and the potential future land users, interested and affected parties must be involved in the agreements regarding future land use of affected areas and thus in the decisions regarding the establishment of objectives for such future land use, as well as in discussing the alternatives for engineering interventions, where decisions | The final end land use recommended for rehabilitation is grazing and wilderness in certain areas. The Rehabilitation Report is attached in Appendix 13. |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| | | | regarding such options will affect the future land use. | |
| | | | It is therefore impossible to determine if measures taken to remediate environmental impacts with the aim of achieving mine closure are in fact "reasonable measures" unless the future land use has been determined, and objectives for remediation have been agreed upon. (Reference: MPRD Regulation 56 & 62). In determining "reasonable measures" the Best Practicable Environmental Option (BPEO) must be followed. The NEMA defines "best practicable environmental option" to mean the option that provides the most benefit or causes the least damage to the environment as a while, at a cost | Digby Wells adheres to legislative requirements and Best Practice when developing Rehabilitation Plans and Reports. |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| | | | acceptable to society in the long term as well as in the short term. | |
| | | | The end point of rehabilitation of Blyvoor Gold, in view of the aforesaid, must therefore be a sustainable sequential land use with associated use of other resources connect with such sequential land use, for example water and soil. If Blyvoor Gold fails to ensure sustainable post closure land use, current and future generations may well have their livelihood opportunities and their quality of life reduced. Post closure land use, with its implications for socio-economic and environmental sustainability, is possibly the most important component of planning in rural communities. | The final end land use is currently set at grazing for certain areas and others will remain wilderness. All rehabilitation efforts adopted should rehabilitate the site to a grazing and wilderness land capability.<br>The Rehabilitation Report is attached in Appendix 13. |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| Mariette Liefferink | Written Response | 26/07/2017 | The FSE is a federation of community based civil society organisations committed to the realisation of the constitutional right to an environment that is not harmful to health or well-being, and to having the environment sustainably managed and protected for future generations. Their mission is specifically focussed on addressing the adverse impacts of mining and industrial activities on the lives and livelihoods of vulnerable and disadvantaged communities who live and work near South Africa's mines and industries. | Noted. |
| | | | The FSE appointed Dr Phil Tanner and Mr Ken Lyell to conduct a peer review of the updated EMP for Blyvoor Gold. On the 3rd of October, 2016 Dr Tanner, on behalf of the FSE, submitted his Report to the FSE. On the 4th of October, 2016 the said Report was submitted by the FSE to Ms Antoinette Pietersen of Golder Associates, as part of the public participation process. | Digby Wells has received the comments made by Phil Tanner which have been considered by the Specialists in the compilation of their reports. |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| | | | We have perused the Comments and Response Report, the Draft Minutes of the Public Meetings and the Blyvoor Gold EMP Update but do not find any reference to the issues raised by Dr Tanner in the above-mentioned Report or responses to these issues except on page 6 of the Draft Minutes of Public Meetings, Blyvooruitzicht, namely: “The Federation for a Sustainable Environment (FSE) has appointed independent consultants to compile a plan to control dust on TSF6 and other sites in the area. These measures have been captured at a high level in the EMP.” The said comment was the EAP’s response to a question from Mr Paulo de Gouveia. | Noted. This formed part of the application process undertaken by Golder. The final comments and responses report will be provided after the public comment period for this EIA is completed. |
| | | | If we have overlooked the inclusion of these issues in the EMP and the responses to these issues by the Applicant or by the EAP, we apologise and respectfully request the Applicant or the EAP to advise us of the page numbers of the EMP where the issues were listed and addressed. | In reference to submission to Golder. Digby Wells has responded to FSE comments received to date and will respond to any further comments raised during the public comment period. |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| | | | We have no doubt, however, that a copy of Dr Tanner's Report was not included in the Comments and Response Report or in the Updated EMP. | Noted. These comments are contained in Appendix 4 |
| | | | The following gaps in information and issues of concern were identified and raised by Dr Phil Tanner: | The six points that follow are Phil Tanner's comments and are responded to individually. |
| | | | 1. Methods to control the impacts:<br>a. The control methods listed to minimize the impacts are not defined in any detail.<br>b. No reference is made to the detailed design criteria required to ensure that the proposed control measures are fully effective. | This is in reference to mitigations proposed in the Golder EMP (2017). Digby Wells has assessed the current conditions on site and proposed mitigation measures and management plans to effectively address the identified legacy impacts identified in this EIA. |
| | | | 2. Windblown dust off TSF surfaces:<br>a. Control methods to be clarified – all or a selected few.<br>b. The underflow separation from the cyclones may not provide sufficient material to remediate the side-slopes or to prevent dust generation from these slopes.<br>c. Additional assurance (in the form of detailed computation of quantities) that this process will provide adequate dust control. | Specialist investigations have been undertaken by Digby Wells and mitigation measures applied.The specialist impact assessments undertaken include:<br>▪ Groundwater (including geochemical analysis);<br>▪ Surface Water;<br>▪ Wetlands and Aquatics; |

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| | | | d. No commitment, if re-mining of TSF No 6 becomes uneconomical, that TSF No 6 will finally be closed sustainably in the event of premature cessation of this activity | ▪ Air Quality;<br>▪ Radiology;<br>▪ Community Health;<br>▪ Addendum Social Report |
| | | | 3. Water balance: Greater detail of the proposed methods of controlling groundwater, surface water and dust emission impacts, water balance and related sizing of water supply dams and pollution control dams. | The draft water balance is provided in Section 4.7 |
| | | | 4. Closure:<br>a. Detailed closure costing methodology used for estimation of the closure cost quantum.<br>b. Sustainable closure and the care and maintenance of TSF No 6 in the event that the new TSF is not approved or commissioned.<br>c. No guidance provided regarding the control measures that will have to be implemented to produce a final TSF configuration that will be sustainable post-closure. | TSFs which are not reclaimed will remain in care and maintenance. This application applies to a 15-year LOM and Closure objectives will need to be examined closer to the 15-year LOM nears completion. Current mine planning is limited to the first 15 years of operation and therefore Blyvoor Gold will need to consider this in planning thereafter. Any TSFs that are not reclaimed or partially reclaimed at the end of the LOM will be rehabilitated upon mine closure. |

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| | | | d. No instruction on what will happen in the event that some TSFs are not fully re-mined. | Refer to the Closure and Rehabilitation Report in Appendix 13. |
| | | | 5. Premature closure:<br>a. No details pertaining to "premature closure" costing exercise.<br>b. The EMP lacks indications of actions to be taken in event of early cessation (unplanned closure) during the first three to five years of operation. | Closure costs were calculated according to the 30 LOM in accordance with the DMR guidelines for Financial Provisioning.<br>Refer to the Closure and Rehabilitation Report in Appendix 13 |
| | | | 6. Monitoring:<br>a. Independent reporting/auditing of these is recommended at two yearly intervals.<br>b. Regular and detailed field monitoring of the degree to which the control methods have been installed and are functioning.<br>c. Monitoring to be done by independent persons competent to provide an opinion on control measure functionality.<br>d. The frequency of reporting on control effectiveness should be increased, particularly during the establishment phase of the operation. | Refer to Section 7 in Part B of this report for the monitoring plan for the various environmental aspects as well as the recommended persons responsible to undertake such monitoring and frequency thereof. |

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| | | | In view of the aforesaid, we request a rectification of the alleged oversight on the part of the Applicant and his EAP. | These comments were considered in the compilation of this report. |
| | | | If this oversight is not corrected, the FSE has, regrettably, no other option but to appeal the Environmental Authorisation (EA), pending its issuing, by the Department of Mineral Resources and/or the authorization by the Department of Water and Sanitation of the Integrated Water Use License Application (IWULA) on the grounds of a flawed public participation process. | Noted. |
| | | | In order to prevent the FSE appealing the Environmental Authorisations, we hereby request the Applicant and/or its appointed EAP to: | Individual responses are provided to each point raised by FSE. |
| | | | 1. Inform the Department of Mineral Resources and other competent authorities of this oversight on the part of Blyvoor Gold; | The DMR is aware of this oversight. Digby Wells is responsible for addressing the comments made by Dr Tanner. |
| | | | 2. Include a copy of Dr Tanner's Report in the Updated EMP; | Refer to Appendix 4. |

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| | | | 3. Include Dr Tanner's comments and the responses from the Applicant or its EAP in the Comments and Response Report; | Dr Tanner's comments were provided to the specialists undertaking the specialist investigations to consider his input. His comments have been captured herein and responses provided. |
| | | | 4. Re-issue and re-submit the Updated EMP with the above-mentioned comments and responses to Interested and Affected Parties, the Department of Mineral Resources and other competent authorities. | Digby Wells corresponded with Mrs Liefferink on 08 February 2018 to confirm the current application process as well as to confirm that Dr Tanner's comments do form part of the scope for Digby Wells. |
| | | | We request a response to this letter with reasonable promptitude, that is, on or before Friday, the 30th of June, 2017. | Digby Wells was not appointed at the time and cannot comment on the action taken on this request. Digby Wells has subsequently consulted with Mariette Liefferink on numerous occasions regarding the project, as captured herein. |
| Phil Tanner | Written response | Oct-16 | The document entitled "EMP update for tailings reclamation and underground mining at Blyvooruitzicht gold mine", dated September 2016, provides, inter alia, an outline of the control methods to be used to minimise environmental impacts that already exist on this site, and that could be | Noted. |

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| | | | exacerbated by the process of remining TSF No 7, with redisposition on TSF No 6. | |
| | | | There is no doubt that the methods outlined have the potential for successful reduction of impacts on the environment resulting from this activity. The control methods listed, however, are not defined in any detail, nor is reference made to the detailed design criteria required to ensure that the proposed control measures are fully effective. Indeed, reference is made in the document to the fact that "BG is investigating a variety of methods" for control of windblown dust of TSF surfaces. In addition, it is not clear if all control methods referred to will be used, or simply a selected few of the proposed methods will be employed | Dust monitoring has commenced at seven locations around the mine .Blyvoor Gold supplied the dust monitoring data to Digby Wells which was considered in the impact assessment in Part A, Section 10.4.<br>In addition, once the mine is operational, available water will be utilised for dust suppression on the TSFs, particularly on TSF 6. |
| | | | The need to develop a detailed water balance is also referred to. This document will be crucial for sizing of pollution control | A draft water balance is included in Part B, Section 4.7. The RWD capacity at TSF No. 6 has been confirmed by Tailex to be |

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| | | | dams, and for water supply dams, for the remining process. | acceptable to manage a 50 year 24 hour rainfall and is estimated at 143,000 $m^3$. |
| | | | The document would benefit significantly, then, from the inclusion of greater detail of the proposed methods of controlling groundwater, surface water and dust emission impacts, and from the inclusion of details of the water balance and related sizing of water supply dams and pollution control dams. | To be finalized once underground access is gained. |
| | | | The monitoring and reporting programme in this EMP update lists a number of lagging indicators to be measured and reported upon (dust levels, groundwater and surface water pollution), and independent reporting/auditing of these is recommended to be done at two yearly intervals.<br>It is recommended that this monitoring section of the EMP be enhanced by the inclusion of regular and detailed field monitoring of the degree to which the control methods have been installed and are functioning.<br>Monitoring should be done by independent | Dust monitoring commenced in January 2018 and is undertaken by a subcontracted Specialist. Blyvoor intends to appoint a subcontractor for Surface Water sampling as recommended by the surface Water Specialist (Surface Water report is contained in Appendix 6). Both dust and surface water monitoring data will be reported on monthly. |

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| | | | persons competent to provide an opinion on control measure functionality. The frequency of reporting on control effectiveness should be increased, particularly during the establishment phase of the operation. | |
| | | | This EMP update provides both EIA and EMP information, partly collated from three previous EIA documents (dated 2000, 2007 and 2012) that had been generated for Blyvooruitzicht gold. | Correct. |
| | | | The comments contained in this note relate to the adequacy, or otherwise, of the commitments made in respect of environmental controls, and monitoring activities, for the tailings reclamation and re-disposal portion of this EMP. | Noted. |
| | | | "There will be no new infrastructure development and these activities will not extend off the existing developed footprint of the mine". | Correct. This includes approved servitudes. |
| | | | Also: "Should it be necessary to develop surface waste rock disposal options, these will be included in a future EIA process to | Agreed. A new TSF is not required for the Project as underground mining will be the focus of the operations and TSF No. 6 can |

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| | | | be run to locate a new TSF site (to be actioned within the next 1-3 years)" | accommodate deposition for more 15 years once the mine is operational.<br>The existing TSF No. 4 & 5 footprints are being considered for use as an alternate tailings deposition site. |
| | | | This means that, in respect of TSF management, the scope of this EMP update is limited to the care and maintenance of inactive TSFs, and to the first three years of the proposed tailings remining and redeposition activity. That is, it focuses largely on the actions of remining TSF #7, with deposition of the reprocessed waste onto TSF # 6. | Correct, this was the focus of the 2016 EMPr. Blyvoor Gold have however focussed on the re-introduction of the underground operation as a priority, and hence the remining of TSF No. 7 has been delayed further. |
| | | | Whilst it is accepted that the need to commence deposition of wet tailings on TSF 6 in order to control the immediate dust issue is urgent, the EMP lacks indications of actions to be taken in event of early cessation (unplanned closure) during the first three to five years of operation. | Financial Provisioning considered a 30-year LOM and must be updated annually, as legislated. The liability as calculated must be provided by Blyvoor Gold to ensure rehabilitation can be undertaken. |

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| | | | "Blyvoor TSF No. 7 has been earmarked as the first resource to be re-mined. The remainder of the TSFs will be placed under care and maintenance until scheduled to be reworked." | This is no longer applicable. Underground operations will take precedence due to the greater economic and employment benefits. |
| | | | Also: "The tailings after retreatment at the plant will be disposed on Blyvoor TSF No. 6 for an initial period. In future, there will be a need to develop a new TSF site; this will be actioned within the next 1-3 years." | TSF No. 6 will only accommodate deposition from the underground workings. The additional TSF will be investigated and applied for if and when necessary. |
| | | | "BG intend to reprocess TSF No. 6 and consequently every ton of tailings deposited onto the surface of this dam in the short-term will need to be removed as sterile material at a point into the future. | Given that the underground operation is being prioritised, the deposition on TSF No. 6 will not be sterile and is expected to contain a residue grade of some 0.3g/t. |
| | | | Consequently, the company has every incentive to limit the period during which tailings is deposited onto TSF No. 6. If they do not do this, this TSF will ultimately become uneconomical to re-mine once the cost of removing the recently placed pre-treated tailings (from which extractable gold has been removed) exceeds the gold value | The observation has merit but given the change in focus to the underground operation, the fresh deposition will be in the order of 0.3g/t which is economical for reclamation and retreatment. |

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| | | | in the underlying TSF No. 6 tailings in the current TSF". | |
| | | | This section places a commitment on the Company to maintain all existing tailings facilities – and, presumably to plan for the sustainable closure and the care and maintenance of TSF No 6 in the event that the new TSF is not approved or commissioned. | All TSFs which are owned by Blyvoor will be maintained and will be subject to competent and sustainable closure planning. |
| | | | This section contains a significant listing of commitments made in respect of management of the potential impacts from the TSFs under Blyvooruitzicht Gold's control. These are listed below, as follows: | Blyvoor is responsible for maintenance of all TSFs in their ownership. |
| | | | "To maximise control of dust off the TSF surfaces for which BG has responsibility, to ensure that applicable standards for dustfall rates are not exceeded (i.e. GN R. 827 in terms of NEM:AQA)" | |

DIGBY WELLS ENVIRONMENTAL

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
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| | | | "The following mitigation measures are applicable to all TSF's in terms of stability management: Ensure pond and beach are appropriately managed and surface of tailings dam always retains 0 .5 m freeboard in addition to capacity to handle one in 50 rainfall event; | |
| | | | In slope of berms to hold rainwater. Ensure after bund wall is intact; Inspect and maintain berms; contained rainwater run-off should be held at the foot slope. Siltation will push this ponding position towards the outer edge of the berm. This must be avoided through regular maintenance; | |
| | | | Inspect and maintain Toe paddocks. Remove accumulated silt when necessary. Ensure Toe paddocks are sized to contain upslope one in 50 year run-off of volume; | |
| | | | Inspect and maintain dirty water seepage system outside toe paddocks. This dirty water seepage trench linked into pollution control dam; and | |

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| | | | Inspect and maintain clean water cut off berm to ensure that clean runoff is diverted around TSF and associated dirty areas to discharge at a point that allows this run-off to enter the natural environment. " | |
| | | | The following mitigation measures are applicable to all TSF's in terms of saline seepage: | Correct. |
| | | | · Manage freeboard on TSF; | |
| | | | · When tailings material has been removed, ensure footprint is free draining to avoid ponding and creating hydraulic head to drive pollution plume | |
| | | | · Manage TSF return water system (PC dams circuit) to be as dry as possible to limit any acidic water in circuit as far as possible; and | |
| | | | · When BG develops a new TSF, ensure that all reasonable measures are taken to limit seepage through the base of the TSF to avoid unnecessary future groundwater contamination. This will be | |

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| | | | expanded on in detail during the future EIA once TSF sites have been identified." | |
| | | | Dust control at the TSFs placed under care maintenance will include a combination of the following mitigation measures: | Correct. |
| | | | · Increasing turbulence on the TSF surface to limit entrainment of tailings particles (particles being picked up and becoming airborne). | |
| | | | · This will happen through a combination of ridge ploughing, use of netting barriers and/or selective vegetation planting; | |
| | | | · Protecting the TSF side slopes, particularly those exposed to prevailing winds through a combination of physical barriers (netting) and use of vegetation, then | |
| | | | · Implementing adequate dust fallout monitoring in proximity to the TSF sites so that the success of these measures can be | |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
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| | | | determined or, should they be deficient, then remedied." | |
| | | | It is probable that the control measures listed above will be adequate for the control of significant dust and water emissions during the operational phase, and during the care and maintenance phase of management of the TSFs under BG's control, if they are correctly designed, established and diligently maintained. | Correct. Refer to the Air Quality Impact Assessment attached in Appendix 8. |
| | | | The issue lies with the interpretation of the phrase "a combination" of measures, and with the adequacy with which the chosen control measures are established. It is probable that more than one measure, and sometimes all measures, will be needed to control the impact (dust or water) of concern. Accordingly, it is recommended that the MONITORING section of this EMP be significantly expanded, to allow for the independent assessment and auditing of the degree to which the listed control measures have been implemented, on a | Mitigation measures have been included in various sections of this report as well as in the respective specialist studies. Refer to Section 10 in Part A for impacts and mitigations, and Section 7 of Part B. |

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| | | | frequent basis, particularly during the early establishment phase. | |
| | | | It must be noted that all measures listed apply simply to the "care and maintenance" phase of the operation, and do not define in any way the measures that will be needed to stabilise sustainably the TSFs at closure. In the event that it becomes uneconomic to re-mine TSF No. 6, for instance, due to delays in commissioning the new TSF, there is no guidance provided in this EMP regarding the control measures that will have to be implemented to produce a final TSF configuration that will be sustainable post-closure. | It is unlikely that additional TSFs are required. In the instance that Blyvoor Gold does require additional TSFs to be constructed, this will need to be applied for separately. Refer to the Closure and Rehabilitation Report in Appendix 13 |
| | | | It is appreciated that the current proposal states that all TSFs under BG's control will be removed, and the residual footprints will be rehabilitated, but this begs the question | The Closure and Rehabilitation Report in Appendix 13 considers the cost to rehabilitate all TSFs and the cost for closure |

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| | | | of what will happen if closure occurs prematurely. | must be secured by Blyvoor Gold to proceed with the operations. |
| | | | "Whilst in operation the top surface and perimeter of the TSF (No 6) would be wet, limiting dust from windblown erosion. It would also be possible to carry out repairs to the existing wind erosion". | Correct. |
| | | | The current status of TSF No 6 is defined as follows:<br>"Since the cessation of mining operations at Blyvoor, the Blyvoor TSF No. 6 has become a serious dust source which has led to numerous complaints as it negatively impacts the communities (Van Deventer, 2016). Tailings dust is blown off the uncovered top surface, slope and beach areas almost on a daily basis leading to large plumes which settle around the nearby villages (Van Deventer, 2016)." | |
| | | | This is not disputed, hence the desire to initiate the remining process as soon as possible. | Underground mining will be prioritised and TSFs maintained for this duration. |

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| | | | While the redeposition of TSF No 7 waste on TSF No 6 undoubtedly provides an opportunity to improve the dust situation in the short term, and provides a significant motivation for this activity, it must be borne in mind that the current EMP does not define how TSF No 6 will be finally closed sustainably in the event of premature cessation of this activity, or if the construction of the “new” TSF is delayed more than three years which would result in the remining of TSF No 6 becoming uneconomic. | TSF 6 will largely accommodate deposition from the underground workings. |
| | | | It should be noted that “The Geometric Design Parameters for TSF no 6” (in Table 5 on Page 15) allows for the deposition of up to 17,5 million tonnes of tailings, over a 5,8 year period – which presumably would render the remining of TSF no 6 uneconomic | The available area on TSF No. 6 is estimated to have a capacity of between 16 Mt and 20 Mt. (Estimated by Davel in 2016) This will be sufficient for the planned tonnes of approximately 6.5 Mt. (Minxcon 43-101 Independent Technical Report June 2018). Future deposition will not render TSF No. 6 uneconomical as the deposition grades are expected to be around 0.3g/t which is economical for reclamation mining. |

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| | | | Accordingly, the EMP update would gain additional credibility if it contained commitment to the final sustainable rehabilitation of TSF No 6, in the event that the deposition of tailings from TSF no 7 continued for such a period as to render remining of TSF No 6 uneconomic. | Refer to the Closure and Rehabilitation Report in Appendix 13. |
| | | | Pages 52-61 (Table 17) Potential impacts per activity per phase<br>Provides the potential impacts of the various listed activities. For the existing TSFs, the potential impacts listed focus exclusively on the care and maintenance of existing TSFs, and on the rehabilitation of footprints once all tailings have been removed. There is no indication in this table of the probability that some of the TSFs may not be remined in their entirety, or of the risk that these remaining TSFs may need sustainable rehabilitation at closure. | The current proposal is to maintain the existing TSFs and commence surface reclamation at a later stage. |

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| | | | Pages 64-67 (Table 13.3) : The possible mitigation measures that could be applied and the level of risk):<br>This table contains a number of mitigation measures designed to minimise impacts during the operational phase, and some indication of the final closure measures required to rehabilitate the TSF footprints at closure. Again, there is no instruction on what will happen in the event that some TSFs are not fully remined. | In the event of early closure resulting in the TSFs not being mined, or fully mined, the TSFs, all of which have been confirmed to have viable economics, will most likely be sold to a dedicated tailings retreatment operator. |
| | | | Commitments contained in this table that are relevant to the management of the TSFs are as follows:<br>“The following mitigation measures are applicable to all TSF's in terms of stability management: | Correct. |

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| | | | "Ensure pond and beach are appropriately managed and surface of tailings dam always retains 0.5m freeboard in addition to capacity to handle one in 50 rainfall event; Inslope of berms to hold rainwater. Ensure afterbund wall is intact; inspect and maintain berms; contained rainwater runoff should be held at the footslope. Siltation will push this ponding position towards the outer edge of the berm. This must be avoided through regular maintenance; Inspect and maintain Toe paddocks. Remove accumulated silt when necessary. Ensure Toe paddocks are sized to contain upslope one in 50 year runoff volume; Inspect and maintain dirty water seepage system outside toe padlock. This dirty water seepage trench linked into pollution control dam; Inspect and maintain clean water cutoff berm to ensure that clean runoff is diverted around TSF and associated dirty areas to discharge at a point that allows this runoff to enter the natural environment. Develop site-wide water balance. Inspect dams regularly for silt build up and maintain | |

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| | | | the 1:100 year free board. Ensure PCDs are largely dry to ensure that retention capacity remains in the dam." | |
| | | | In respect of dust control during the remining and redeposition activity, the mitigation methods for dust generated on side slopes of TSFs are the same as those to be used for TSFs under care and maintenance: that is: | Currently, TSF No. 6 is mostly responsible for the current dustfall and once the mine is operational and access to underground water for suppression is possible, dust management will commence. |
| | | | "Protecting the TSF side slopes, particularly those exposed to prevailing winds through a combination of physical barriers (netting) and use of vegetation" | Noted. |

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| | | | No detail is provided in respect of these methodologies. The EMP would benefit significantly from reference to the design criteria to be used for netting use and for vegetation establishment, if required. | |
| | | | In respect to the surface of TSF No 6, the following control commitments are made: "The TSF surface is not available for physical intervention and, while active, dust is controlled through management of tailings deposition to ensure that the surface of the TSF remains moist where possible." | |
| | | | In respect of the TSFs under care and maintenance, dust from side-slopes is to be controlled in the same manner as for TSF No 6. The surfaces of TSFs will not have the benefit of continual wet tailings placement, and the commitment given for these areas is as follows: | |

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| | | | "BG is investigating a variety of methods to maximise control of dust off the TSF surfaces for which they have responsibility. Dust control will include a combination of: increasing turbulence on the TSF surface to limit entrainment of tailings particles (particles being picked up and becoming airborne). This will happen through a combination of ridge ploughing, use of netting barriers and/or selective vegetation planting" | |
| | | | It is clear from the reference to BG "investigating a variety of methods" that control technology to be used for dust control has not yet been finally agreed to or defined. This "investigating" should be completed, so that detailed design criteria for the chosen control methodologies can be defined for implementation BEFORE initiation of operations. | Dust suppression will be implemented once the mine is operational, using water from underground. |
| | | | Page 79, Item 17.0, Financial Provision: The quantum determined for closure is stated as follows: "The total amounts provided for scheduled and unscheduled | Refer to the Closure and Rehabilitation Report in Appendix 13.The financial provisioning is also provided in this report in Part B, Section 6. |

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| | | | closure for the assets acquired by BG are R 48 242 068.21 and R 66 797 051.06 respectively". | |
| | | | No detail is provided regarding the additional costs associated with early closure, and accordingly it cannot be determined whether allowance has been made for sustainable rehabilitation of the TSFs in the event of early closure. | Refer to the Closure and Rehabilitation Report in Appendix 13. |
| | | | It would be an advantage if the detailed closure costing was provided as an appendix to this EMP. | The Closure and Rehabilitation Report is attached as Appendix 13. |
| | | | Page 80; financial provision:<br>Allowance is made for only 2 to 3 years' care and maintenance, post rehabilitation. | Post-closure monitoring is included in section 7.6 in Part B. |
| | | | It is recommended that this period be extended to at least 5 years, as experience has shown that this is the minimum that will allow for sustainability. | |

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| | | | Pages 84 - 87, Section 20.9: "Mechanisms for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon".<br>This section defines the monitoring of performance only – in terms of lagging indicators such as pollution levels experienced. | |
| | | | The classic monitoring programmes (dust deposition, vegetation cover, water pollution in boreholes) effectively provide measures of control failure. | |
| | | | In terms of achieving control of environmental impacts, it is more effective to monitor control effectiveness per se, thus reducing the likelihood of both short and longer term failure | |
| | | | It is therefore recommended that this EMP define leading indicators that are to be monitored as well. This would mean that a programme of inspections should be instituted to assess the implementation of control measures at the time at when they | |

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| | | | are being implemented. Thus control items such as wind netting, ridge ploughing, toe paddock design, toe paddock and berm cleaning, etc etc, would be monitored at the time of implementation, and regularly thereafter, to ensure that they had been properly constructed or maintained. | |
| | | | Control effectiveness monitoring should be done on a regular basis, preferably monthly as a minimum, during the early operational phase of mining of TSF No 7 and deposition of tailings on TSF No 6. It is probable that a slightly lower frequency of control effectiveness monitoring during the care and maintenance phase of the other TSFs would be acceptable | |
| | | | Page 89; Item 20.10: Performance assessment report.<br>The interval recommended for generation of this report by the consultants is every two years. As the planned duration of the initial phase of deposition on TSF No 6 is only 1 to 3 years, it is contended that the two year reporting interval is inadequate to provide time for correction of inadequacies in | The capacity of TSF No. 6 should be sufficient and is deemed a low risk (Davel estimated an available capacity of between 16 Mt to 20 Mt capacity). The available area on TSF No. 6 is estimated to have a capacity of between 18 Mt and 20 Mt. This is sufficient for the planned tonnes of approximately 6.5 |

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| | | | control effectiveness of this operation. Accordingly it is recommended that regular independent performance review reports be generated, preferably at 3 months, 6 months, 1 year and 2 years after initiation. | Mt. (Minxcon 43-101 Independent Technical Report June 2018). |
| **2018 Comments** | | | | |
| Mariette Liefferink | Written Response | 04/02/2018 | Dear Sirs<br>I have received the subjoined and attached notification from Ms Elise Tempelhoff of Beeld.<br>Notwithstanding the fact that the FSE is a key stakeholder in the Blyvoor Mine matter, the FSE was not notified of the attached application.<br>Kindly explain. | Dear Mariette<br>Please note that notification was sent to the old email address (please see below for proof)<br>We kindly apologise that we did not include the new email address to this correspondence. |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| Mariette Liefferink | Written Response | 05/02/2018 | Dear Alan and BVG Team,<br><br>I refer to our comments, which were submitted in September 2016 and October 2016 respectively. Dr Phil Tanner was commissioned by the FSE to comment on the updated EMPR. As you may recall, these comments were not included in the Comments and Response Report which was a matter of serious concern to us. Please see the 3rd attached letter, dated July 2017 in this regard.<br><br>We trust that these comments will now be included in the Comments and Response Report and that the BVG Team will respond to Dr Tanner's comments. The FSE will augment our previous comments pending receipt of the documents (i.e. Air Emissions License and Environmental Authorisation Applications). | As previously indicated, Dr Tanner's comments were provided to Digby Wells by Blyvoor Gold as well as Mariette Liefferink. These comments have been captured and responded to. |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| Mariette Liefferink | Written Response | 05/02/2018 | Dear Nondumiso<br>With reference to the above-mentioned Application, we request clarification on a number of issues.<br>Firstly, on page 1 of the Background Information Document (BID), reference is made to 6 TSFs while on page 2 only 5 TSFs (TSF No 6, TSF No 7 and 3 Doornfontein TSFs) are identified. Please clarify. | A formal response to Mrs Liefferink's comments was sent on 08 February 2018 and a copy thereof is contained in Appendix 4. Digby Wells addressed the incorrect information contained in the BID and an updated BID was distributed to all I&APs to correct this. |
| | | | Will the documents be electronically available on Digby Wells Environmental's website?<br>The attachments which I have received from Ms Elise Tempelhoff include a copy of the BID pertaining to the application for an air emissions licence but not a copy of the BID pertaining to the application for an environmental authorisation. Please clarify. | The Scoping Report was made available on the Digby Wells website, as is the Draft EIA, and so will the Final EIA.<br>The Environmental Authorisation Application is in response to the section 93 Directive attached to MR 143 GP and is also applicable to the requirement for an AEL. |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| | | | We furthermore request clarification on the statement: "All other activities remain unchanged and are therefore approved under the 2017 EMP with the transferred Mining Right (GP 30/5/1/2/2 (143) MR)." From our previous discussions with the Applicant we inferred that the Public Participation for the updated 2017 EMP would be redone because of the failure by the previous EAP (Golder Associates) to include the FSE's comments, which were prepared by Dr Phil Tanner. Please clarify.<br><br>We kindly request an electronic copy of the 2017 EMP. | Digby Wells was provided the comments made by Dr Tanner and these comments have been captured a and have been addressed.<br>An electronic copy of the Golder EMP was also provided to Mariette Liefferink. |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| | | | While the FSE has taken note of Blyvoor Gold's application for an Air Emissions Licence (AEL) to operate two gold recovery plants, the FSE's principal concern is the monitoring and management of the dust during the reclamation operations. It is an established fact that the TSF No 6 is a major source of wind-blown dust. The control of dust also falls under the NEM:AQA.<br><br>In view of the aforesaid, we hereby kindly request a copy of the dust management plan. Regulation 15 of the National Dust Control Regulations Amendments, which will be published shortly (to be submitted to the Minister for approval on the 31 March 2018) prescribes: "Notwithstanding regulation 14, any person conducting a mining operation; and any person conducting any activity in such a way as to give rise to dust that may exceed acceptable dustfall rates set out in regulation 4 must prior to undertaking such activity, develop and implement a dust | Dust monitoring has commenced at seven locations around the mine. Once the mine is operational, underground water will be utilised for dust suppression on the TSFs. |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| | | | management plan." The TSF No 6 and TSF No 7 are in close proximity to the Blyvoor Villages and an informal settlement. It follows hence that the applicable dust fall rate ought to be less than 600mg/m2/month as opposed to the dust fall rate for non-residential areas. | |
| | | | In conclusion, we request that our previous comments, which include Dr Phil Tanner's comments on behalf of the FSE, be included in the Comments and Response Report pertaining to the Applications for an Air Emissions License and Environmental Authorisation. | These comments have been included as provided throughout this table. |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| Mr Musa Zwane | Written Response | 05/02/2018 | Good morning,<br>Thank you for the reports.<br>Kindly note that the Atmospheric Emission License application process should run parallel to the EIA process. | The AEL application will be submitted during the EIA Phase. |
| Mariette Liefferink | Written Response | 06/02/2018 | Dear All,<br>I wish to hereby notify you that I was approached by the news media and affiliated NGOs (inter alia Carletonville Herald and groundWork) to comment on the above application.<br>I forwarded the FSE's concerns to the above parties. These concerns were explained in my correspondence with you. Regrettably I was not in the position to supply the above parties with your response since I have received no response at the time of writing. | Dear Mariette<br>Thank you for your email<br>Please be advised that our EAP has been sent your comments/concerns<br>In addition your comments have also been included in the Comment and Response Report<br>We trust the above is in order<br>Warm regards |
| Patrick Deane | Written Response | 06/02/2018 | Good day sir<br>I would really and meaningfully like to join up and assist with the E I A assessment as interested party for the new Blyvooruitzicht Gold Mine.<br>Reason : | Information forwarded to Blyvoor Gold. |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| | | | 1) I am a Bird and nature watcher and i have records of the trends of the bird populations going back to 1995 .I have been keeping a hawk eye on the change through the years<br>and what i have is accurate and true.<br>2) Why: i know this ground very well and i dont intend to stop monitoring the Nature. I know i could help immensely i will be able to field questions to the best of my Knowledge and limited qualifications.<br>Brief overview of experience:<br>ex Blyvoor Gold mine<br>Radiation protection monitor(certificated)<br>acting Radiation Protection officer(Certificated)<br>non profit . On going "Terra Nova bird nature and habitat survey"<br>(private Survey) since 1995.<br>over 1000 field trips on foot and by MTB Bicycle.<br>kindly let me know the steps i saw the notification poster at our local shop but i could not take a pic of it.<br>thank you | |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| | | | yours sincerely<br>Patrick Deane . | |
| Brienne van der Walt | Written Response (Comment Form) | 14/02/2018 | **How do you think the project might impact you**<br>My farming business comprises hunting tourism and accommodation. The noise and air pollution will negatively impact my ability to conduct my business in a commercially optimal manner. I am also concerned about water pollution | Dust monitoring has commenced and will be monitored monthly. A surface water monitoring programme has been provided in this EIA. The noise levels are anticipated to be within legal limits and will be monitored. |
| | | | **How do you think the project might affect your socio-economic conditions**<br>it will reduce my income that I might earn from the farm. It will reduce the value of my investment in and on the farm. It will reduce my positive and pleasant experience of the farm | The mitigation measures provided will address the existing environmental impacts. The mine has been in place since 1937 and no expansion is planned and therefore no new impacts will be experienced by the surrounding land owners. |
| | | | **How can these impact be managed, avoided and/or fixed?**<br>Water safety measures | Water management and monitoring will be implemented at the mine. |
| | | | **Impacts cannot be fixed- permeant damage will be done** | Dust monitoring has commenced. Once the mine is operational and water is available |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| | | | I am not sure how the air and noise pollution can .. | dust suppression will be activated and noise levels will be monitored. |
| | | | **If you are a landowner or occupier, what is your land currently being used for?** Game farm breeding and hunting, ecotourism | Noted. |
| | | | **Are there any environmental, social or heritage features on the proposed project are we need to be aware of/** The Varkenslaagte Spruit, my only source of water | No change is anticipated to current water discharges associated with the mine. This will be confirmed once the water balance has been completed. All water discharged will be monitored, sampled and reported to the DWS on a monthly basis. |
| | | | **Where are these found?** Entering the farm on the South Eastern Border | Noted. |
| | | | **Do you think the project could impact infrastructure you might have?** Water levels both surface and underground Newly build shed and roundavels | Noted. |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| | | | **If so how can these impacts be managed, avoided or fixed?**<br>Monitoring and testing of water<br>Fresh water supply by Blyvoor Gold<br>I am not sure how earth tremors or ground movements that can damage top structure be avoided | Water monitoring will be implemented and reported on monthly basis. Water from the underground operations will be used for dust suppression. No blasting will take place near the surface. |
| | | | **General Comments**<br>I am very concerned about the negative impact that the proposed re-opening of Blyvoor Gold at the Blyvoor mine will have on my farm, the business I conduct there and the quality of water and air (noise and air pollution) | Noted. |
| Paulo Jorge de Gouveia | Written Response (Comment Form) | 14/02/2018 | **How do you think the project might impact you**<br>We as landlord and tenants and customers and community are concerned about the uncontrolled dust fallout | The reopening of the mine will have an overwhelmingly positive influence on the current dust fallout, and in addition, mitigation measures will be introduced.<br>Refer to the Community Health Impact Assessment attached in Appendix 10. The impacts assessed are also provided in Part A, Section 10.6 |
| | | | **How do you think the project might affect your socio-economic conditions**<br>The dust is toxic and affects our health. The dust fallout chases customers away from the OK Foods supermarket | |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| | | | **How can these impact be managed, avoided and/or fixed?**<br>Proper rehabilitation and continuous and maintenance | A rehabilitation plan is provided in the Closure and Rehabilitation Report attached in Appendix 13. |
| | | | **If you are a landowner or occupier, what is your land currently being used for?**<br>Landowner, commercial land and shopping centre | Noted. |
| | | | **Are there any environmental, social or heritage features on the proposed project are we need to be aware of/**<br>Yes big dust fall outs | Blyvoor Gold is aware of the dust problems experienced by the surrounding community and dust suppression will be implemented when the mine is operational. |
| | | | **Do you think the project could impact infrastructure you might have?**<br>Yes | Noted. |
| | | | **If so how can these impacts be managed, avoided or fixed?**<br>Proper and continuous rehabilitation | |
| | | | **General Comments**<br>Do not make slime dam number 6 bigger. Please stop dust fall-out in Blyvoor | Deposition onto TSF No. 6 will alleviate dust fallout from this TSF as deposition material will be wet. |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| Mr Emmanuel | Public Meeting | 21/02/2018 | We hope that Digby Wells will be able to complete process | The comment was noted |
| | | | Is the village included in the plan/map? We know the delay tactics used by the departments | The village is not owned by Blyvoor Gold and there are no delay tactics planned for this project as it is in the interest of everyone to start as soon as possible |
| | | | Are you going to consider previous comments? | Previous comments which were not previously addressed have been included and responded to herein. |
| | | | Why was there a delay in letting the community know? When did Blyvoor receive this notification from the DMR | Blyvoor Gold became the holder of the mining right in September 2017, and the Section 93 directive was received with the mining right. Further to this, the Directive instructed Blyvoor Gold to submit an Environmental Authorisation Application to amend the 2017 EMP in November 2017. The Application submission deadline was then extended to 26 January 2018 to avoid the public participation process taking place during the December/January holiday period. |
| | | | These potential impacts presented are they impacts from the previous process or is it observations from you? | Reference has been made to the impacts identified in the 2017 EMP and these are general impacts we assume will occur. |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| | | | | Further investigations for this project have been looked at in more details as part of impact assessment phase |
| Mariette Liefferink | Public Meeting | 21/02/2018 | I would like to give the public a brief background about our organisation and what we have encountered with Blyvoor. In 2014 we had criminal charges lodged against Blyvoor and in 2016 there have been four hearings in Carletonville. | Comment was noted in the public meeting held on 21 February 2018. |
| | | | We want to know the medium-to-long term future land use, water use that is agreed upon. This land use type needs to be agreed on before commencement of the EIA phase | Investigations into the appropriate post-closure land uses requires in-depth investigation have been done as part of the EIA Phase. The land uses recommended include grazing and wilderness areas. |
| | | | We would like an electronic version of the scoping report | A copy of the CD was provided to the stakeholder |
| | | | We also request a written confirmation that Phil Tanners comments and response will be included | Written confirmation was provided on 08 February and 14 February 2018. |
| | | | In terms of the amended dust regulations, mining companies are required to have dust management plans not only monitoring | This was noted. |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| | | | If you deposit on slime dam 6 there could be degradation and it may collapse. Blyvoor needs to ensure structural integrity (as it is also part of the right) therefore engineers are needed to confirm this. | Noted |
| | | | Shaft 4 and 5 are highly radioactive. There has been 43 million and another 100 million for this investment. We hereby request that money be ploughed back into the entire area for rehabilitation because the community is exposed. | Blyvoor Gold has, through negotiation with the authorities agreed to provide rehabilitation provisioning for assets that it has not purchased. The agreement with the authorities allows for this provisioning to be put in place over a ten-year period. |
| | | | We also hope this fixing (reconstruction of vandalised/stolen or sold infrastructure) does not trigger any listed activities | Digby Wells was requested by DMR to align this EIA/EMP to the activities approved in the approved EMP (2000) and apply for activities which require authorisation. Activities requiring authorisation are included in Table 5-2, above. |
| Paul | Public Meeting | 21/02/2018 | With the dust monitoring that is being done what is the plan and the way forward for it | Dust monitoring has commenced at seven locations around the mine. Once the mine is operational, underground water will be utilised for dust suppression on the TSFs. |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| | | | Deposition on TSF6 will continue for up to 8 years. After recycling dump 6 this where will you dump again? | The construction of a new TSF for deposition will be investigated and applied for at a later stage, when and if required. |
| Suga | Public Meeting | 21/02/2018 | What will happened in the interim period from now to have the mine be in full operation (referring 300 day NEMA process) | During this time Blyvoor Gold will commence reconstruction of stolen/vandalised or sold infrastructure which was previously approved. In addition, it is possible to reduce the legislated timeframes through the way in which Digby Wells, Blyvoor Gold and the department undertake the work. The only way in which this cannot be changed is through the legislated public commenting periods of 30 days as this is required by law. However, Digby Wells does not want to rush the application process to ensure the process is done effectively. |
| Titos | Public Meeting | 21/02/2018 | Within the 300 days is there is no way to repair things and begin operation before the 300 day period is over? | Blyvoor Gold is putting plans together, ordering equipment and speaking to investors to commence fixing the shafts and other infrastructure. By this we are trying to shorten the preparations. Required to make the mine operational again. |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| Paulos Modibeng | Public Meeting | 21/02/2018 | Statement on the code of conduct for today's meeting- there are people outside having their own meeting when the meeting is meant to be inside.<br>Secondly we were asked to please switch off cell phones- those who haven't please do so because we all have cell phones here | Comment was noted in the public meeting |
| | | | There are new faces here and legal heads of this and there is illegal activities causing dust- how will you resolve these issues? Will you bring police to enforce and mitigate these issues- how will you do it? | Digby Wells and Blyvoor Gold are aware of the dust issues. The Police are not responsible to manage the dust issue. Dust monitoring will provide the information regarding the extent of the problem. We must also bear in mind that the mine has been in liquidation and when there are windy months there is dust accumulation. The best is to provide mitigation measures and the mine must ensure they can adequately deal with dust from their tailings dams. |
| | | | Also hungry people do not have patience for all of this | Digby Wells has committed to reduce the legislated timeframes, if this is feasible. The socio-economic impact is noted. |
| | | | The issue with the dust what will you do? Must we die first like the others? | We understand the environmental and social issues which need to be mitigated |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| | | | | accordingly in terms of what is required by law. |
| *Name not verified* | Public Meeting | 21/02/2018 | In terms of the mining regulated for this process and when reference is made to Blyvoor and their shafts, slime dams. From what I understand Blyvoor also includes Doornfontein so what I want to know is why the village is not part of this process or included as part of Blyvoor | T There have been specific questions and issues that have been raised which are all relevant. There is one thing to note that Blyvoor Gold and the other mines in the area have their own slime dams. The mining right is what Blyvoor Gold has brought and the legalities of this can be provided in more detail.<br>Further to this response, it was indicated to Blyvoor Gold during the 2016/2017 meeting that the community wishes to be managed by the municipality and not by the mine. It is Digby Wells' understanding that negotiations are underway with the relevant municipality and Departments to address the issues of service delivery in the community. |
| | | | We read in the newspapers many people who have taken over Blyvoor | When the mine was in liquidation, the liquidators were the owners of all the mine assets and were in a position to choose which assets would be sold. Various parties in the area have certain interests in the BGMC assets. Other companies are currently reclaiming the waste rock dumps, |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| | | | | and also utilising Shafts 4 and 6 for water. Although certain infrastructure are not owned by Blyvoor Gold, are still included in the closure costing estimate in this EIA. |
| | | | The people for construction, where will these people come from? | The attendance register at the meeting was used to gather contact information of previous employees who will be first priority for re-employment. Blyvoor Gold can assure that local community is a priority for employment and more so for those who were previously employed by the mine. Blyvoor Gold will have to employ people with specialised skills if this skill cannot be provided by people in the community and surrounds. |
| | | | There is about 63 million tonnes at TSF 7. When TSF 7 is mined, what will happen at TSF 6 because it would have doubled in size. | Deposition from underground working only onto TSF No. 6 will allow for approximately 15 years of deposition onto this TSF. |
| | | | When Blyvoor started with shaft 2 and 3 did they know about the sinkholes? | Ancient sinkholes pre-dating mining activity are present in the area |
| | | | There is currently (a housing development) 1200 houses that are being prioritized. | Digby Wells is not aware of a housing development in the area but should this |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| | | | What will happen they are being built? Should there be a stormwater issues how will this be prevented? | development go ahead, stormwater management will be required. |
| Mongezi | Public Meeting | 21/02/2018 | When the mine starts operating will there be new infrastructure such as medical facilities, transport and complexes that will be built | The No. 5 Shaft Treatment Plant, some small buildings for accommodation and medical facilities at the shaft are required in terms of the Mine Health and Safety Act, 1996 (Act No. 29 of 1996) (MHSA) and Occupational Hygiene requirements. |
| Erika van den Heever | Written Comment | 22/02/2018 | Good day Xanthe,<br>Could you please register me as an I&AP for the Blyvoor Gold mine project.<br>Thank you. | Good morning Erika,<br>Thank you for your email. I have cc'd Ndumi, our Stakeholder Engagement Specialist, into the email and she will confirm with you once your details have been captured on our database. |
| Mariette Liefferink | Written Comment | 21/02/2018 | | |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| | | | I thank you for the public participation meeting on the 21st instant and the CD which you kindly supplied me with.<br>I now refer to the Directive by the DMR, which is attached to the Scoping Report. From a reading of the Directive I infer that the Applicant is instructed to *inter alia*<br>▪ Conclude and sign a BEE Agreement<br>▪ Revise the social and Labour Plan<br>▪ Correct the number of people to be employed<br>▪ Compile a 5 year plan on how the above elements will be implemented<br>▪ Submit an organogram<br>▪ Identify a LED project<br>▪ Submit a plan on JV's SMME's, black suppliers<br>▪ Submit a strategy to assist employees to own houses<br>▪ Provide R66 797 051 for environmental liabilities<br>▪ Apply for an amendment of the Environmental Authorisation | Email response on 28 February 2018:<br>Good morning Mariette,<br>Thank you for your email.<br>Please refer back to the letter dated 08 February (attached for ease for reference) which explains the process being undertaken, and also confirms that the comments made by Phil Tanner have been received and will be addressed in this EIA/EMP process. |

| Interested and Affected Parties | Consulted | Date of Comments Received | Issues Raised | EAPs Response to Issues as Mandated by the Applicant |
|---|---|---|---|---|
| | | | I find no reference, however, to instructions that the Applicant's EIA/EMPR process was flawed and that Blyvoor Gold Capital has to redo the process (which will allow for Phil Tanner's comments on behalf of the FSE to be included in the Comments and Response Report and to be put before the DMR for a decision).<br>While I have taken cognisance of your comments during the public participation meeting on the 21st in which you confirmed the inclusion of Dr Tanner's comments, I remain perplexed. Please direct me to the section in the DMR's directive where reference is made to the renewed public participation process.<br>I furthermore infer that the public participation meeting which was held on the 21st pertained to the application for an Air Emissions License and not to the EIA/EMPR process. Is my inference lame? | |

## 8.4 Item 3(h)(iv): The Environmental Attributes associated with the Development Footprint Alternatives

This section details the baseline environment of the Project which explains the type of environment which may be impacted by the proposed activities.

### 8.4.1 Climate

Climate data considered for the Project includes temperature, rainfall and humidity. This information was sourced from both the existing EMPs and climate data records considered as part of the Air Quality Impact Assessment.

#### 8.4.1.1 *Temperature*

The monthly maximum and average temperature in the Project area is given in Table 8-4 and Figure 8-1. The maximum temperatures were observed in the summer and autumn months, with the highest temperature of 33°C recorded in December. The monthly averages varied from 10°C and 23°C (Table 8-4). An estimated 27°C was calculated as the annual average temperature for the Project area.

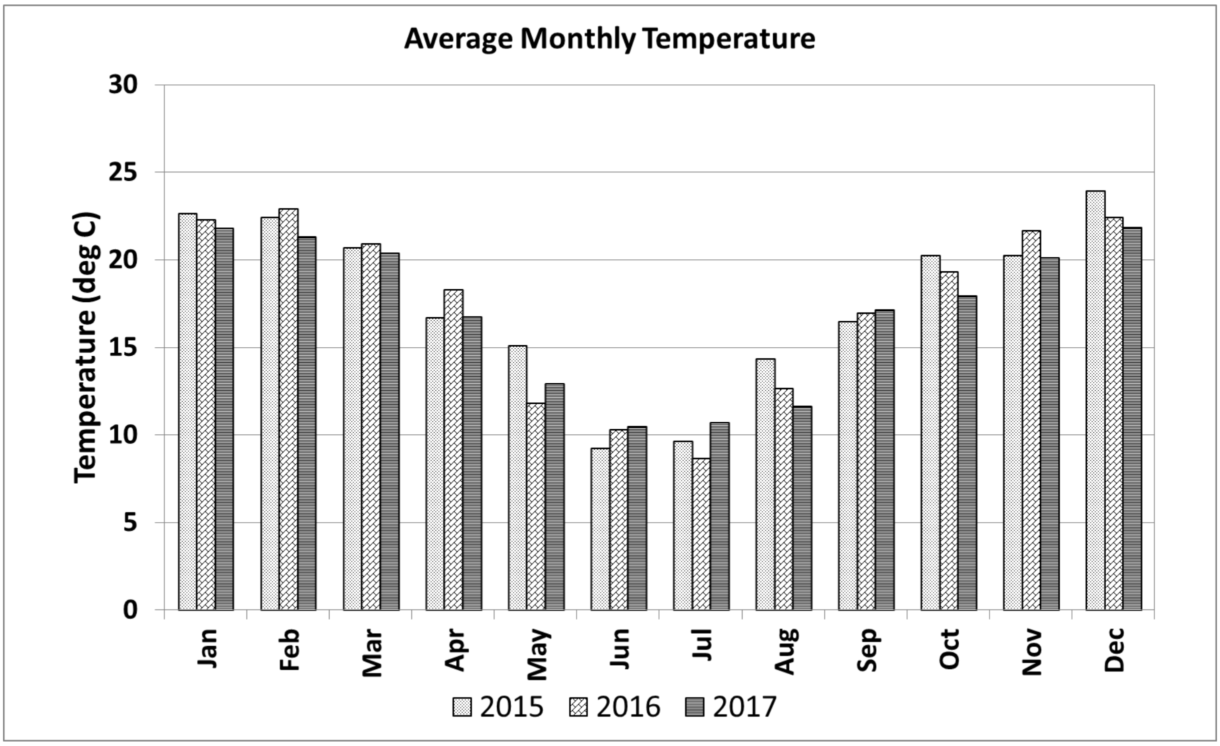



**Figure 8-1: Average Monthly Temperature**

**Table 8-4: Monthly Temperature Records**

| Temp(°C) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Ann |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly Max. | 32 | 31 | 29 | 28 | 23 | 20 | 20 | 25 | 27 | 31 | 31 | 33 | 27 |
| Monthly Ave | 22 | 22 | 21 | 17 | 13 | 10 | 10 | 13 | 17 | 19 | 21 | 23 | 17 |

#### 8.4.1.2 Rainfall

The total monthly and the average rainfall are reported in Table 8-5 for the period (2015 - 2017). The highest total monthly rainfall (278 mm) was observed in January. June, July and August were the driest months with less precipitation. The annual total rainfall of 1232 mm was recorded. Graphical representation of the rainfall variability over a year is depicted in Figure 8-2.

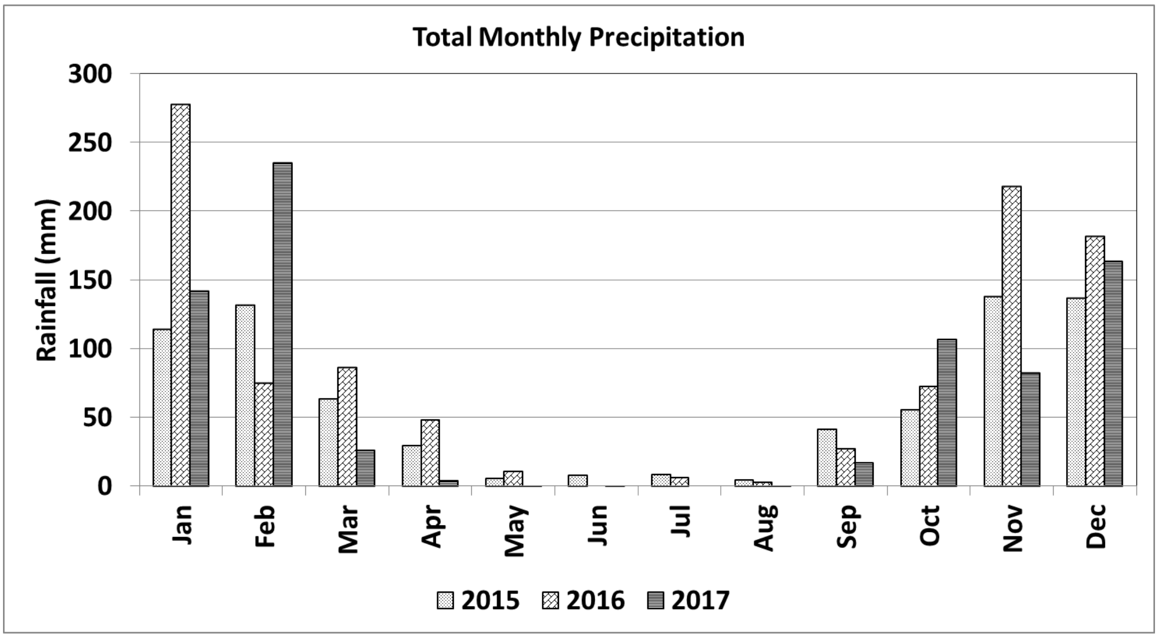



**Figure 8-2: Total Monthly Rainfall**

**Table 8-5: Total Monthly Rainfall Records**

| Rainfall (mm) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Ann |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tot. Mon Rainfall (Max) | 278 | 235 | 87 | 49 | 11 | 9 | 9 | 5 | 42 | 107 | 218 | 182 | 1232 |
| Aver. Mon Rainfall | 178 | 148 | 59 | 28 | 6 | 3 | 5 | 3 | 29 | 79 | 147 | 161 | 846 |

### 8.4.1.3 *Relative Humidity*

The data in Table 8-6 are representative of the relative humidity for the Blyvoor Gold Project area. The amount of moisture in the air is reported as relative humidity, which is the percentage of the total water vapour air can hold at a particular air temperature and how much water vapour a parcel of air can contain before it becomes saturated (100% relative humidity). The monthly averages vary between 54% in November and 71% in June. The monthly average relative humidity is presented graphically in Figure 8-3.

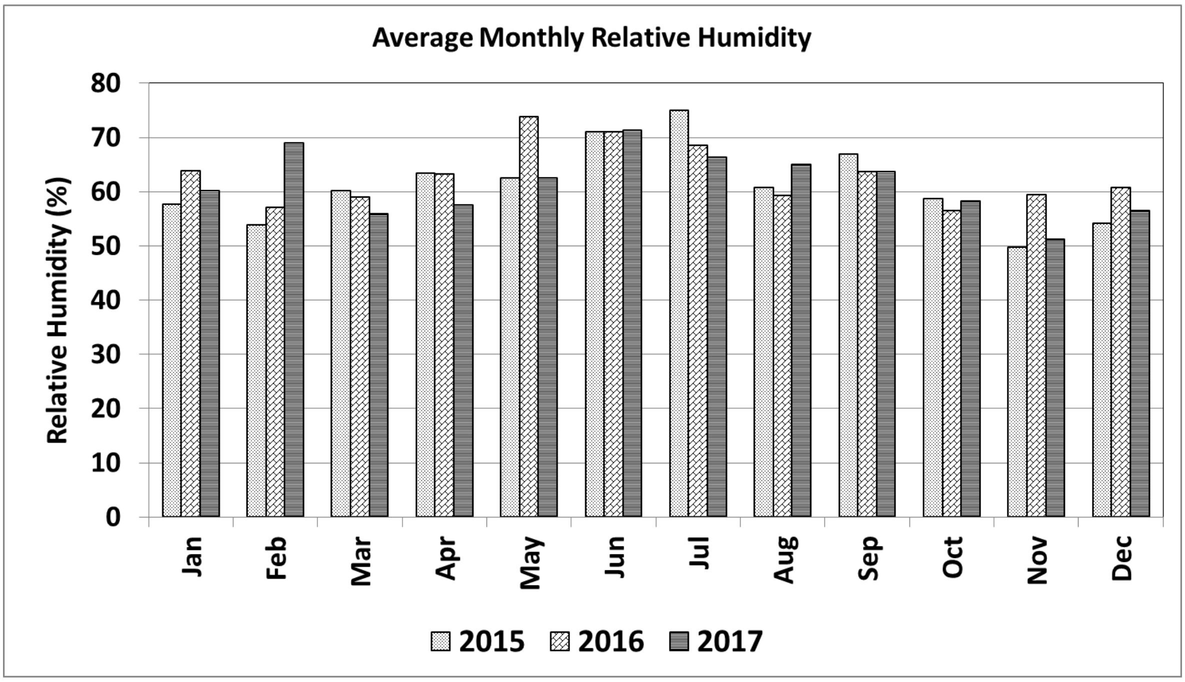



**Figure 8-3: Average Monthly Relative Humidity**

**Table 8-6: Average Monthly Relative Humidity**

| Relative Humidity (%) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Ann |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly Max | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Monthly Ave | 61 | 60 | 58 | 61 | 66 | 71 | 70 | 62 | 65 | 58 | 54 | 57 | 62 |

### 8.4.2 Topography and Drainage

The mine is located in the Vaal Water Management Area (WMA) as revised in the 2016 (Republic of South Africa Government Gazette Vol. 615 no. 40279), previously subdivided into the Lower Vaal, Middle Vaal and Upper Vaal WMA.

The project area is mainly located on a topographic high compared to the immediate surroundings; it is located within quaternary catchment C23E, close to the boundary of quaternary catchment C23G and C23J. Elevation at the project area ranges from 1 483 to 1677 metres above mean sea level (mamsl). Non-perennial streams occur within the project area, draining towards the Mooirivierloop from a south-east to a north-west direction.

### 8.4.3 Geology

The regional geology is characteristic of the following stratigraphic succession from top to bottom (also discussed below):

- Quaternary;
- Transvaal Sequence; and
- Witwatersrand Supergroup.

The local geology is found to be a stratigraphic succession of the Transvaal dolomite overlain by the younger sedimentary rocks of the Pretoria Group of the Transvaal Supergroup.

#### 8.4.3.1 *Quaternary*

This horizon is characterised by soil deposits from hillwash, alluvial and windblown origin.

#### 8.4.3.2 *Transvaal Sequence*

The Transvaal Sequence occurs throughout the project area. These rocks consist of the dolomite of the Malmani Subgroup which occurs over the north-western portion of the mine property, overlain by the Pretoria Group which occurs predominantly in the south eastern area. The Pretoria Group rocks consist mainly of chert breccia overlain by quartzites and shales. The chert breccia is extremely broken containing some cavities. The underlying dolomite of the Malmani Subgroup varies in thickness from 850 m on the northern boundary to 1,300 m on the southern boundary.

#### 8.4.3.3 *Witwatersrand Supergroup*

The Witwatersrand Supergroup rocks occur at considerable depths beneath the mine varying from 1 000 m on the northern boundary of the mine to 1 500 m on the southern boundary. Two reef horizons of the Witwatersrand Supergroup are mined on Doornfontein namely the Carbon Leader and the Middelvlei reefs (Main Reef). Both these reefs occur in the Main Conglomerate Formation of the Johannesburg Subgroup. The Carbon Leader is the principal economic horizon while the Middelvlei reef is not as economical to mine due to the presence structures and as a result is mined in a scattered manner.

#### 8.4.3.4 *Structural Geology*

The mine is divided into two main tectonic blocks. The eastern block is relatively undisturbed and the western tectonic block hosts numerous faults. Numerous dykes are found in the rocks of the Witwatersrand Supergroup. A number of these extend into the overlying dolomite. The structural features that extend into the overlying dolomite and act as preferential groundwater flow paths into the mine workings. The Eastern and Western Oberholzer dykes are of Pilanesberg age and cut, in a northeast-southwest direction, through the middle of the mine.

### 8.4.4 Groundwater

The baseline information provided herein is summarised from the Groundwater Impact Assessment report, attached as Appendix 5. The proposed monitoring boreholes are contains as Plan 4, Appendix 3.

Two main aquifers are identified within the project area; the shallow perched aquifer and the unconfined/ semi-confined dolomite aquifers. The shallow perched aquifer is located in the Pretoria Group sediments overlying the dolomite in areas underlain by clay horizons within the group, unconfined/ semi-confined dolomite aquifers are located within the Transvaal Sequence as well as some of the weathered zones of the Pretoria Group.

#### 8.4.4.1 *Groundwater Levels and Flow Direction*

Golder (2003) conducted a drilling programme of seven boreholes (G1 – G7, as shown in Figure 8-4) within the project area. Only three boreholes were found to have water, and these water levels ranged from 9.95 to 30.59 metres below ground level (mbgl). The remaining four boreholes were dry as detailed in Table 8-7. Due to limited groundwater occurrence, impacts to the groundwater by the TSFs may be less. This is however applicable in the absence of preferential groundwater flow paths (faults and dykes), that connect the potential contamination sources and the local receptors. Additionally, the nature of the local aquifer may either occur solely as a perched or a shallow aquifer experiencing impacts of dewatering in some areas may be present (with isolated areas where aquifer is depleted). Drilling by Golder was undertaken within a limited area, relatively limited depth (ranging from 43 to 63 mbgl) and drilling may have potentially been targeted in an area located within the radius of influence of a cone of depression resulting from dewatering. Therefore, no conclusion may be drawn about the nature of the local shallow aquifer from these investigations and more investigations would have to be conducted to define its nature.

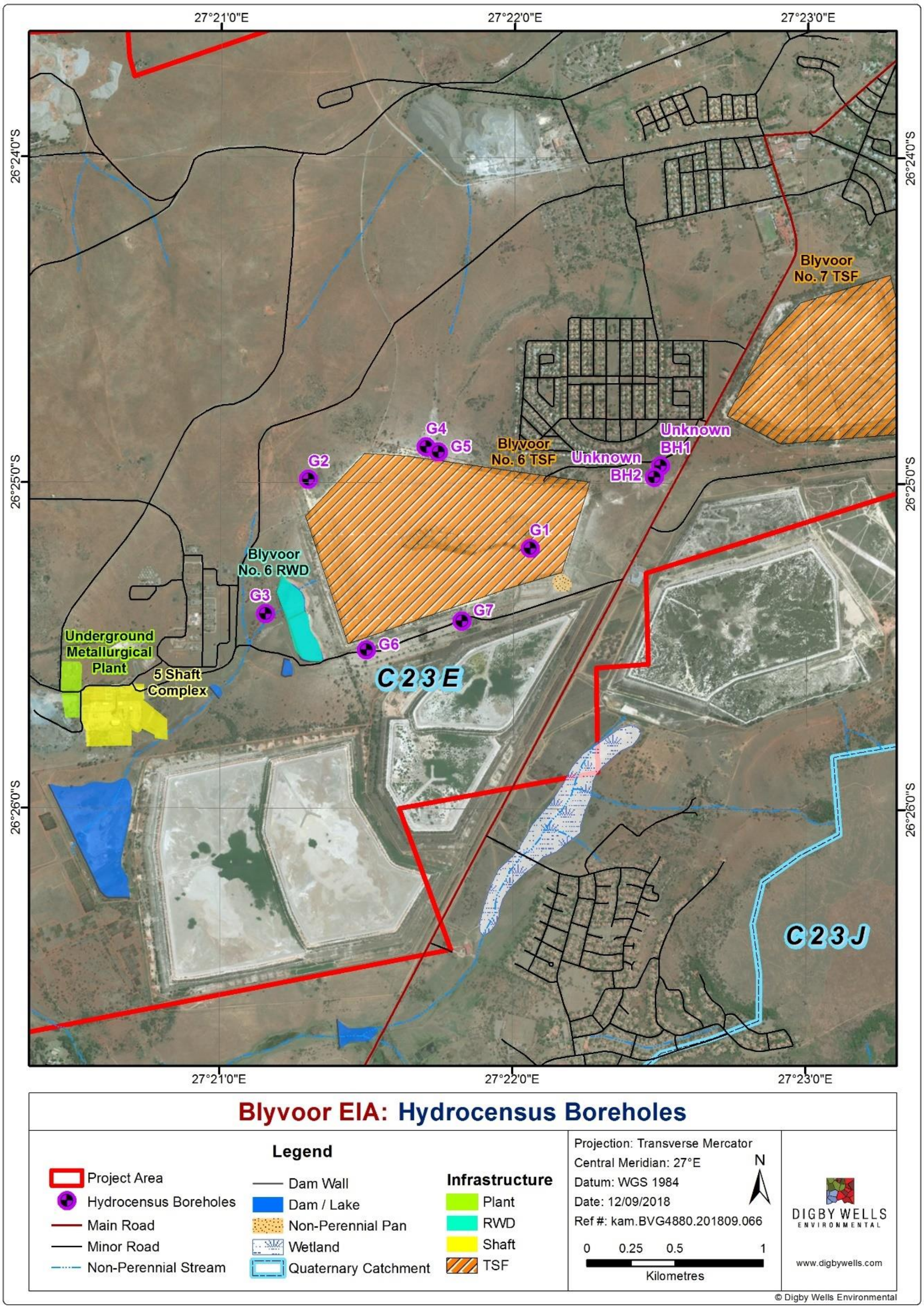


**Figure 8-4: Existing Boreholes Surveyed for Hydrocencus**

The baseline groundwater flow direction in the weathered zone is expected to follow the local topography, therefore migrating in a north-westerly direction towards the Mooirivierloop. Dewatering activities that have been taking place since the 1930s (Golder, 2017) have been observed to have affected the shallow aquifer. This is shown by the numerous boreholes having been found to be dry. There is also a presence of sinkholes on site due to mining activities. Groundwater flow direction may differ depending on the hydraulic head gradient present as a result of dewatering and presence of sinkholes.

**Table 8-7: Local**

| BH ID | Latitude | Longitude | Depth (m) | Water Level (mbgl) |
|---|---|---|---|---|
| G1 | -26.41999 | 27.3676 | 43 | Dry |
| G2 | -26.41649 | 27.355 | 46 | Dry |
| G3 | -26.42337 | 27.35257 | 63 | 18.32 |
| G4 | -26.41481 | 27.36168 | 36 | Dry |
| G5 | -26.41507 | 27.36237 | 57 | Dry |
| G6 | -26.42522 | 27.3583 | 50 | 30.59 |
| G7 | -26.42373 | 27.36374 | 33 | 9.95 |

#### 8.4.4.2 *Potential Contaminant sources*

TSFs are potential contamination sources to the groundwater; namely:

- TSF No. 6 will be operational throughout the duration of the Project (15 years);
- Existing TSF No. 7, TSF No. 6 and TSF No. 4 & No. 5 will be re-mined;
- Existing, however inactive TSFs, namely:
  - TSF No. 1;
  - DTSF No.1;
  - DTSF No. 2;
  - DTSF No. 3; and
- TSF No. 4 & No. 5, which are currently partially reclaimed serve as an alternative deposition site which may be operational during the LOM.

The material stored within these facilities are relatively fine in grain size, exposed to air and moisture during deposition or as precipitation infiltrates. These conditions allow for chemical reactions that potentially produce leachate. The severity of the chemical concentrations of the leachate will then vary based on the extent of the leachate formation conditions mentioned above and the constituents of the parent material. More detail regarding the definition of the potential contamination source is found in Section 8.4.11.

As TSF 7 and 6 are progressively mined during operation, the risk to the groundwater environment will reduce as a potential contamination source will be undergoing depletion throughout this process.

#### 8.4.4.3 *Potential Receptors*

Potential receptors are the parts of the system in and around the project area, which may be impacted negatively if the groundwater quality deteriorates as a result of the TSFs. The potential receptors are identified as humans that use groundwater for domestic use and surface water bodies that receive baseflow.

As part of the hydrocencus, Digby Wells undertook a desktop study to identify existing boreholes from the data available. No private boreholes were identified during the desktop assessment however there are settlements (Carletonville, Welverdiend, Wedela and Khutsong) surrounding the mine which potentially could have boreholes currently or in future, making use of the groundwater as source of the water supply.

Dams and non-perennial streams (draining towards the Mooirivierloop), within the project area may be affected should the groundwater be contaminated, and they receive baseflow.

### 8.4.5 Surface Water

The baseline information provided herein is summarised from the Surface Water Impact Assessment report, attached as Appendix 6. The water quality monitoring localities are shown in Plan 4, Appendix 3.

The project is located in the Vaal Water Management Area 5 (WMA 5), with the proposed Project footprint falling within quaternary catchment C23E. This quaternary catchment lies in the Mooirivierloop Catchment, to the north and Loopspruit to the south of the Tailings Treatment Plant. The Mooi River has smaller tributaries which include the Wonderfonteinspruit which joins the Mooi at a point adjacent to the Project area. The Mean Annual Precipitation (MAP), Mean Annual Runoff (MAR) and Mean Annual Evaporation (MAE) of the region were calculated to be 634 mm, 7.1 mm and 1 675 mm, respectively (Table 8-8). The MAP indicates moderate to high rainfall for the region of which approximately 1% is redistributed as surface runoff.

**Table 8-8: Mean Annual Rainfall, Runoff and Evaporation for Quaternary C23E**

| Month | Rainfall (mm) | Runoff (mm) | Evaporation (mm) |
|---|---|---|---|
| Oct | 56.6 | 0.4 | 183.7 |
| Nov | 85.9 | 0.5 | 190.8 |
| Dec | 101.7 | 0.7 | 207.2 |
| Jan | 109.2 | 0.9 | 204.9 |

| Month | Rainfall (mm) | Runoff (mm) | Evaporation (mm) |
|---|---|---|---|
| Feb | 91.2 | 1.1 | 165.2 |
| Mar | 84.1 | 0.9 | 150.1 |
| Apr | 49.4 | 0.6 | 109.7 |
| May | 18.0 | 0.5 | 82.7 |
| Jun | 7.8 | 0.4 | 63.3 |
| Jul | 4.7 | 0.4 | 70.7 |
| Aug | 7.1 | 0.4 | 102.5 |
| Sep | 18.7 | 0.4 | 144.2 |
| **Annual** | **634** | **7.1** | **1675** |

From the DWS' water use database, the registered water users within the affected quaternary catchments include mining, irrigation, livestock watering and industry, urban and non-urban. However, the predominant use of surface water is irrigation and livestock watering.

Available surface water quality data was obtained from the client for the period April 2014 to August 2018 for the Project area. Details of the monitoring points and surface water chemistry results are presented in the following subsections. The water quality monitoring is being undertaken at eight sampling points. The location and description of historical, current and proposed monitoring localities are presented in Table 8-9 and Figure 8-5.

**Table 8-9: Location and Description of Surface Water Quality Monitoring Points at the Project Site**

| Sample Number | Description | Coordinates (Latitude/Longitude) | |
|---|---|---|---|
| DRD 3 | Shaft 4 Discharge | -26.383882° | 27.382833° |
| DRD 10 | Shaft 6 Discharge | -26.407145° | 27.326735° |
| DRD 7 | Downstream of Shaft 6 in canal between the Doornfontein TSF | -26.376051° | 27.336066° |
| DRD 12 | End of Doornfontein canal | -26.372292° | 27.254210° |
| DRD 8 | Upstream of canal in Wonderfonteinspruit | -26.367098° | 27.270639° |
| DRD 9 | Downstream of canal in Wonderfonteinspruit | -26.370242° | 27.248049° |
| WWS34 | South of Blyvoor RWD | -26.415862° | 27.406061° |
| BV81L | Southeast of Blyvoor RWD | -26.422499° | 27.403025° |

The water quality at each monitoring point is analysed for a comprehensive list of parameters which include pH, Total Dissolved Solids (TDS), Electrical Conductivity (EC), Sulphates ($SO_4$), Uranium (U), and Cyanide Dissolved (CN) which are the main six parameters.

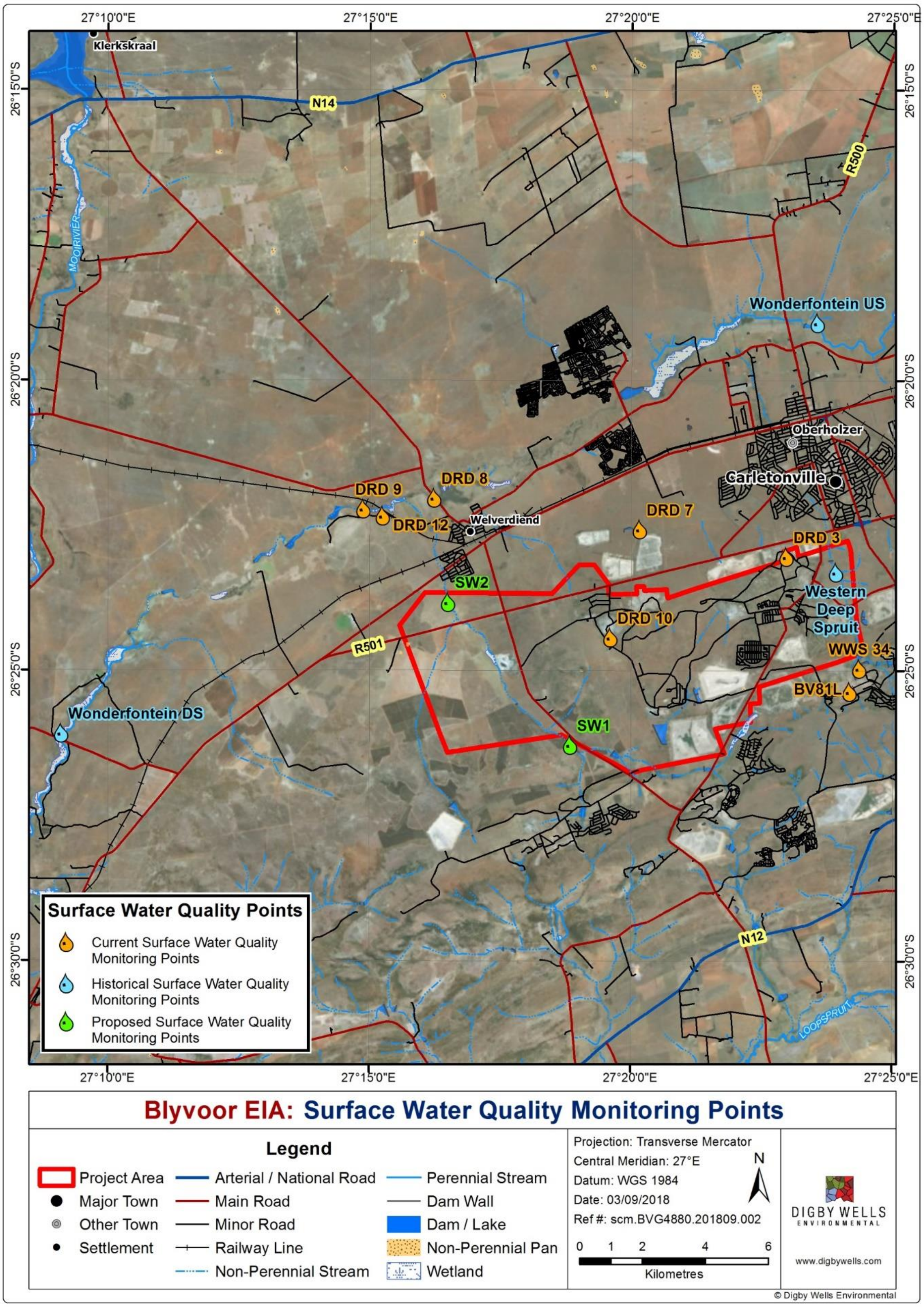



**Figure 8-5: Water Quality Monitoring Points at the Project Site**

## Table 8-10: Baseline Water Quality

| Parameter | Result |
|---|---|
| pH | The surface water pH of most samples except DRD 7 and DRD 12, are within acceptable levels with respect to DWS irrigation target values. A considerable drop in pH was noted at point WWS34 at the end of 2016 which indicates temporary acid contamination at this point. This point is upstream of the Blyvoor lease area, therefore, other pollution sources excluding the Blyvoor Gold should be responsible for this drop in pH. Water quality at BV81L also shows acid contamination for the period mid- 2017 to August 2018 |
| Electrical Conductivity | Points DRD 08 and DRD 09 show acceptable Electrical Conductivity (EC) levels with respect to the Resource Water Quality Objectives (RWQO) for the Mooi River catchment throughout the 2014 to August 2018 monitoring period. DRD 03, DRD 07, DRD 10 and DRD 12 indicate acceptable EC levels beginning January 2017 to August 2018. The water quality monitoring which occurred during mid-2017 to August 2018 indicate high but declining EC and Total Dissolved Solids (TDS) levels at the BV81L monitoring site. |
| Nitrate | Acceptable nitrate levels are indicated for the monitoring period April 2014 to August 2018 except for a short period in mid-2014, where only point WWS34 had nitrate levels below the RWQO for the Mooi River catchment. This result shows that faecal pollution in the water is absent or minimal which provides a suitable environment for aquatic ecosystems including fish. |
| Metal Toxins | Generally, Lead (Pb) levels are slightly above the RWQO during most of the monitoring period from April 2014 to August 2018. Cadmium (Cd) and Uranium (U) monitored at BV81L and WWS34 points generally indicate higher concentrations than the recommended RWQO. Selenium levels are acceptable at all monitored points except at WWS34. Higher metal toxins at BV81L and WWS34 can be attributed to either industrial operations at Western Deep Levels, spillages from waste water dams upslope of BV81L or from operations at Savuka Mine. Aluminium (Al) levels fluctuated slightly above the RWQO from 2014 to 2017, from where a decline to acceptable limits occurred until the August 2018 period |
| Cyanide | Cyanide is used in the extraction of gold from low-grade ore by converting the gold to a water-soluble coordination complex. It is the most commonly used leaching process for gold extraction. As such, cyanide is one of the major potential pollutants at any gold mine. Monitoring of cyanide at Blyvoor Gold is underway and cyanide levels are acceptable (<0.02 mg/l) being lower than the DWS Aquatic Ecosystem and the World Health Organisation (WHO) target water quality value of 0.1 mg/l (DWA, 1996; WHO, 2016) |

### 8.4.6 Regional Flora

The baseline information provided herein is summarised from the Biodiversity Impact Assessment report, attached as Appendix 7.

The project area falls within Carletonville Dolomite Grassland to the North with patches of Gauteng Shale Mountain Bushveld to the South, as described by Mucina and Rutherford (2006).

#### 8.4.6.1 *Carletonville Dolomite Grassland*

This vegetation unit mainly occurs in the North-West Province but also in Gauteng and marginally into the Free State Province. It is distributed in the region of Potchefstroom, Ventersdorp and Carletonville, extending westwards to the vicinity of Ottoshoop, but also occurring as far east as Centurion and Bapsfontein in Gauteng Province. The altitude ranges from 1360-1620 m.

This vegetation occurs on slightly undulating plains dissected by prominent rocky chert ridges. It forms a complex mosaic pattern dominated by many species. Grasses such as: *Loudetia simplex* (Common Russet Grass), *Hyparrhenia hirta* (Common Thatching Grass), *Brachiaria serrata* (Velvet Signal Grass) and *Heteropogon contortus* (Spear Grass) are prominent while shrubs such as: *Euclea undulata* (Common Guarri), *Searsia magalismontana* (Berg Taaibos), *Zanthoxylon capense* (Small Knobwood) and *Diospyros lycioides* (Bluebush) are scattered in protected places (e.g. among rocks and boulders). The geology of this vegetation unit consists of dolomites and cherts of the Malmani subgroup from the Transvaal super group.

Conservation status is currently considered vulnerable, with only a small extent conserved in statutory reserves (Sterkfontein Caves – part of the Cradle of Humankind World Heritage Site, Oog Van Malmani, Abe Bailey, Boskop Dam, Schoonspruit, Krugersdorp, Olifantsvlei, and Groenkloof) and in at least six private conservation areas. Almost a quarter of the vegetation type has already been transformed by cultivation, urban sprawl or by mining activities as well as construction of the Boskop and Klerkskraal Dams. According to the Department of Agriculture's Predicted Soil Loss data in the vegeatation type. Percentages indicate tonnes/ha/annum; more than 60% is considered very high, 26-60% is high, 6-12% is low, and very low 0-5%. Erosion within this vegetation type varies between 84% and 15%.

#### 8.4.6.2 *Gauteng Shale Mountain Bushveld*

This vegetation unit occurs in Gauteng and North-West Provinces, mainly on the ridge of the Gatsrand south of Carletonville–Westonaria–Lenasia and at altitudes from 1 300 to 1 750 m. It occurs on low broken ridges varying in steepness and generally with a high surface rock cover. The vegetation is a short (3 to 6 m), semi-open thicket, dominated by a variety of woody species such as: *Acacia caffra*, *Searsia leptodictya*, *Cussonia spicata* and *Englerophytum magalismontanum*. The understory is dominated by grasses such as: *Cymbopogon pospischilii* and *Digitaria eriantha*. Some of the ridges form plateaus that carry scrubby grassland. The geology consists of shale and andesite from the Pretoria group (Transvaal supergroup).

Conservation status is currently considered to be Vulnerable, statutorily conserved in Skanskop and Hartebeesthoek Nature Reserves, Magaliesburg Nature Area and Groenkloof National Park. Approximately 21% of the entire vegetation unit is transformed mainly by urban and built up areas, mines and quarries, cultivation and plantations. Wattle is a common invader plant species.

#### 8.4.6.3 *Plant Possible Species of Special Concern*

The study site lies within three Quarter Degree Square (QDS) grids, namely 2627AD. According to the PRECIS, no Red Data species are expected to occur for the QDS for each of the sites. The list of expected plant species in the study area can be found in Appendix B of the Biodiversity Report attached to this report as Appendix 7.

The Plants of South Africa (http://posa.sanbi.org) website list was obtained from the SANBI website, it lists all the Red Data plant species officially recorded by SANBI for Quarter degree square grid. For a plant species to be included in this list, a specimen collected in this grid must be supplied to SANBI. This list is therefore not a comprehensive list representing only those species that may occur in these grids, but rather a guideline as to what is likely to occur here. The sites sampled are also only a very small portion of the whole grid and habitats suitable for certain species in these POSA lists may not be present at the sites sampled. It is therefore not unusual for species in the POSA list to be absent from the sampling sites.

Certain species included in the below list was confirmed by scrutinising previous specialist studies that were undertaken in the past. SSC likely to occur on site are listed in Table 8-11.

**Table 8-11: Plant SSC likely to occur on site**

| Plant species | Status |
|---|---|
| *Kniphofia typhoides* | NT (confirmed) |
| *Trachyandra erythrorrhiza* | NT (confirmed) |
| *Hypoxis hemerocallidea* | Declining (confirmed) |
| *Eucomis autumnalis subsp. clavata* | Not Evaluated (confirmed) |
| *Boophone disticha* | *Declining* |
| *Adromischus umbraticola subsp. umbraticola* | NT |
| *Drimia sanguinea* | NT |

| Plant species | Status |
|---|---|
| *Khadia beswickii* | VU |

### 8.4.7 Fauna

The baseline information provided herein is sourced from the Biodiversity Impact Assessment report, attached as Appendix 7.

Fauna expected to occur on site include assemblages within terrestrial and wetland ecosystems: mammals, birds, reptiles, amphibians and invertebrates. Each of these assemblages occurs within unique habitats and the ecological state of these habitats directly relates to the number of species found within them. The main habitats occurring in the project area are grassland plains and pans, with little altitudinal variation.

#### 8.4.7.1 *Mammals*

A database search for mammal species that have been recorded in the three QDS grids (2627 AD) on the virtual museum of the Animal Demography Unit (ADU) (http://www.adu.org.za). This database forms part of the Department of Biological Science at the University of Cape Town. No recent records of mammals have been recorded in the study area. The limited vegetation types, and the current condition of the Project site limits the variety of mammal species expected on site, however, mammals recorded in Gauteng and six of these species may occur are indicated below in Table 8-12 as per ADU database searches.

**Table 8-12: Expected Mammal Species**

| Family | Genus | Common name | Red list category (IUCN 2018-1) |
|---|---|---|---|
| Sciuridae | *Xerus (Geosciurus) inauris* | South African Ground Squirrel | LC |
| Bovidae | *Connochaetes gnou* | Black Wildebeest | LC |
| Bovidae | *Alcelaphus buselaphus caama* | Red Hartebeest | Not Evaluated |
| Bovidae | *Taurotragus oryx* | Eland | Not Evaluated |
| Bovidae | *Antidorcas marsupialis* | Springbuck | LC |
| Bovidae | *Kobus ellipsiprymnus* | Water Buck | Not Evaluated |

#### 8.4.7.2 *Avifauna*

According to the South African Bird Atlas Project (SABAP2), 319 species of birds have been identified in the area, and the majority of these birds are Grassland species. All birds that could be present within QDS 2627 AD, are listed in Appendix A of the Biodiversity Report, attached as Appendix 7 to this report. Of these species, 10 have been assigned an international Red Data status with one Endangered, six Near Threatened, and three Vulnerable species recorded. These species are listed in the Table 8-13 below.

**Table 8-13: Red Data bird species**

| Common Name | Scientific Name | Red Data Status SA Red Data Status (2018); (IUCN 2018-1) |
|---|---|---|
| Maccoa Duck | *Oxyura maccoa* | NT*, VU* |
| Lesser Flamingo | *Phoenicopterus minor* | NT*, NT* |
| Grass Owl | *Tyto capensis* | VU*, LC* |
| Black Winged Pratincole | *Glareola nordmanni* | NT*, NT* |
| Blue Korhaan | *Eupodotis caerulescens* | LC*, NT* |
| European Roller | *Coracias garrulus* | NT*, LC* |
| Pallid Harrier | *Circus macrourus* | NT*, NT* |
| White Backed Vulture | *Gyps africanus* | CR*, CR* |
| Cape Vulture | *Gyps coprotheres* | EN*, EN* |
| Secretarybird | *Sagittarius serpentarius* | VU*, VU* |

Key: NT-Near Threatened, VU-Vulnerable, LC- Least Concerned, CR-Critically Endangered.

### 8.4.7.3 *Reptiles*

The presence of rocky out crops within a study area is could mean the presence of reptile species. According to the South African Reptile Conservation (SARCA) ADU's virtual museum, a total of 14 species have been recorded in this QDS in the past (http://sarca.adu.org.za/). These species are listed in Table 8-14.

**Table 8-14: Expected Reptiles**

| Scientific name | Common name | Red list Category (SARCA 2014) |
|---|---|---|
| *Agama atra* | Southern Rock Agama | Least Concern |
| *Dasypeltis scabra* | Rhombic Egg-eater | Least Concern |
| *Cordylus vittifer* | Common Girdled Lizard | Least Concern |
| *Hemachatus haemachatus* | Rinkhals | Least Concern |

| Scientific name | Common name | Red list Category (SARCA 2014) |
|---|---|---|
| *Lygodactylus capensis capensis* | Common Dwarf Gecko | Least Concern |
| *Pachydactylus capensis* | Cape Gecko | Least Concern |
| *Gerrhosaurus flavigularis* | Yellow-throated Plated Lizard | Least Concern |
| *Aparallactus capensis* | Black-headed Centipede-eater | Least Concern |
| *Boaedon capensis* | Brown House Snake | Least Concern |
| *Psammophis trinasalis* | Fork-marked Sand Snake | Least Concern |
| *Psammophylax rhombeatus rhombeatus* | Spotted Grass Snake | Least Concern |
| *Trachylepis varia sensu lato* | Common Variable Skink Complex | Least Concern |
| *Afrotyphlops bibronii* | Bibron's Blind Snake | Least Concern |
| *Causus rhombeatus* | Rhombic Night Adder | Least Concern |

#### 8.4.7.4 *Amphibians*

No previous records of amphibians that occur on site were found on the SARCA website (http://sarca.adu.org.za/). The Near threatened Giant Bullfrog (*Pyxicephalus adspersus)* could have been expected on site due to available habitat, before the mine commenced construction.

#### 8.4.7.5 *Invertebrates*

Butterflies are a good indication of the habitats available in a specific area (Woodhall 2005). Although many species are eurytropes (able to use a wide range of habitats) and are widespread and common, South Africa has many stenotrope (specific habitat requirements with populations concentrated in a small area) species which may be very specialised (Woodhall 2005). Red Data species expected to occur on site are the Marsh sylph (*Metisella meninx*), Roodepoort Copper (*Aloeides dentatis dentatis VU*) and Highveld Blue (*Lepidochrysops praeterita EN*).

### 8.4.8 Wetlands

The baseline information provided herein is summarised from the Surface Water Impact Assessment report, attached as Appendix 7. The wetland delineation done for the site is shown in Plan 7, Appendix 3.

#### 8.4.8.1 *Wetland delineation and classification*

Three primary hydrogeomorphic (HGM) units were identified within the Blyvoor Gold Mining Right Area (MRA) at the time of the assessment. A large channelled valley bottom wetland (HGM Unit 1) was identified on the western portion of the project area, with the upper reaches of the system stretching from the south-western border of the mining rights area. An unchannelled valley bottom wetland (HGM Unit 2), originating from the central portion of the mining rights area, in the vicinity of TSF No.6, joins HGM Unit 1 downstream of the Project and Anglo Gold TSF and mining operations. To the east, is a channelled valley bottom system (HGM Unit 3) stretching from the northern to the southern border of the MRA. The breakdown of the wetland types per area is detailed in Table 8-15 and illustrated in Figure 8-6.

**Table 8-15: Wetland HGM Units**

| HGM Unit | HGM Unit Type | Area (ha) |
|---|---|---|
| 1 | Channelled Valley Bottom | 193.69 |
| 2 | Un-channelled Valley Bottom | 67.66 |
| 3 | Channelled Valley Bottom | 39.03 |

The buffer zones relating to the wetlands are illustrated in Figure 8-7. Zones of Regulation of 100m around each wetland have been assigned according to the regulations on use of water for mining and related activities aimed at the protection of water resources (GN R704 in GG 20119 of 4 June 1999).

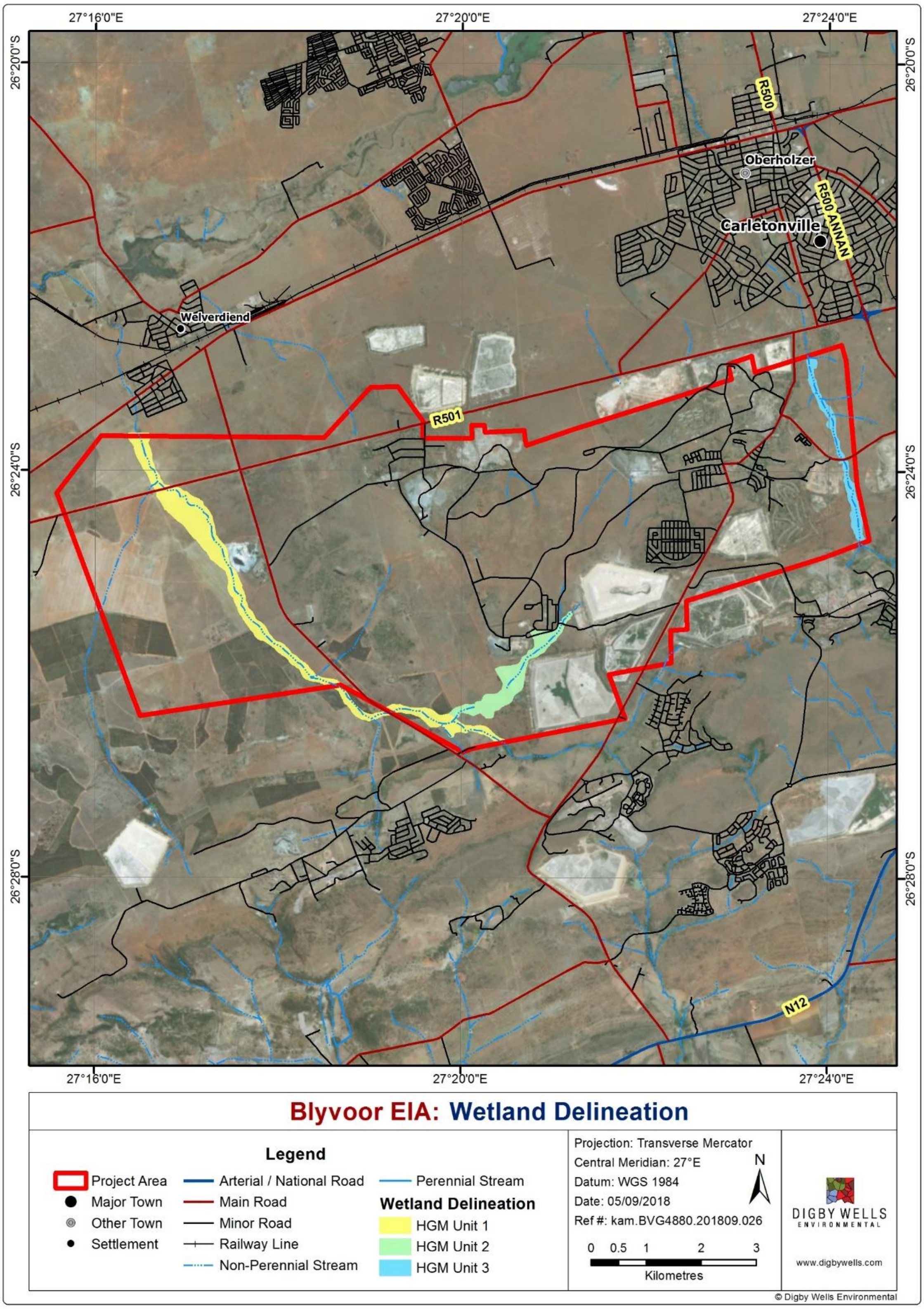



**Figure 8-6: Wetland Delineation**

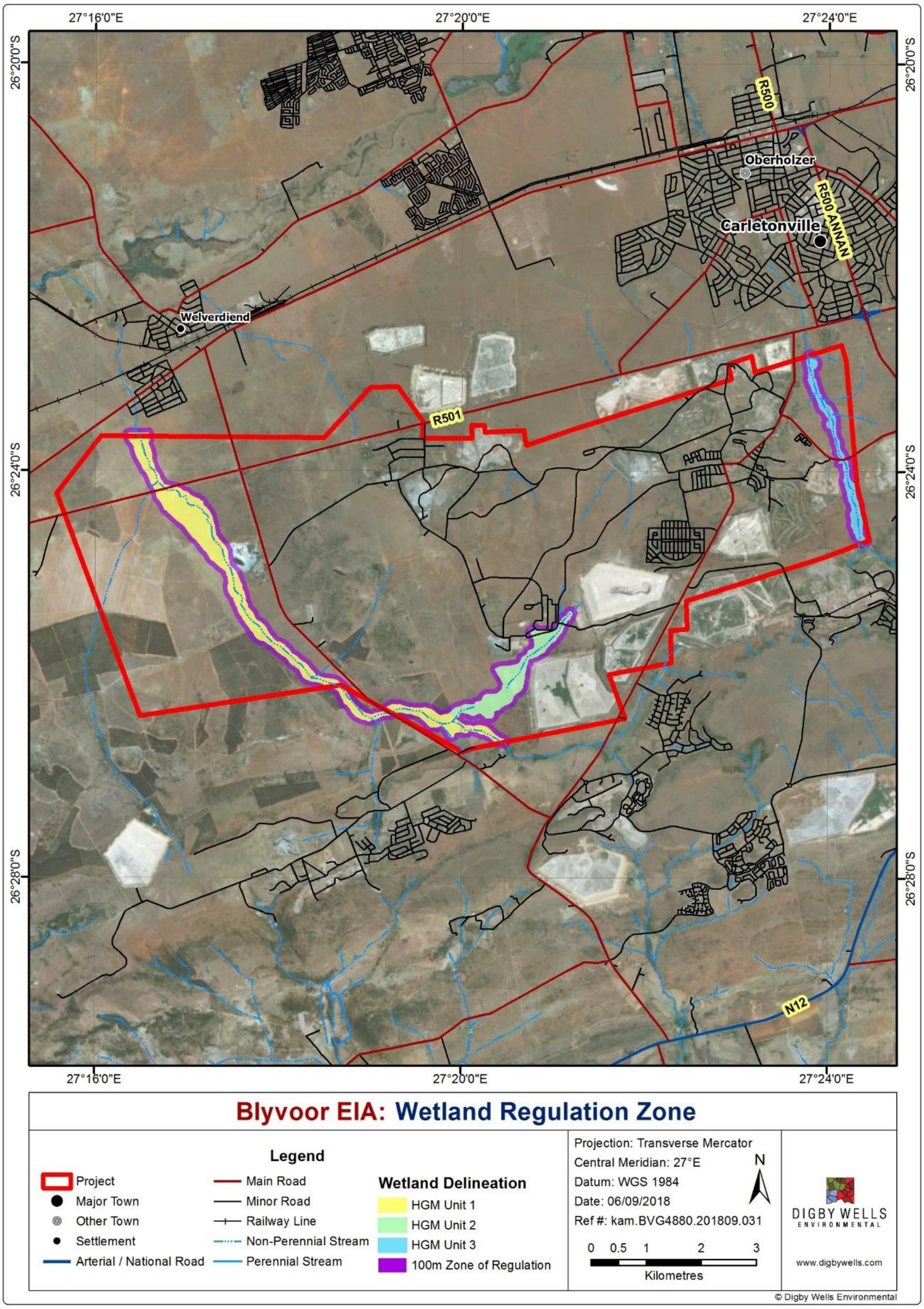



**Figure 8-7: Wetland Regulation Zones**

#### 8.4.8.2 HGM Unit 1

The temporary zone of the upper reaches of HGM Unit 1 are dominated by *Eragrostis curvula*, *Eragrostis plana, Elionuris muticus* and *Themeda triandra*. Within the seasonal and permanent zones, dense stands of *Phragmites* sp., *Typha capensis* and *Juncus effusus* were observed. Some impacts along this portion of the system include small impoundments, which alter the geomorphology and hydrology of the system, several culverts and small concrete channels were also observed intermittently along the length of this portion of HGM Unit 1.

Further downstream, on the north-western portion of this system, dense patches of *Eucalyptus* and *Seriphium plumosum* encroach into the temporary and seasonal zones of the wetland. A slightly larger impoundment was observed downstream of a large road crossing, where some water abstraction activities were taking place. A stone quarry is situated adjacent to HGM Unit 1 and encroaches into the temporary and seasonal zones.

Some water abstraction activities related to the quarry were observed at the time of the assessment. Other impacts include soil hardening and compaction at various points for road and fence crossings, erosion and the associated loss of vegetation cover as well as some sedimentation instream. Limited cattle grazing activities within the area may further aggravate the erosion and sedimentation observed in areas where erosion has already occurred. Dominant species observed within the temporary zone of this portion of the wetland include *Eragrostis plana, Eragrostis gummiflua, Themeda triandra* and *Cynodon dactylon*. Seasonal zones comprised mainly of *Eragrostis gummiflua* and *Andropogon eucomus*, while the permanent zone species included stands of *Juncus effusus, Typha capensis, Nasturtium officinale* and *Marsilea macrocarpa.* See Table 8-16 for a complete list of species identified in HGM Unit 1.

**Table 8-16: Plant species identified in HGM Unit 1**

| Species name | Temporary | Seasonal and permanent |
|---|---|---|
| *Cynodon dactylon* | x | x |
| *Andropogon eucomus* | | x |
| *Eragrostis capensis* | | x |
| *Elionurus muticus* | x | |
| *Eragrostis curvula* | x | |
| *Eragrostis gummiflua* | x | x |
| *Eragrostis plana* | x | x |
| *Eucalyptus sp.* | x | |
| *Juncus effusus* | | x |

| Species name | Temporary | Seasonal and permanent |
|---|---|---|
| *Phragmites sp.* | | x |
| *Typha capensis* | | x |
| *Verbena bonariensis** | | x |
| *Themeda triandra* | x | |
| *Digitaria eriantha* | x | |
| *Seriphium plumosum* | x | |
| *Persicaria sp.** | | x |
| *Nasturtium officinale** | | x |
| *Marsilea macrocarpa* | | x |

* denotes alien species


**Figure 8-8: Habitat of the downstream portion of HGM Unit 1 (A: Wetland habitat; B: Culverts; C: Dump; D Wetland habitat; E: Invasive species, Eucalyptus; F: Impoundment)**


**Figure 8-9: Habitat of the upstream portion of HGM Unit 1 (A: Wetland habitat; B: Seriphium plumosum, an indigenous invader; C: Wetland habitat; D: Impoundment)**

#### 8.4.8.3 *HGM Unit 2*

This HGM Unit has been severely impacted in terms of hydrology and geomorphology. Several trenches and roads cross this wetland, resulting in fragmentation of the system, soil hardening and loss of flow to the areas directly downstream of each structure. Some impact in terms of dust pollution associated with the TSF and potentially other surrounding TSFs was observed. In addition, a number of dams were observed along the length of this system, including the Anglo RWD associated with the neighbouring Anglo TSF, which has resulted in a severe modification to this wetland system both upstream in terms of inundation and alterations to water quality, as well as downstream in terms of desiccation of the wetland. The downstream portion of this HGM Unit is characterised by large areas of soil disturbance, loss of natural vegetation and erosion. See Table 8-17 for a complete list of species identified in HGM Unit 2.

**Table 8-17: Plant species identified in HGM Unit 2**

| Species name | Temporary | Seasonal and permanent |
|---|---|---|
| *Cynodon dactylon* | x | |
| *Eragrostis curvula* | x | |
| *Eragrostis gummiflua* | x | |
| *Eragrostis plana* | x | |
| *Hyparrhenia hirta* | x | |
| *Juncus effusus* | x | x |
| *Phragmites sp.* | | x |
| *Themeda triandra* | x | |
| *Typha capensis* | | x |
| *Verbena bonariensis** | | x |

* denotes alien species


**Figure 8-10: Habitat representational of HGM Unit 2 (A: Dense *Phragmites* stands; B: Trenches dug within the wetland; C: Dried out wetland habitat; E: Impoundment; F: A trench that has been dug being invaded by alien species)**

#### 8.4.8.4 HGM Unit 3

The temporary zone of this system was dominated by *Bidens pilosa, Cosmos bipinnatus, Eragrostis curvula* and *Setaria sphacelata*. In the seasonal and permanent zones, large *Salix babylonica* and dense stands of *Populus x canescens* were observed, with a sparse understory. Species observed included *Typha capensis*, stands of *Phragmites* sp., *Tagetes minuta, Juncus effusus* and *Lemna* sp. See Table 8-18 for a complete list of species identified in HGM unit 3.

Evidence of artisanal mining along the length of this system included soil disturbance, digging within the seasonal and permanent zones, salt crystallisation at the waters' edge and remnants of equipment used.

**Table 8-18: Plant species identified in HGM Unit 3**

| Species name | Temporary | Seasonal and permanent |
|---|---|---|
| *Asparagus sp.* | | x |
| *Bidens pilosa** | x | |
| *Cosmos bipinnatus** | x | |
| *Cynodon dactylon* | x | |
| *Eragrostis curvula* | x | |
| *Juncus effusus* | | x |
| *Lemna sp.* | | x |
| *Phragmites sp.* | | x |
| *Populus x canescens** | | x |
| *Salix babylonica** | | x |
| *Setaria sphacelata* | x | |
| *Tagetes minuta** | | x |
| *Typha capensis* | | x |

* denotes alien species


**Figure 8-11: Habitat representational of HGM Unit 3 (A: Wetland habitat; B: pipelines within the wetland; C: Wetland habitat; D: *Typha* stands; E: A road within the wetland; F: Dense *Typha* stands)**

### 8.4.8.5 *Sensitivity of the Site*

#### *8.4.8.5.1 Present Ecological State*

Table 8-19 indicates the PES scores for the various HGM Units.

HGM Unit 1 obtained a PES Category C (Moderately Modified) on application of the WET-Health assessment tool and may be regarded as moderately modified from its pristine reference state.

HGM Unit 2 obtained a PES Category E (Seriously Modified) on application of the WET-Health assessment tool and may be regarded as seriously modified from its pristine reference state.

HGM Unit 3 was assigned a PES Category D (Largely Modified) on application of the WET-Heath assessment tool based on modifications to the geomorphology as well as the vegetation structures of this system.

**Table 8-19: Present Ecological Health Scores**

| HGM Unit | Hydrological Health Score | Geomorphological Health Score | Vegetation Health Score | Final Ecological Health Score | PES Score |
|---|---|---|---|---|---|
| **1** | 1 | 0.5 | 7.8 | 2.8 | C |
| **2** | 7 | 2.1 | 8.4 | 6 | E |
| **3** | 6 | 0.9 | 6.4 | 4.6 | D |

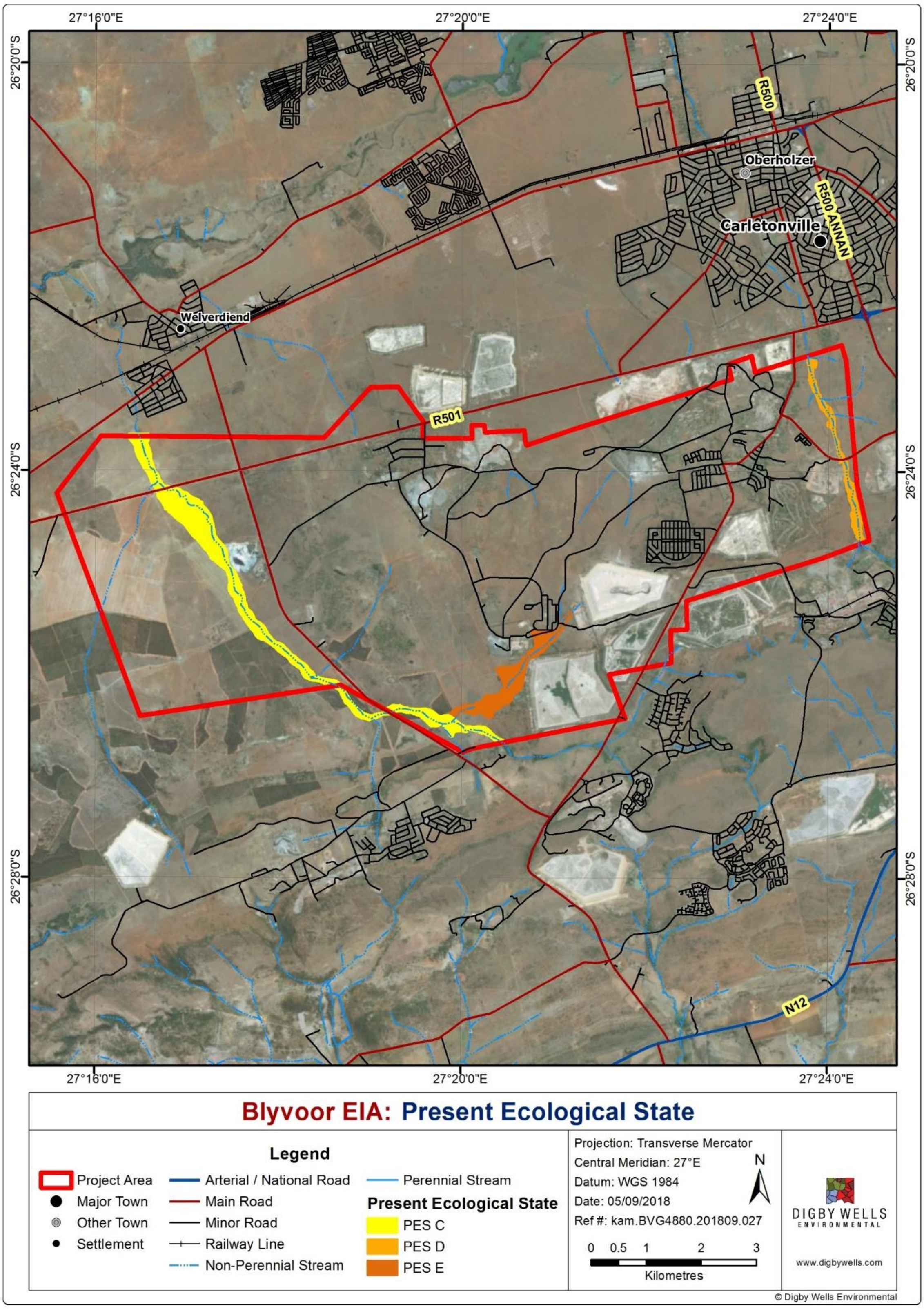



**Figure 8-12: Present Ecological State**

#### *8.4.8.5.2 Ecological Importance and Sensitivity*

Table 8-20 indicates the EIS scores for various HGM units.

HGM Unit 1 may be regarded as High (2.3) in terms of sensitivity to flow and habitat modifications as well as in terms of biodiversity maintenance and habitat provision.

HGM Unit 2 may be regarded as Moderate (1.8). This score may be largely attributed to the unchanneled valley bottom nature of this system, which will play a key role in terms of stream flow regulation and flood attenuation as well as in the provision of habitat.

HGM Unit 3 may be regarded as Moderate (1.5). However, this score may be largely attributed to the channelled valley bottom nature of this system, which will play a key role in terms of stream flow regulation and flood attenuation as well as in the provision of habitat. In terms of Hydrological Importance as well as Direct Human Benefits, this HGM Unit may be regarded as Low (0.8 and 0.2, respectively).

**Table 8-20: EIS Scores**

| HGM Unit | Ecological Importance & Sensitivity | Hydrological/Functional Importance | Direct Human Benefits | Final EIS Score | Final EIS Category |
|---|---|---|---|---|---|
| 1 | 2.3 | 1.9 | 1 | 2.3 | High |
| 2 | 1.8 | 1.3 | 0.1 | 1.8 | Moderate |
| 3 | 1.5 | 0.8 | 0.2 | 1.5 | Moderate |

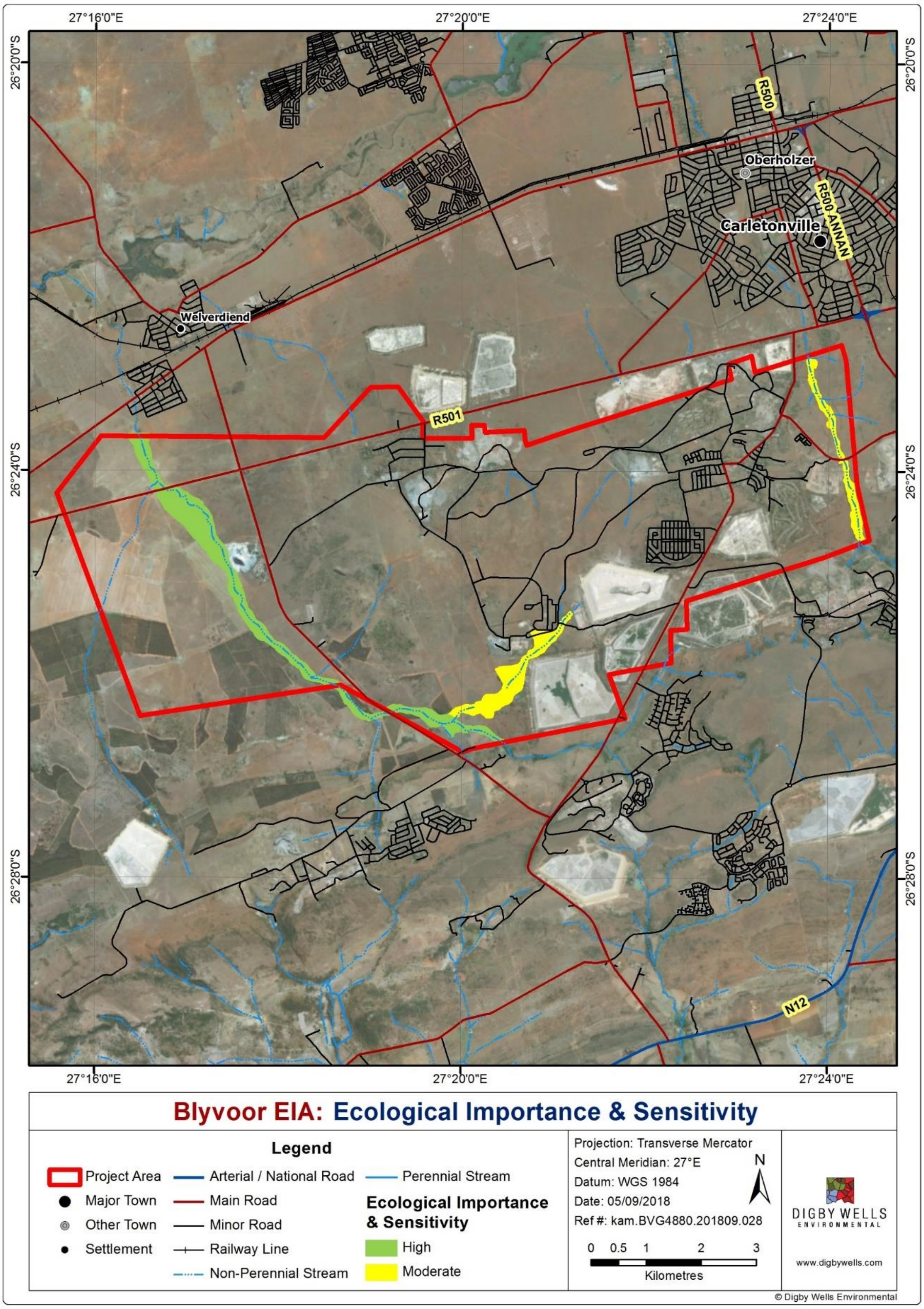



**Figure 8-13: Ecological Importance and Sensitivity**

### 8.4.9 Aquatic Biodiversity

The baseline information provided herein is sourced from the Biodiversity Impact Assessment report, attached as Appendix 7. The Aquatic monitoring points are shown in Plan 6, Appendix 3.

Figure 8-14 displays the locations of the biomonitoring and water quality sites assessed within the MRA during the August 2018 baseline assessment. Two unnamed river reaches were observed within the MRA, namely, C23E-01465 (represented by sites BVG1, BVG2 and BVG3) and C23E-01436 (represented by site BVG4). These systems form part of the Mooirivierloop catchment, however, according to the PESEIS database (2014), these systems are not connected to the main stem of the Mooirivierloop and thus, further investigation of these river reaches was not undertaken. Furthermore, for information purposes, three additional points, considered unsuitable for the application of the SASS5 and MIRAI assessment methodologies, were assessed for water quality only (represented by sites BVG_WQ1, BVG_WQ2 and BVG_WQ3).

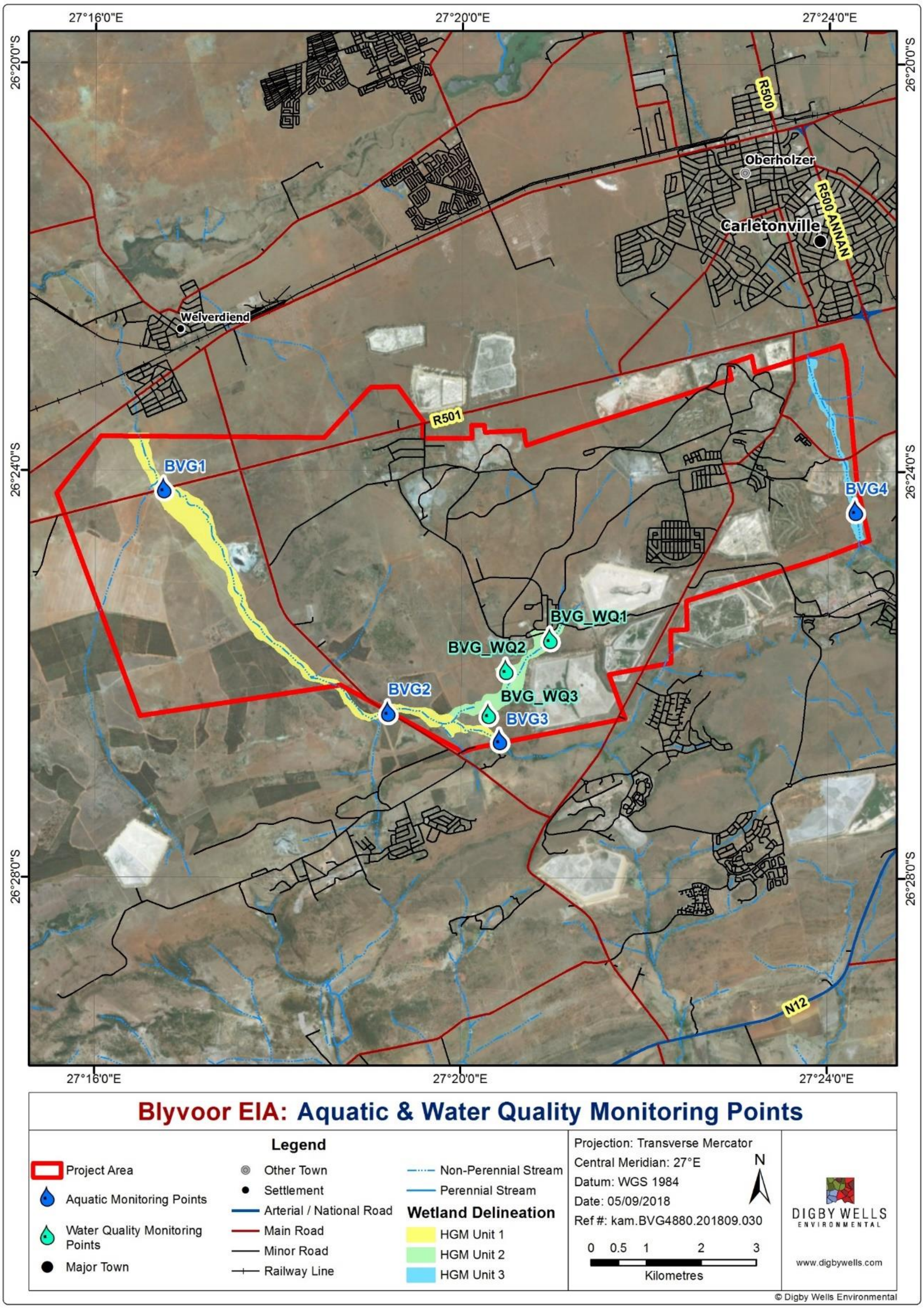



**Figure 8-14: Aquatic and Water Quality Monitoring Points**

#### 8.4.9.1 *Water Quality Assessment*

Due to the highly dynamic nature of flowing systems, water quality conditions have been known to vary both on a temporal and spatial scale within a watercourse (Dallas and Day, 2004). Despite these variations, the assessment of *in situ* water quality variables is important for the interpretation of results obtained during biological investigations, as aquatic organisms are influenced by the environment in which they live. *In situ* water quality findings recorded during the survey are presented in Table 8-21.

**Table 8-21: In-situ Water Quality Findings**

| Site | Guideline Values | BVG1 | BVG2 | BVG3 | BVG4 | BVG_WQ1 | BVG_WQ2 | BVG_WQ3 |
|---|---|---|---|---|---|---|---|---|
| Temperature (ºC) | - | 6.6 | 11.8 | 15.9 | 14.5 | 12.4 | 15.7 | 17.8 |
| pH | 6.5-9 | 8.22 | 8.27 | 8.25 | 8.75 | 7.29 | 7.71 | 10.43 |
| Conductivity (µS/cm) | | 2750 | 12430 | 2450 | 12620 | 1158 | 1420 | 958 |
| Dissolved oxygen (mg/L) | >5 | 10.41 | 10.68 | 10.80 | 15.15 | 5.78 | 7.30 | 12.64 |
| Saturation percentage | 80-120 | 86.1 | 96.3 | 97.9 | 146.6 | 51.7 | 76.6 | 152.8 |

*Red shading indicates constituents exceeding recommended guidelines

Most aquatic systems within South Africa are relatively well-buffered, as a result of dissolved bicarbonate/carbonate ions originating from exposed geological formations and atmospheric deposits, and as such, these systems are expected to exhibit close-to-neutral pH levels (i.e. pH 6.5-9; Department of Water Affairs and Forestry, 1996; Dallas & Day, 2004). The pH values observed within the MRA may thus be regarded as somewhat alkaline, however, as these values fall within the recommended guideline values, with the exception of BVG_WQ 3, no negative impact to aquatic life in terms of the pH values are likely. Aquatic communities that were expected to be present at BVG_WQ 3 may have already been impacted due to the elevated pH level.

Electrical conductivity values recorded at the time of the survey were observed to exhibit extremely high levels, with special mention of sites BVG2 and BVG4. These observations serve as an indication of some contribution of dissolved salts or pollutants to the system. At site BVG2, some impact may be expressed as a result of a tailings spill observed in the upper reaches of the system at the time of the assessment (therefore not associated with the Project area). This cannot be confirmed with certainty and further investigation into other point and diffuse sources of pollution should be undertaken to suitably mitigate any potential impacts to the system. At site BVG4, elevated dissolved salt concentrations may be related to artisanal mining activities observed along the entire length of the system. However, other potential point and diffuse sources of pollution should be investigated to adequately confirm and mitigate impacts. No obvious spatial trends were observed between sites BVG1, BVG2 and BVG3.

Dissolved oxygen concentrations of 80%-120% saturation are considered adequate to protect all life stages of the vast majority of aquatic organisms that are endemic (or adapted) to inhabiting aerobic warm water habitats (Department of Water Affairs and Forestry, 1996). Furthermore, according to a study conducted by Nebeker, *et al*. (1996), dissolved oxygen concentrations of less than 5 mg/L are likely to limit the diversity and sensitivity of the aquatic communities likely to occur at each site. At the time of the assessment, all dissolved oxygen concentrations exceeded the minimum of 5 mg/L. However, should the percentage saturation be considered, the dissolved oxygen concentrations at sites BVG_WQ2 and BVG_WQ3 may be regarded as poor. At sites BVG4 and site BVG3_WQ3, the dissolved oxygen concentrations greatly exceeded the upper limit of 120% saturation (i.e. supersaturated). Some level of eutrophication at sites BVG4 and BVG_WQ3 is suspected based on the algal blooms observed at both sites.

#### 8.4.9.2 *Invertebrate Habitat Assessment System (IHAS)*

Site BVG1 exhibited poor habitat availability. While both marginal and aquatic vegetation were sampled, marginal vegetation was dominated by stems and shoots, thus minimising the suitability of this biotope to serve as a refuge area for colonisation by macro-invertebrates. Furthermore, sand and mud dominated the remaining available substrate, with no gravel or stones habitats available. Sites BVG2 and BVG3 presented a diversity of habitat conditions, stones in and out of current, gravel-sand-mud, as well as vegetation, thus increasing the potential for habitat provision for aquatic organisms at these sites. Habitat availability at site BVG4 was considered severely compromised as a result of loss of bankside vegetation due to impacts related to large alien trees in the marginal riparian zones as well as activities related to artisanal mining. Stones in current were absent at this point at the time of the assessment, with marginal habitat limited to stems and stalks in pools. Limited aquatic vegetation was present. In terms of the remaining substrates, the site was severely affected by dredging and siltation and only mud substrates were available for sampling at this point at the time of the assessment.

**Table 8-22: IHAS findings**

| Site | BVG1 | BVG2 | BVG3 | BVG4 |
|---|---|---|---|---|
| **IHAS** | 40.00 | 70.91 | 78.00 | 27.27 |
| **Interpretation** | **Poor** | **Good** | **Very good** | **Poor** |

#### 8.4.9.3 *Macro-invertebrates*

Due to the differential sensitivities of aquatic macroinvertebrates, the composition of the aquatic macroinvertebrate community can provide an indication of changes in water quality and other ecological conditions within a watercourse. The use of the SASS has undergone numerous advances, culminating in Version 5 presently being utilised in river health studies along with the application of the MIRAI.

Based on the derived reference list and distribution, a total of approximately 45 different aquatic macroinvertebrate families were to be expected within the study area (based on locality, altitude, geomorphology, site structure and experience). Of these aquatic macroinvertebrate families, a total of only 21 taxa were collected at the time of the survey (including an alien Physidae), ranging from 8 families at the Site BVG4 to 13 families at Site BVG2. Accordingly, the corresponding SASS5 scores ranged from a low 21 to moderate 51 at the same respective sampling sites. The highest Average Score Per Taxon (ASPT) values were observed at Sites BVG2 and BVG3. Only one taxon, generally regarded as moderately sensitive to water quality impairment, was collected, namely Hydracarina (Water Mites).

**Table 8-23: SASS5 findings**

| Site | BVG1 | BVG2 | BVG3 | BVG4 |
|---|---|---|---|---|
| **SASS5** | 21 | 51 | 34 | 41 |
| **Taxa** | 8 | 13 | 9 | 12 |
| **ASPT** | 2.63 | 3.92 | 3.78 | 3.42 |
| **% of SASS5 Reference** | 10.19 | 24.76 | 16.51 | 19.90 |
| **% of ASPT Reference** | 57.42 | 85.59 | 82.53 | 74.67 |
| **Dallas 2007 Classification System** | E/F | E/F | E/F | E/F |

On consideration of the IHAS scores obtained for each assessment point respectively, some correlation between the reduced SASS5 score and the available habitat observed at site BVG1 is evident. At site BVG3, however, while the IHAS score served as an indication of “very good” habitat availability for colonisation by macro-invertebrates, the SASS5 score comprised of only 16.51% of the expected reference assemblage.

Despite the high ASPT scores obtained in relation to the reference macro-invertebrate assemblage, the absolute scores reflect a macro-invertebrate assemblage of relatively low sensitivity, with an increased tolerance for poor water quality and low levels of dissolved oxygen. Both sites BVG1 and BVG4 are dominated by moderately tolerant air-breathing taxa such as *Corixidae* (Water boatmen), *Pleidae* (Pigmy backswimmers) and *Dytiscidae* (Diving beetles). The Dallas (1997) classification system, while not considered sufficient for the determination of the PES and the allocation of an Ecological Category, was applied as a supplementary information source. On application of this system, each of the sites were regarded as Seriously to Critically modified (E/F) from the reference conditions expected in these types of streams and within this portion of the Highveld Ecoregion.

#### 8.4.9.4 *Present Ecological State*

Although Chutter (1998) originally developed the SASS5 protocol as an indicator of water quality, it has since become clear that the SASS5 approach gives an indication of more than mere water quality, but also a general indication of the current state of the macroinvertebrate community. While SASS5 does not have a particularly strong cause-effect basis for interpretation, as it was developed for application in the broad synoptic assessment required for the old River Health Programme (RHP), the aim of the MIRAI is to provide a habitat-based cause-and-effect foundation, making use of the SASS5 results, to interpret the deviation of the aquatic macro-invertebrate assemblage. from the reference condition (Thirion, 2008). The use of the MIRAI allows the determination of the PES and an Ecological Category for each site.

**Table 8-24: Results obtained following the application MIRAI at selected sampling sites at the time of the August 2018 field survey**

| Site | REC | MIRAI Value | Ecological Category | Description |
|---|---|---|---|---|
| BVG1 | E | 26.44 | E | Seriously modified |
| BVG2 | E | 30.02 | E | Seriously modified |
| BVG3 | E | 25.46 | E | Seriously modified |
| BVG4 | E | 29.22 | E | Seriously modified |

In relation to perceived reference conditions, it was determined that the ecological condition of the macro-invertebrate assemblages collected within the study area each exhibited seriously modified conditions (i.e. Ecological Category E; Table 8-24). Further interrogation of the applied MIRAI indices suggested that the primary driver of change at site BVG1 was related to poor habitat availability. At site BVG4, the macro-invertebrate assemblage was influenced by impacts to habitat availability and compounded by further impacts to water quality. At sites BVG2 and BVG3, the key driver of change is likely related to impacts to water quality, the sources of which require confirmation.

On further investigation, however, it is important to note that the PESEIS database (2014) provides no information on either of the river reaches investigated at the time of the assessment due to lack of sufficient stream connectivity to the Mooirivierloop further downstream. Thus, despite the compromised ecological integrity observed along each of the river reaches observed within the MRA as a result of the current various impacts to habitat integrity and water quality observed, historical data serves as an indication that these systems are likely limited in diversity and function within the greater catchment as a result of various anthropogenic activities including but not limited to; dams, water abstraction activities, agriculture and livestock farming as well as mining.

### 8.4.10 Air Quality

The baseline information provided herein is summarised from the Air Quality Impact Assessment report, attached as Appendix 8. The dust deposition on site, the annual dispersion of $PM_{2.5}$ and $PM_{10}$ are contained in Plans 8 to 10 in Appendix 3.

During the day, the predominant winds blow from either north, north northeast or north northwest (Figure 8-16). The predominant wind direction at night was from the north northeast (32%) and north (19%). In the morning, the wind was blowing from north and north northeast, with both at 22%, while the afternoon saw winds from the north (14.5%) and north northwest (13.8%) and north (23.7%) and north northeast (15.6%) at night respectively.

The seasonal variability in wind direction is depicted in Figure 8-17. The seasonal signature shows the dominant wind direction as blowing from the north and north northeast.

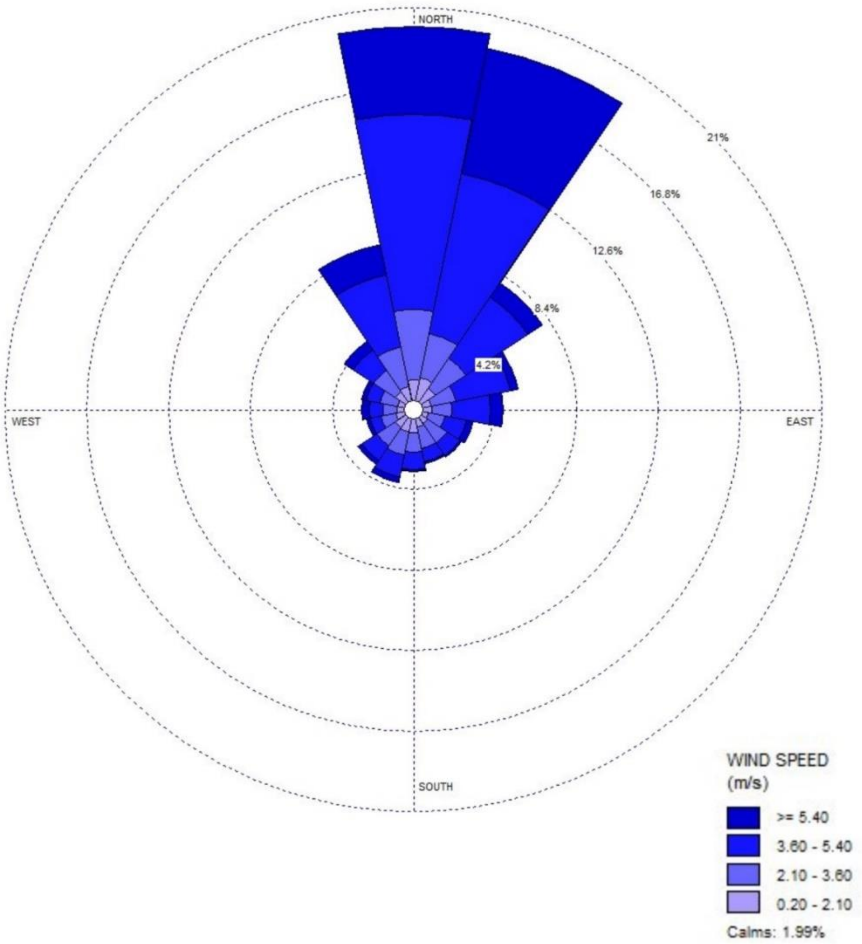



**Figure 8-15: Surface Wind Rose for Project Area**

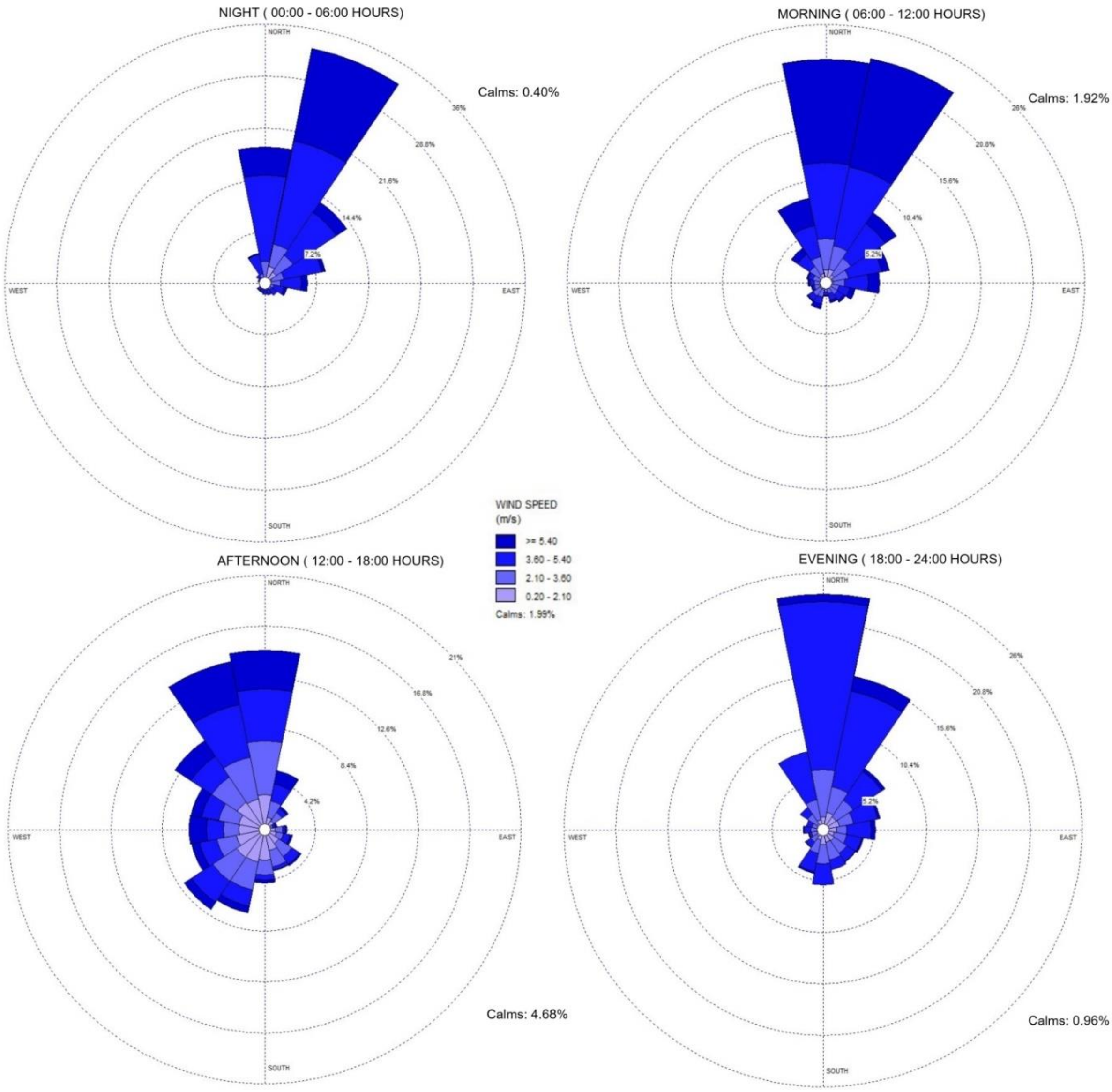



**Figure 8-16: Diurnal variations wind direction**

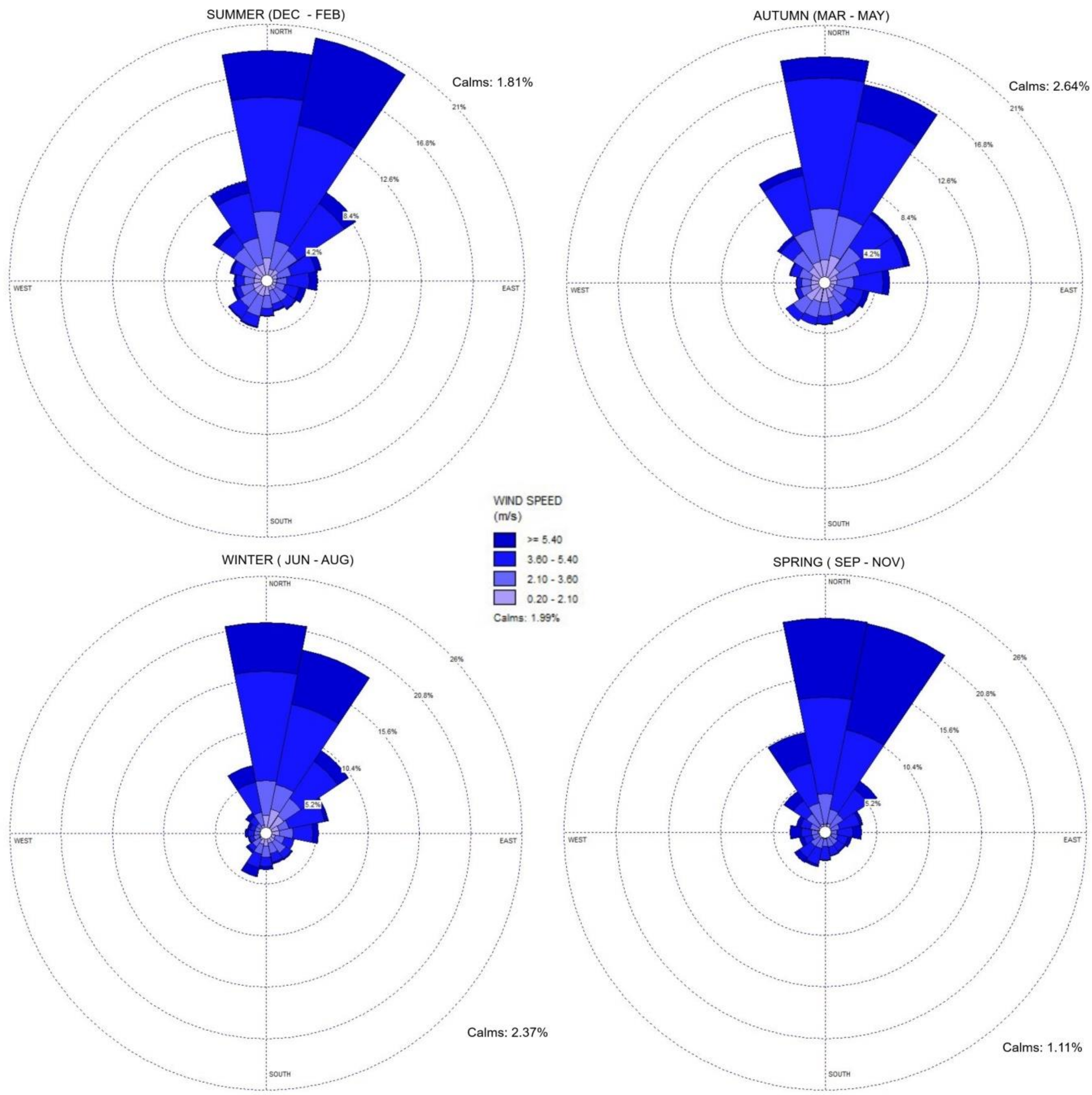



**Figure 8-17: Seasonal variability in wind direction**

The amount of particulate matter generated by wind is highly dependent upon the wind speed. Below the wind speed threshold for a specific particle type, no particulate matter is liberated, while above the threshold, particulate matter liberation tends to increase with wind speed. The amount of particulate matter generated by wind is dependent also on the surface properties, for example, whether the material is crusted, the fraction of erodible particles, and the particle size distribution (Fryrear *et al*., 1991).

### 8.4.10.1 Existing Air Quality

#### *8.4.10.1.1 Dust Deposition*

At the time of compiling this report, several years of historical dust deposition data have been collected and documented using American Society for Testing and Materials (ASTM) as an accepted method of determining dust deposition rates from various sources (ASTM D1739-98) and data was made available by Blyvoor Gold for analyses and interpretation. This data was used to understand background dust deposition scenario in the vicinity of the Project. Figure 8-18 shows the dust monitoring locations[1] Dust deposition measurements are being conducted currently at seven different sites in the area. Although there were gaps in the data provided, the dataset was considered sufficient to understand the background dust deposition rates. The TSFs in the area remain the main sources of dust in the area. The dust deposition rates are very high, with rates that are several magnitudes higher than the industrial limit recorded i.e. deposition rates reaching 40,000 mg/m$^2$/day; 50,000 mg/m$^2$/day; and in some case above 10,000 mg/m$^2$/day (Figure 8-23 and Figure 8-25).

#### 8.4.10.2 *Fine Particulate Matter*

Fine particulate matter sampler was set up near the existing plant in August 2018 to monitor $PM_{10}$ and $PM_{2.5}$ records. The few weeks of data available are presented graphically in Figure 8-26. The ambient $PM_{10}$ levels measured are below the South African ambient air quality limit of 75 µg/m$^3$. The ambient concentrations were most of the time below 30 µg/m$^3$. Monitoring is still on-going on site and data collected will be used to inform management plans to ensure compliance with regulatory limit onsite and offsite once Blyvoor Gold commences operations.

[1] Some of the dust monitoring locations have been changed and updated data was not available to confirm some of the locations cited in the 2017 dust deposition data provide.

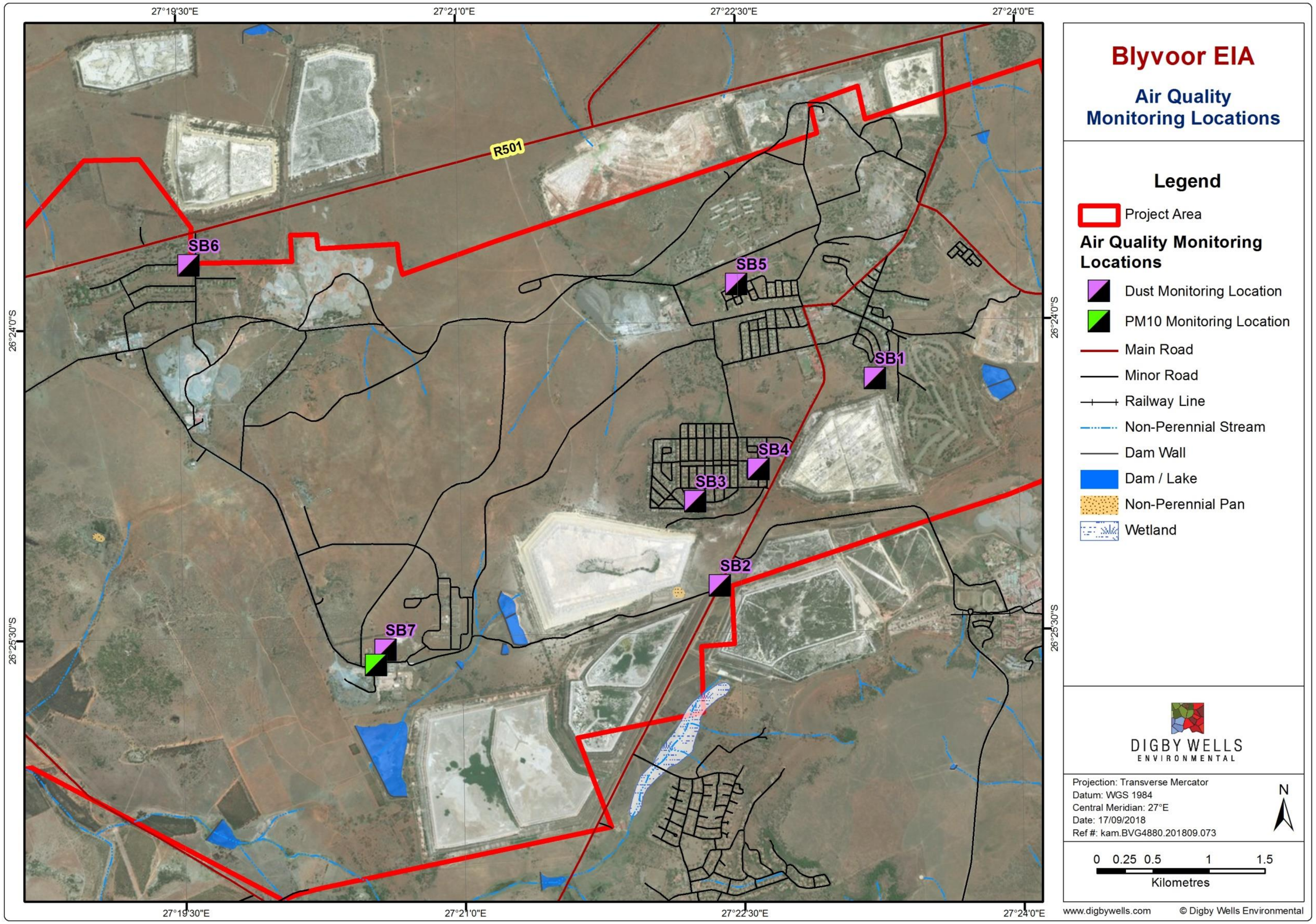



**Figure 8-18: Dust Monitoring Locations**

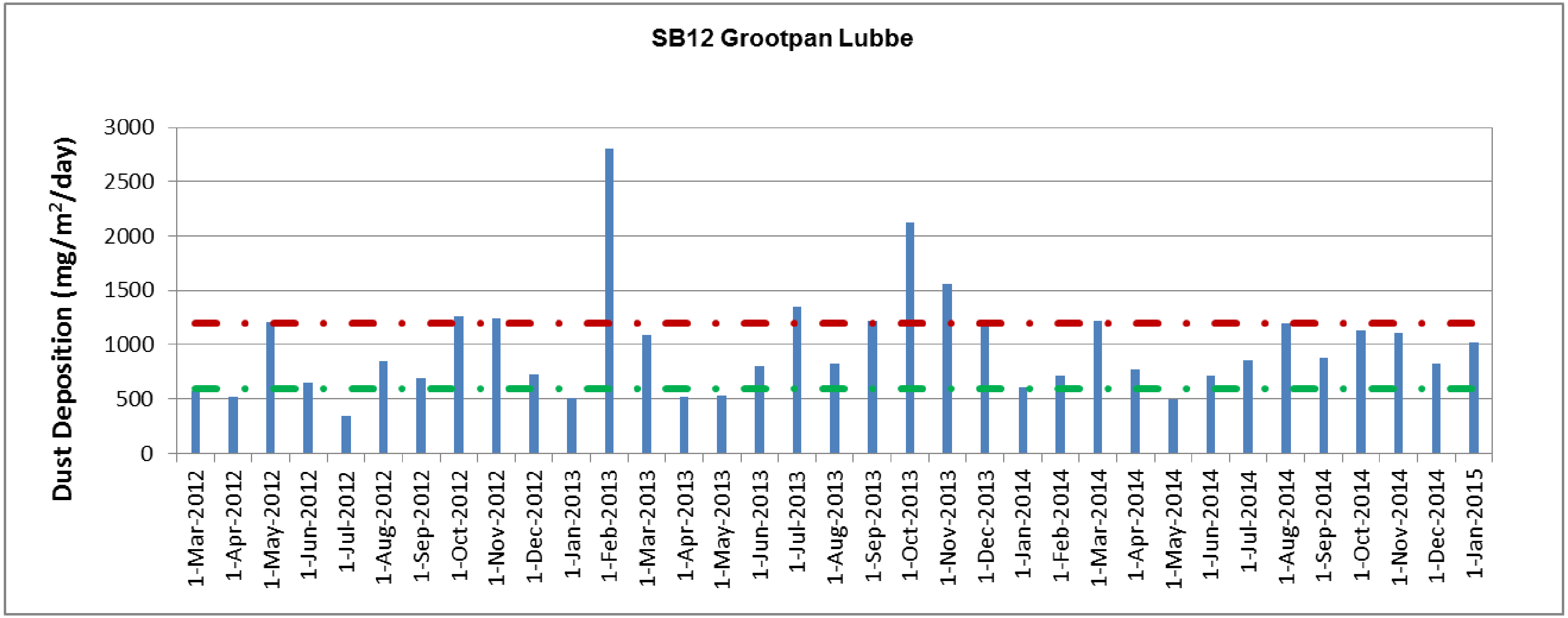



**Figure 8-19: Dust Deposition Rates**

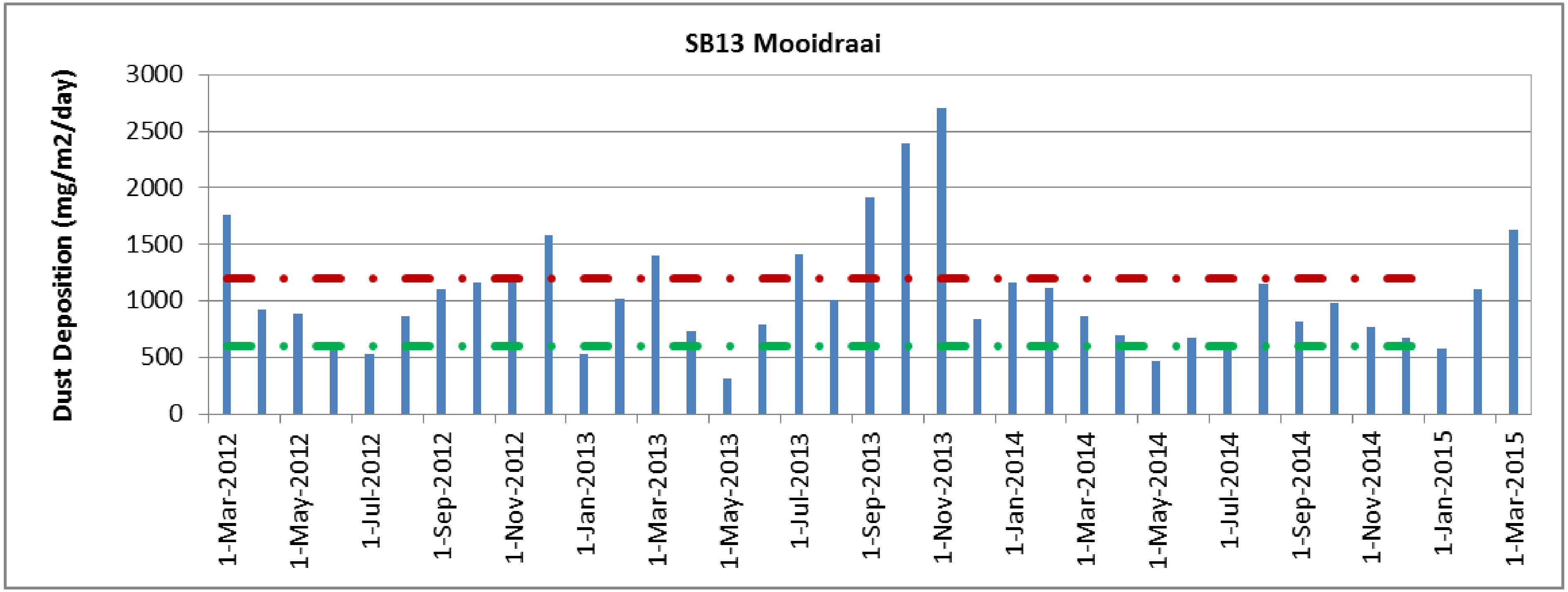



**Figure 8-20: Dust Deposition Rates**

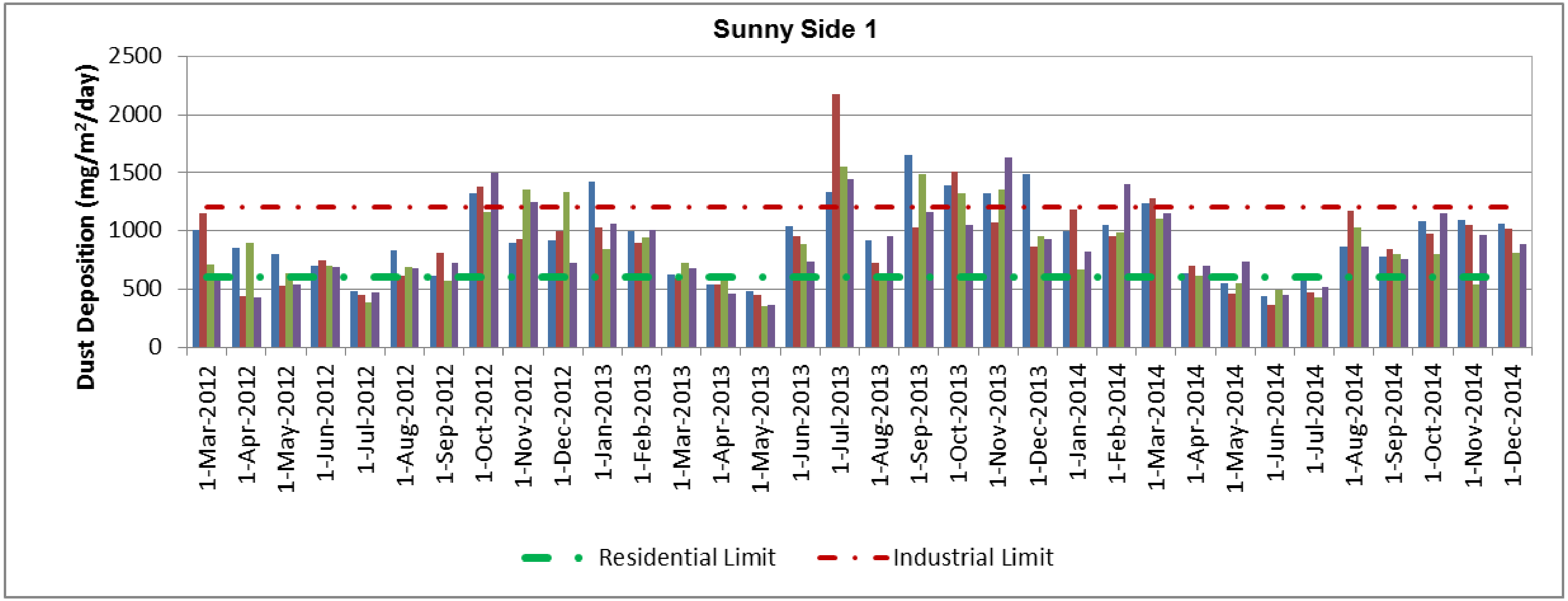



**Figure 8-21: Dust Deposition Rates**

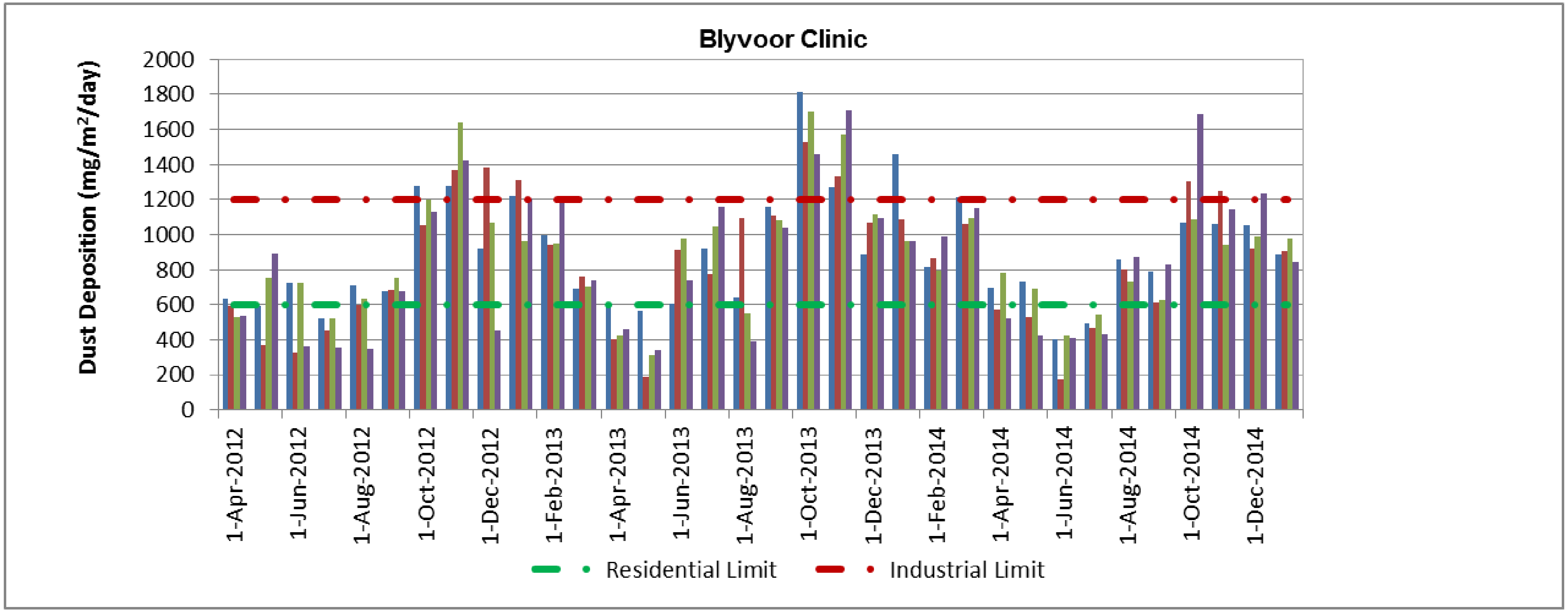



**Figure 8-22: Dust Deposition Rates**

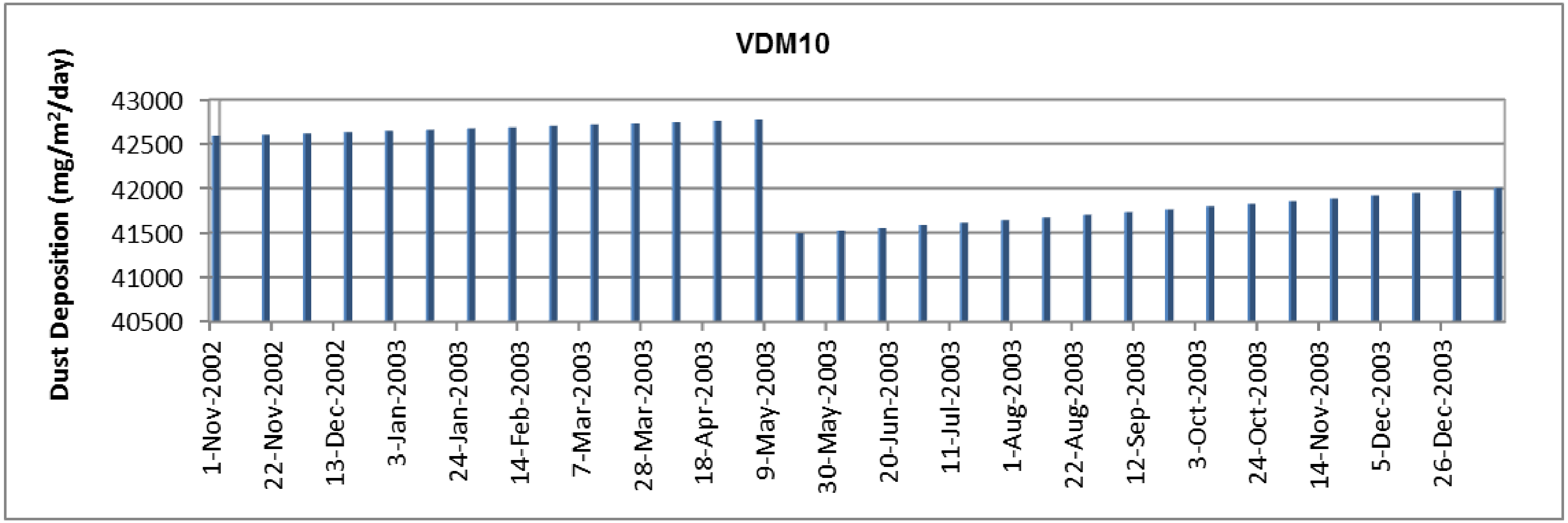



**Figure 8-23: Dust Deposition Rates**

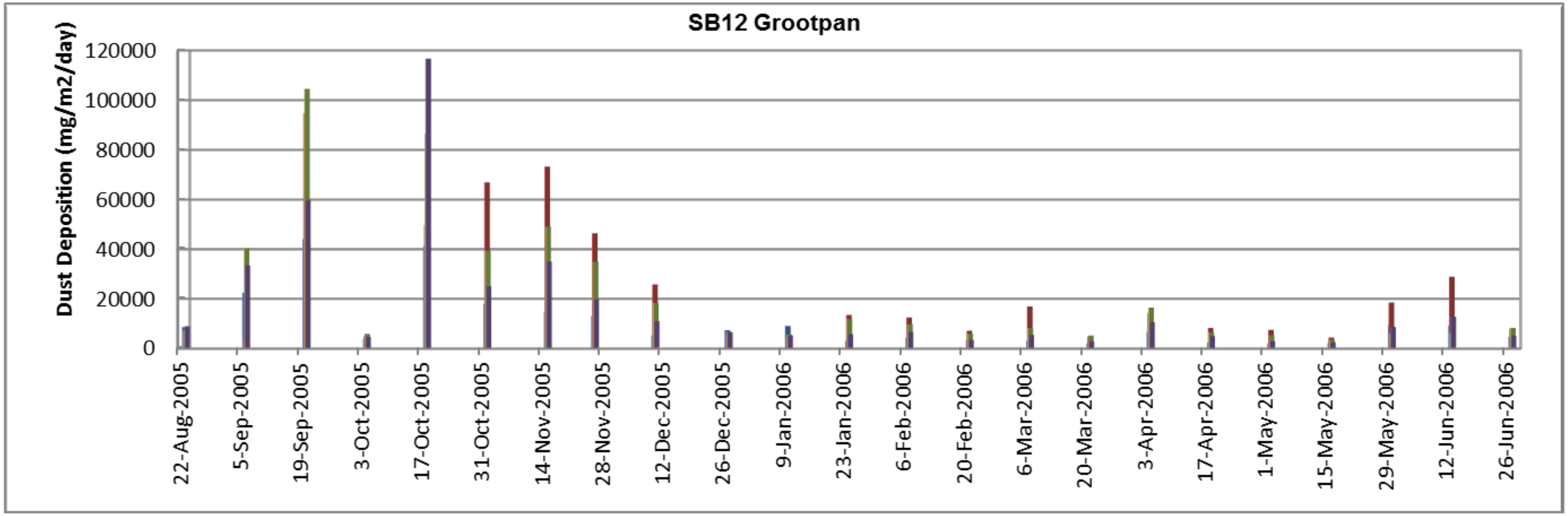



**Figure 8-24: Dust Deposition Rates**

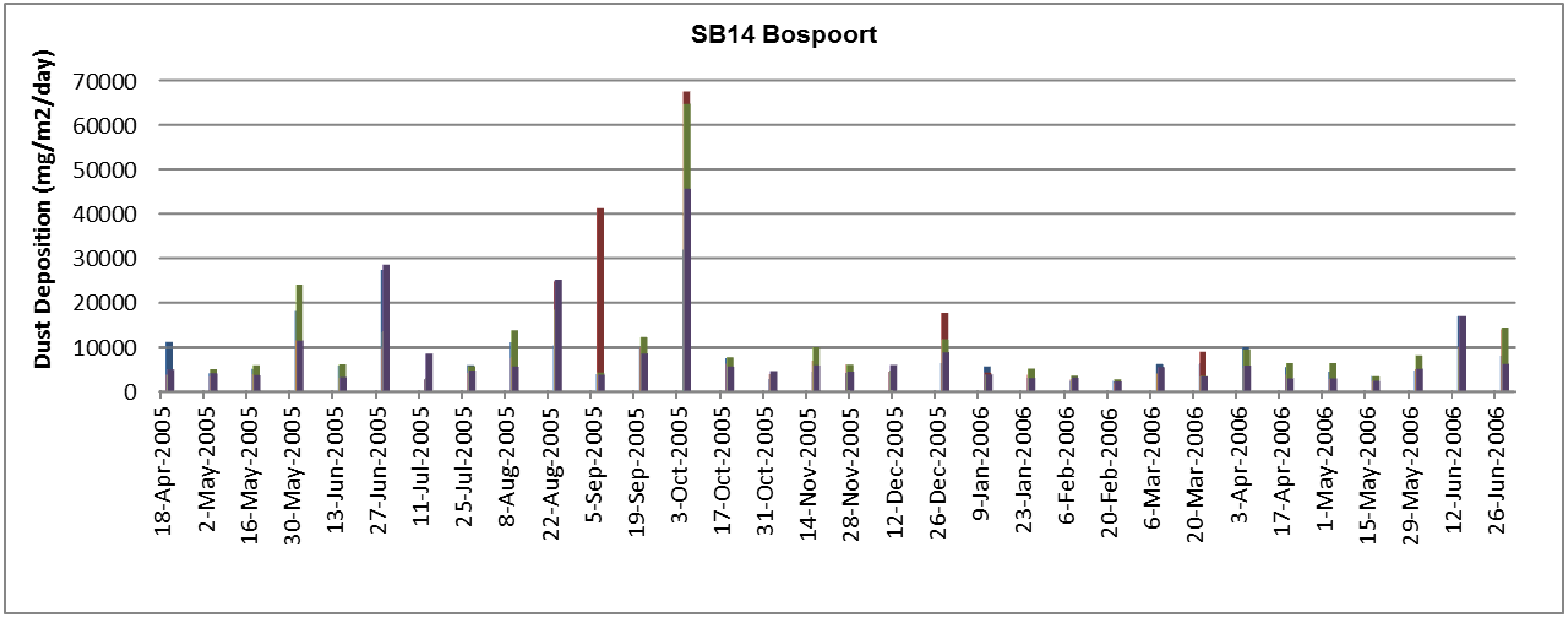



**Figure 8-25: Dust Deposition Rates**

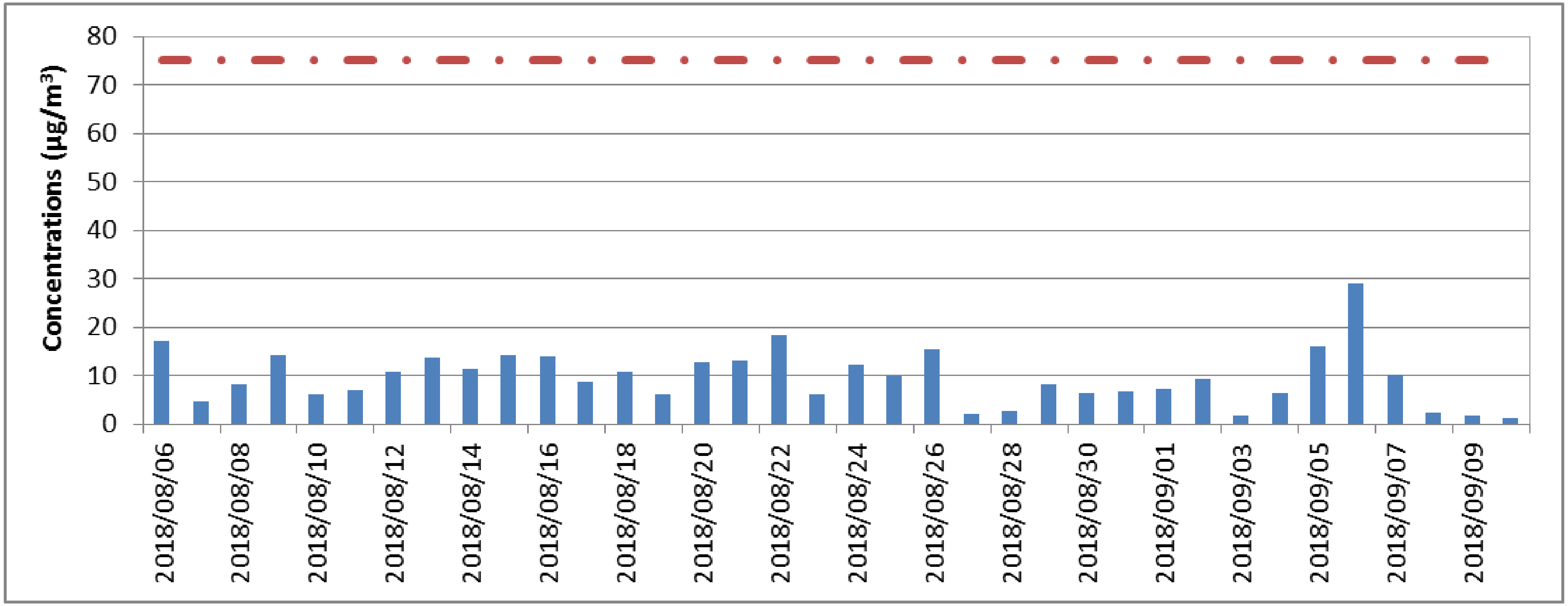



**Figure 8-26: Dust Deposition Rates**

### 8.4.11 Geochemical and Waste Assessment

Geochemical samples were submitted to M&L Laboratory Services (Pty) Ltd for analysis. This section provides an overview of the geochemical results and interpretation. The laboratory certificates of the geochemical tests are available in Appendix A.

#### 8.4.11.1 *Rock Mineralogy*

The mineralogy of the samples is shown in Table 8-25. Quartz is the primary mineral composed within the samples; while muscovite, pyrophyllite and clinochlore are secondary. Dolomite, calcite, bassanite and actinolite are trace minerals.

The mineralogy results show no or very low carbonate mineral content (only found in trace minerals). Carbonates are beneficial as they have the potential to buffer acid. However no sulphide bearing minerals (such as pyrite or arsenopyrite) have been detected, therefore reducing the risk of acid generation.

**Table 8-25: Mineralogical composition in weight percentage**

| Minerals | Ideal Composition | DTSF No. 1 | DTSF No. 2 | DTSF No. 3 | TSF No. 1 | TSF No. 6 | TSF No. 7 |
|---|---|---|---|---|---|---|---|
| Actinolite | $Ca_2(Mg,Fe)_5Si_8O_{22}(OH)$ | - | - | - | - | 0.88 | - |
| Bassanite | $CaSO_40.67H_20$ | - | - | - | - | 2.08 | - |
| Calcite | $CaCO_3$ | 2.55 | - | - | - | - | - |
| Clinochlore | $(Mg,Fe)_5Al(AlSi_3O_{10})(OH)_8$ | 3.35 | 1.36 | 5.49 | 7.69 | 13.7 | 3.46 |
| Dolomite | $CaMg(CO_3)_2$ | - | - | - | - | 7.52 | - |
| Muscovite | $KAl_2((OH)_2A_1Si_3O_{10})$ | 13.32 | 2.13 | 9.9 | 9.39 | 9.63 | 4.13 |
| Pyrophyllite | $Al_2Si_4O_{10}(OH)_2$ | 3.79 | 7.74 | 10.44 | 7.43 | 5.72 | 5.24 |
| Quartz | $SiO_2$ | 76.99 | 88.77 | 74.17 | 75.49 | 60.47 | 87.17 |

#### 8.4.11.2 *Acid-Base Accounting*

The acid-base-accounting results are presented in the Table 8-26 and discussed below.

**Table 8-26: ABA result summary**

| Sample ID | Total Sulphur S% | Sulphide S% | Paste pH | NAG pH | AP (CaCO3 kg/t) | NP (CaCO3 kg/t) | NNP (CaCO3 kg/t) | NPR |
|---|---|---|---|---|---|---|---|---|
| DTSF No. 1 | 0.1 | 0.02 | 3.1 | 3.2 | 3.12 | 0 | -3.12 | 0 |
| DTSF No. 2 | 0.17 | <0.01 | 3.3 | 3.3 | 5.31 | 0 | -5.31 | 0 |
| DTSF No. 3 | 0.05 | 0.03 | 3.6 | 3.7 | 1.56 | 0 | -1.56 | 0 |

| Sample ID | Total Sulphur S% | Sulphide S% | Paste pH | NAG pH | AP (CaCO3 kg/t) | NP (CaCO3 kg/t) | NNP (CaCO3 kg/t) | NPR |
|---|---|---|---|---|---|---|---|---|
| TSF No. 1 | 0.21 | <0.01 | 3.4 | 3.9 | 6.55 | 0 | -6.55 | 0 |
| TSF No. 6 | 0.36 | <0.01 | 7.2 | 6.7 | 11.2 | 30.9 | 19.7 | 2.76 |
| TSF No. 7 | 0.34 | <0.01 | 3.7 | 4.6 | 10.6 | 0 | -10.6 | 0 |

###### *8.4.11.2.1 Paste pH*

The paste pH of the samples was found to be acidic (ranging between 3.1 and 3.7), with the exception of TSF No. 6 which has a neutral pH of 7.2. The guideline value for paste pH values are 5, any pH below this is considered acid generating. The duration or extent of this acid producing reaction will be determined by the sulphide and NPR values.

###### *8.4.11.2.2 Net Acid Generating (NAG) pH*

The NAG pH of the samples was found to be acidic ranging between 3.2 and 6.7; according to the criteria for NAG pH the samples are potentially acid generating. TSF No. 6 is observed to have less acid generating potential compared to the other samples, with a NAG pH of 6.7. The NAG and Paste pH of sample TSF No. 6 is most likely higher than the other samples due to the dolomite content (carbonate) countering any acid production.

###### *8.4.11.2.3 Sulphur Speciation*

The Sulphide-S content of the samples shows that none of them have more than 0.3% S. Based only on the sulphide content the material is not likely to generate acid. However, the acid generation can be controlled by various factors and all results need to be considered.

###### *8.4.11.2.4 Net Neutralisation Potential (NNP)*

All the samples have a negative NNP, with the exception of TSF No. 6 which has an NNP of 19.7 kg $CaCO_3$/tonne. Since the NNP of TSF No. 6 is above 0 and below 20 the acid forming potential purely based on NNP is uncertain. However, this sample is classified as potentially acid neutralising based on other available data. The remaining samples have a negative NNP and are therefore observed to have acid generating potential (DTSF No. 3 having the least potential and TSF No. 7 having the most acid generating potential).

The remaining samples have a negative NNP and are therefore observed to have acid generating potential (DTSF No. 3 having the least potential and TSF No. 7 having the most acid generating potential).

###### *8.4.11.2.5 Neutralisation Potential Ratio (NPR)*

The NPR is zero for all samples with the exception of TSF6 (NPR=2.76). All samples are regarded potentially acid generating; except for TSF6 which has low acid generating potential with a sulphide content that is below the detection limit. However, the sulphide content in general is limited which reduces the likelihood of acid generation.

Although the NPR shows an acid generating potential these reactions will most likely be of short duration due to the low sulphide content.

### 8.4.11.3 *Waste Classification*

Results of the TC and LC analysis are shown in Table 8-27 and Table 8-28, respectively. The results are compared to threshold concentrations published in the NEM:WA Waste Classification and Management Regulations.

#### *8.4.11.3.1 Total Concentration Results*

The analysis shows that:

- TCT0 threshold values of As and Pb are exceeded in all samples from the tailings;
- TCT0 threshold values of Cr are exceeded in all samples with the exception of DTSF No. 1;
- TCT0 threshold values of Cu are exceeded in all samples with the exception of DTSF No. 1 and DTSF No. 3; and
- Based on the outcome of the TCT assessment; more than one element exceeds the TCT0 limits for the tailings' material therefore the material according to the regulations is classified as Type 3 waste requiring a Class C liner..

#### *8.4.11.3.2 Leachable Concentration Results*

The analysis shows that:

- Mn is in excess in samples DTSF No. 2 and TSF No. 1 for LCT0 threshold values;
- Ni is in excess in all samples for LCT0 threshold values, with the exception of DTSF No. 3 and TSF No. 6;
- Based on the outcome of the LCT assessment:
  - DTSF No. 3 and TSF No. 6 are classified as Type 4 waste requiring disposal in a facility with a Class D liner; and
  - The remaining samples are classified as Type 3 waste requiring a Class C liner.

Material from TSF No. 4 & 5 were not sampled and are assumed to be represented by the majority of the tailings' material sampled. Therefore, they are expected to be acid generating and classified as Type 3 Waste requiring a Class C liner.

## Table 8-27: TCT classification

| Constituents | Total Concentration Thresholds (mg/kg) | | | Total Concentrations (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | TCT0 | TCT1 | TCT2 | DTSF No. 1 | DTSF No. 2 | DTSF No. 3 | TSF No. 1 | TSF No. 6 | TSF No. 7 |
| Arsenic as As (mg/kg) | 5.8 | 500 | 2000 | 57 | 8.77 | 41 | 26 | 9.51 | 27 |
| Boron as B (mg/kg) | 150 | 15000 | 60000 | <0.6 | <0.6 | <0.6 | <0.6 | <0.6 | <0.6 |
| Barium as Ba (mg/kg) | 62.5 | 6250 | 25000 | 18.05 | 12.51 | 11.05 | 15.11 | 57 | 10.05 |
| Cadmium as Cd (mg/kg) | 7.5 | 260 | 1040 | <0.05 | <0.050 | <0.050 | <0.050 | <0.05 | <0.050 |
| Cobalt as Co (mg/kg) | 50 | 5000 | 20000 | 3.35 | 7.60 | 1.89 | 11.26 | 16.92 | 3.50 |
| Chromium VI as Cr (mg/Kg) | 6.5 | 500 | 2000 | 27 | 31 | 26 | 44 | 94 | 37 |
| Copper as Cu (mg/kg) | 16 | 19500 | 78000 | 12.26 | 16.62 | 12.23 | 23 | 28 | 19.79 |
| Mercury as Hg (mg/kg) | 0.93 | 160 | 640 | <0.10 | <0.10 | <0.10 | <0.10 | <0.10 | <0.10 |
| Manganese as Mn (mg/kg) | 1000 | 25000 | 100000 | 27 | 34 | 35 | 108 | 681 | 74 |
| Molybdenum as Mo (mg/kg) | 40 | 1000 | 4000 | 1.40 | <0.10 | <0.10 | <0.10 | <0.10 | <0.10 |
| Nickel as Ni (mg/kg) | 91 | 10600 | 42400 | 18.97 | 23 | 12.74 | 44 | 62 | 13.02 |
| Lead as Pb (mg/kg) | 20 | 1900 | 7600 | 34 | 29 | 42 | 31 | 64 | 43 |
| Antimony as Sb (mg/kg) | 10 | 75 | 300 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Selenium as Se (mg/kg) | 10 | 50 | 200 | <3.0 | <3.0 | <3.0 | <3.0 | <3.0 | <3.0 |
| Vanadium as V (mg/kg) | 150 | 2680 | 10720 | 4.84 | 3.95 | 5.08 | 12.58 | 15.80 | 10.84 |
| Zinc as Zn (mg/kg) | 240 | 160000 | 640000 | 29 | 32 | 27 | 45 | 94 | 37 |

### Table 8-28: LCT classification

| Constituents | Leachable Concentration Thresholds (mg/l) | | | | Leachable Concentrations (mg/l) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | LCT0 | LCT1 | LCT2 | LCT3 | DTSF No. 1 | DTSF No. 2 | DTSF No. 3 | TSF No. 1 | TSF No. 6 | TSF No. 7 |
| Arsenic as As (mg/L) | 0.01 | 0.5 | 1 | 4 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Boron as B (mg/L) | 0.5 | 25 | 50 | 200 | 0.076 | 0.065 | 0.054 | 0.057 | 0.029 | 0.030 |
| Barium as Ba (mg/L) | 0.7 | 35 | 70 | 280 | 0.071 | 0.049 | 0.056 | 0.067 | 0.066 | 0.048 |
| Cadmium as Cd (mg/L) | 0.003 | 0.15 | 0.3 | 1.2 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Cobalt as Co (mg/L) | 0.5 | 25 | 50 | 200 | 0.15 | 0.36 | 0.013 | 0.30 | 0.005 | 0.042 |
| Chromium as Cr (mg/L) | 0.05 | 2.5 | 5 | 20 | 0.003 | 0.010 | <0.003 | <0.003 | 0.003 | <0.003 |
| Copper as Cu (mg/L) | 2 | 100 | 200 | 800 | 0.66 | 0.33 | 0.027 | 0.36 | 0.003 | 0.038 |
| Mercury as Hg (mg/L) | 0.006 | 0.3 | 0.6 | 2.4 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Manganese as Mn (mg/L) | 0.5 | 25 | 50 | 200 | 0.26 | 0.78 | 0.053 | 0.69 | <0.001 | 0.36 |
| Molybdenum as Mo (mg/L) | 0.07 | 3.5 | 7 | 28 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Nickel as Ni (mg/L) | 0.07 | 3.5 | 7 | 28 | 0.31 | 0.85 | 0.038 | 0.87 | 0.004 | 0.11 |
| Lead as Pb (mg/L) | 0.01 | 0.5 | 1 | 4 | <0.01 | <0.01 | <0.01 | 0.010 | <0.01 | <0.01 |
| Antimony as Sb (mg/L) | 0.02 | 1 | 2 | 8 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Selenium as Se (mg/L) | 0.01 | 0.5 | 1 | 4 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 | <0.03 |
| Vanadium as V (mg/L) | 0.2 | 10 | 20 | 80 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 |
| Zinc as Zn (mg/L) | 5 | 250 | 500 | 2 000 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |

#### 8.4.11.3.3 Classification

Based on the classification method mentioned in the NEM: WA, the samples are classified as Type 3 waste because the total concentration of more than one constituent of samples is between the TCT0 and TCT1 threshold values. Additionally, the leachable concentration of all constituents is between the LCT0 and LCT1 threshold values (with the exception of DTSF No. 3 and TSF No. 6).

All samples fell within the Type 3 waste, requiring a Class C liner (Figure 8-27). However, it is observed that the material at TSF No. 6 does not pose an environmental risk based on the laboratory results yielding the following outcomes:

- Acid-base-accounting results consistently show that the material at TSF6 does not show evidence of acid generation; and
- The leachate quality is found to be inert.

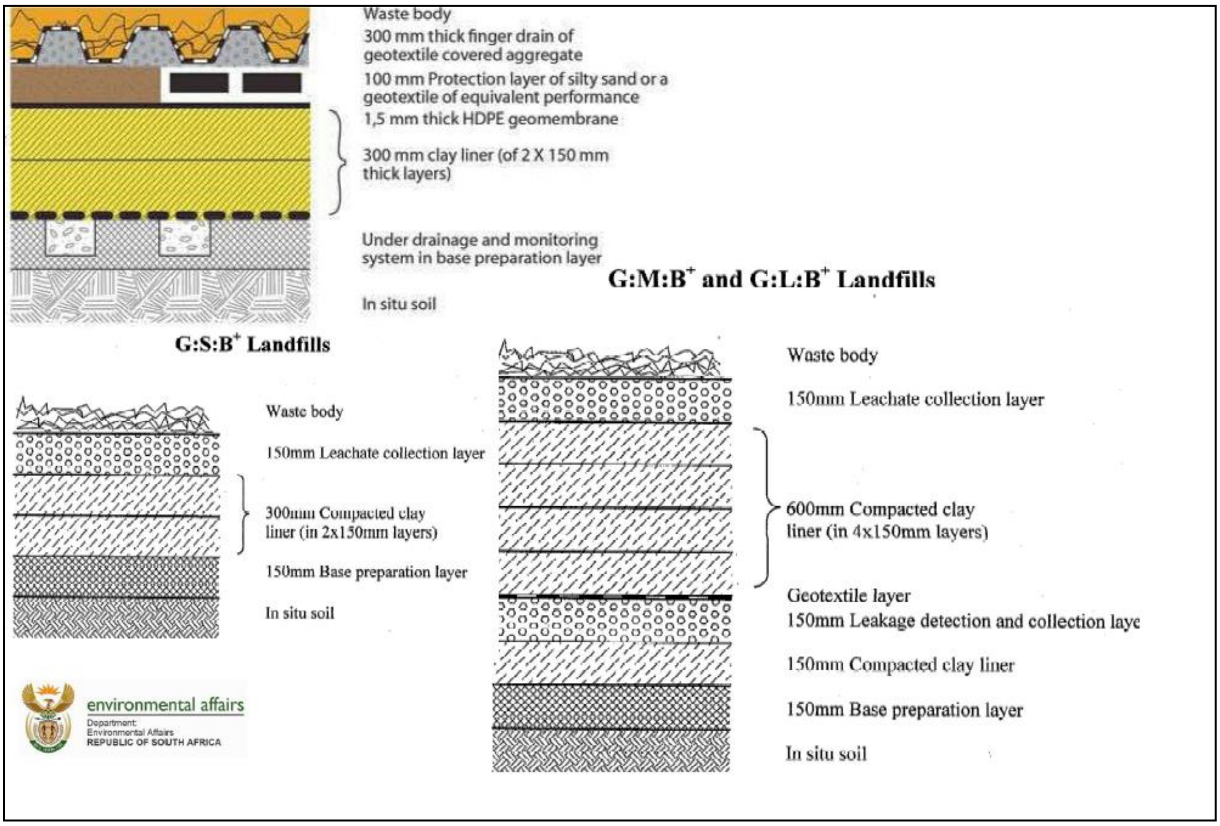



**Figure 8-27: Class C Containment Barrier Requirements**

All TSFs within the project area were constructed prior to the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008). Therefore, the type of material on each cannot be deposited on the required liner due to the pre-existence of the facilities and volumes of material already deposited at various TSFs.

### 8.4.12 Radiological

The baseline information provided herein is summarised from the Radiological report titled, *Radiological Public Impact Assessment for Blyvoor Gold Operations*, dated October 2018 and compiled by Aquisim Consulting (Pty) Ltd, attached as Appendix 9.

The most recent information available is from a Public Hazard Assessment Report prepared for BGMC in 2008. Although the author(s) of the report is unknown at present, the report was referenced as Blyvoor Gold (2008).

#### 8.4.12.1 *Safety Standards for the Protection of the Public*

The Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards published in the General Safety Requirement (GSR) series in 2014 by the International Atomic Energy Agency (IAEA) Safety Standards provide thresholds for exposure to radiological material. The aim is to provide compliance requirements to protect people and the environment. These thresholds include:

- An effective dose of one millisievert (mSv) in a year;
- In special circumstances (e.g., in authorized, justified, and planned operational circumstances that lead to transitory increases in exposures), a higher value of effective dose in a single year could apply, provided that the average effective dose over five consecutive years does not exceed 1 mSv per year;
- An equivalent dose to the lens of the eye of 15 mSv in a year; and
- An equivalent dose to the skin of 50 mSv in a year.

#### 8.4.12.2 *Radiological Conditions of the Project*

Radon gas is found in Uranium ores and Uranium is a by-product of gold mining activities, and radionuclides are atoms containing nuclear energy which emit radiation. TSFs associated with gold mining comprise of waste material left over from the gold extraction process which contain radionuclides. For this study, three main factors were examined to establish a baseline on site:

- The mining operation was considered to identify and quantify radionuclide concentrations (the source);
- Thereafter, mining activities and processes were assessed to identify the potential release of radioactive particulates and gasses into the natural environment (the pathway); and
- Lastly, the surrounding land uses were examined to identify individuals, landowners, communities and community infrastructures that may be exposed to radiation from the mine (the receptor).

Radionuclide concentrations were calculated based on assumed values for the TSFs, WRDs and extracted underground ore. Due to the presence of radon gas in TSFs, radon gas will continuously be released into the atmosphere, known as radon exhalation.

The mining operation has a ventilation shaft which facilitates air flow through the underground workings which is released on surface. Once the mine becomes operational and the ventilation shaft is recommissioned, radon gas and other particulates will be brought to the surface from this shaft, exposing potential receptors downwind of the ventilation shaft.

Potential receptors for radon absorption include surface water, groundwater, fish, crops, fruit, root vegetables and leafy vegetables. All of these receptors can be ingested by humans, resulting in potential contamination.

### 8.4.12.3 *Source-Pathway-Receptor Analysis*

To establish which receptors have been impacted by radon on site and surrounds, a Source-Pathway-Receptor (SPR) Analysis is conducted. This requires establishing historic, current and future sources of radiation associated with the Blyvoor Gold Mine which may be released into the environment with the risk of being harmful. Thereafter, pathways are identified whereby radionuclides can be disbursed or transferred within or between different environmental systems with which humans interact.

#### *8.4.12.3.1 Sources*

Two sources for the operation have been identified, namely airborne sources and waterborne sources.

Potential Airborne sources include the two metallurgical plants associated with this application which are assumed to have stacks (chimneys) once operational. The particulate matter emitted by these plant stacks is generally insignificant and is therefore not considered a credible source of radionuclides. The dust currently being blown from the TSFs, and potential future windblown dust during the process of reclamation is and will be radioactive dust and may also be associated with radon gas emissions. The TSFs therefore contribute to the airborne activity concentrations of radioactive emissions. This too applies to the ventilation shaft, although the emissions from this shaft must be monitored during operation to quantify airborne radioactivity.

Waterborne sources include filtration of water through the TSFs into the underlying geosphere, spillage from plant areas where spillages occur, and water management areas such as dams and channels where spillages and seepage may occur. The TSFs on site are large, unlined structures resulting in leached radionuclides but the plant areas and water management areas are considered less likely sources of contamination.

#### *8.4.12.3.2 Pathways*

The pathways through which members of the public may be exposed to radiation include atmospheric pathways, aquatic (waterbody) pathways or gamma radiation, as summarised below:

- Atmospheric pathways include the release and distribution of radon gas or radioactive dust particles and the subsequent inhalation by humans, or the deposition of radioactive dust onto soil or crops and being ingested;

- Aquatic pathways include ingesting fish and other aquatic biota from a contaminated water body, ingesting crop produce irrigated by contaminated water, and ingesting animal products from animals who have been drinking from contaminated waterbodies; and
- Gamma radiation from the TSFs but radiation will be higher the closer a receptor is to the sources.

##### *8.4.12.3.3 Receptors*

Receptors are the members or groups of the public at risk of being exposed to radiation through release from the applicable sources through the exposure pathways. Factors considered in identifying these receptors include the habits, location/proximity, age or other defining characteristics of a group. On a local scale, the land use conditions are similar, with the residential village areas (North Dene, South Dene, East Dene, The Village, The Hillside and Doornfontein) previously owned by BGMC as the closest areas of human settlement to the mine. The three receptor groups likely to be exposed to radionuclides released by the mining operation include:

- Formal and informal residential areas;
- Workers at nearby mines and other industries;
- Commercial and small-scale farmers.

#### 8.4.12.4 *Results*

This section provides the outcomes of the baseline assessment and potential for existing radioactive contamination to receptors.

##### *8.4.12.4.1 Contributions from Groundwater Pathways*

Radionuclides have leached into the ground where TSFs are located and will migrate through the aquifer-type groundwater concentration beneath the TSFs. Hypothetical conditions were utilised to calculate contributions of contamination from groundwater pathways. Based on the calculations presented in the Radiological report, contamination and risk of dosage from water abstracted from a borehole 300m from a TSF (the specific example provided only considered Doornfontein TSF No.1) will only be realised thousands of years from now. Figure 8-28 illustrates the predicted dosage of varying age groups over time as a result of ingesting groundwater from Doornfontein TSF No.1.

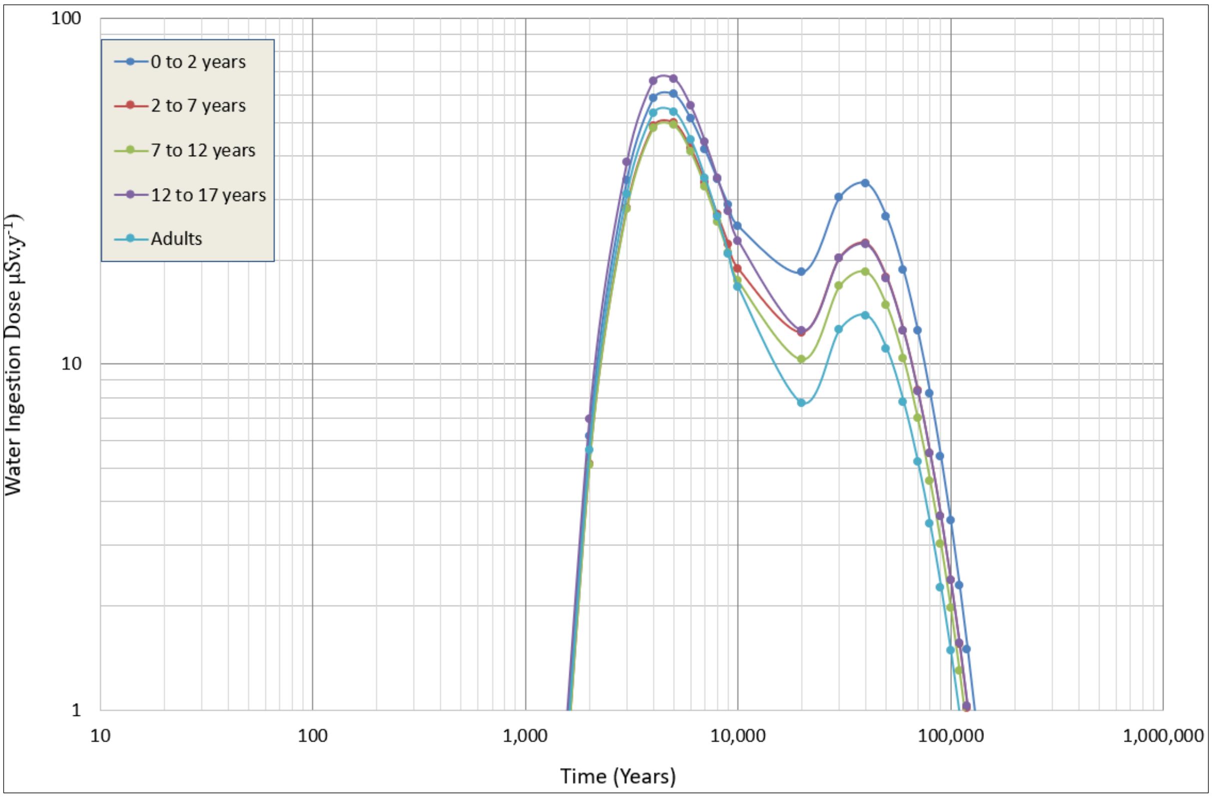



**Figure 8-28: The Simulated Water Ingestion Dose to the Different Age Groups 500 m from DTSF No. 1 (Aquisim, 2018)**

### *8.4.12.4.2 Contribution from Radon Inhalation*

The simulation results presented Figure 8-29 show radon inhalation dose is higher the closer a receptor is to the sources. Radon dispersion was modelled to provide a visual representation of radon gas coverage in relation to the sources and dispersion largely follows a north-south direction from site. Refer to section 4.6 of the Radiological Report attached in Appendix 9 for the modelling methodology. The most significant sources for radon inhalation are from the ventilation shaft but due to the nature of the ventilation shaft, the airborne radon concentration decreases drastically as distance from the shaft is increased. The DTSF No. 1 and TSF No. 4 & 5 have a lesser impact in comparison to the ventilation shaft. TSF No. 4 & 5 has mostly been reclaimed with an assumed 435,500 tonnes of tailing material currently left on the footprint, but this TSF is still shown to be a radon exhalation source.

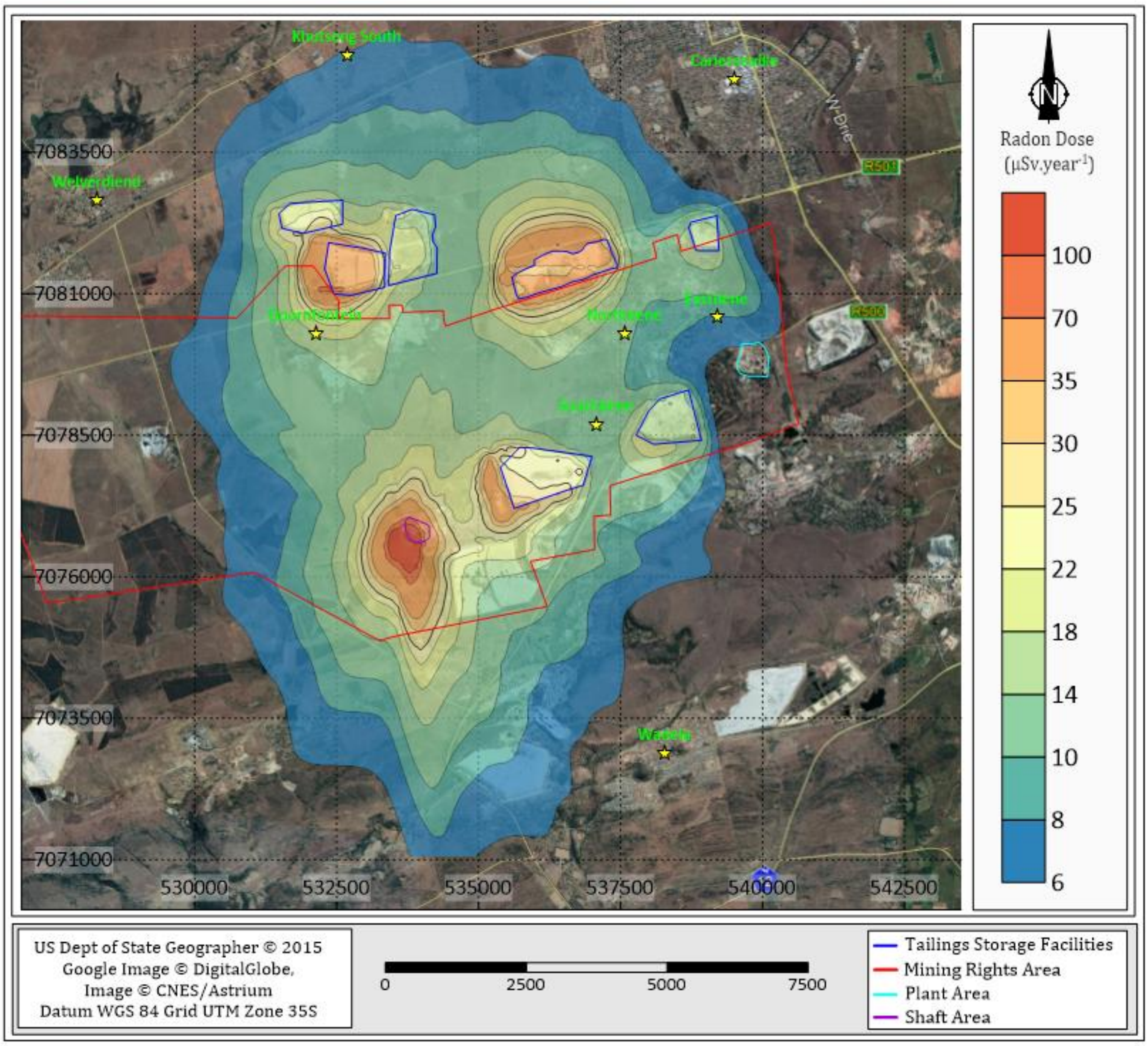



**Figure 8-29: The Distribution of the Radon Inhalation Dose Induced by the Facilities Associated with the Operations (Aquisim, 2018)**

### *8.4.12.4.3 Residential Area Exposure*

The Radiological study defined Residential Area Exposure Condition by considering the informal residential areas and varying socio-economic conditions surrounding the mine. As a result, it is assumed that the lower-income communities rely on up to 40% subsistence farming for food requirements. The study assumed maize, vegetables, fruit, and animal products (eggs, milk and meat) were the sources of food produced in household gardens.

The results for residential exposure are informed by the outcomes of the Air Quality Impact Assessment. The dose assessment simulation shows Doornfontein, Northdene, Southdene and Eastdene having the most exposure but the total effective dose that includes the contribution of the radon inhalation is less than 0.1 mSv per year. Figure 8-30 shows the anticipated dosage exposure for the age group 12 to 17, as this group is the most susceptible.

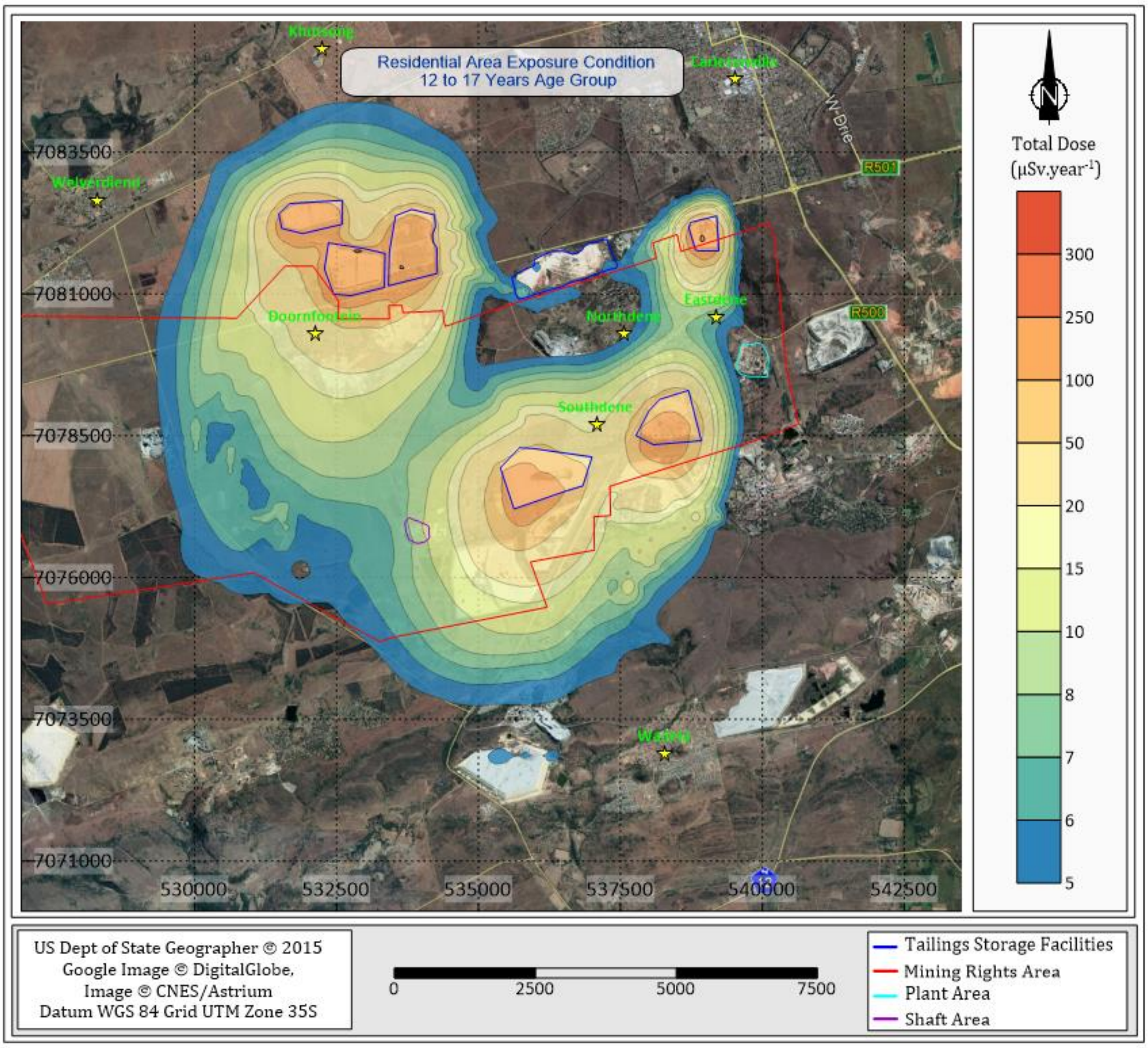



**Figure 8-30: Total Effective Dose Associated with the 12-to-17-Year Age Group for the Residential Area Exposure**

### *8.4.12.4.4 Commercial Agricultural Exposure*

Commercial Agricultural Exposure Condition was defined by the assumption that 100% of the public relies on farming for their annual food requirements. As with the residential areas, this allows the study to factor in varying socio-economic circumstances, and the same foods were applied to commercial agriculture as applied when considering subsistence farmers. A dust deposition period of 40 years is assumed to calculate the build-up of radionuclides in the topsoil layer, which is very conservative.

Considering contamination via groundwater will only be applicable in thousands of years, commercial agriculture will be impacted by atmospheric pathways north of the three Doornfontein TSFs, and south and west of the MRA. The expected maximum total effective dose will be less than 0.1 mSv per year, which is below the threshold. The most exposed age group associated with contamination of commercial farms is the 12 to 17-year-old group, and the extent thereof is shown in Figure 8-31.

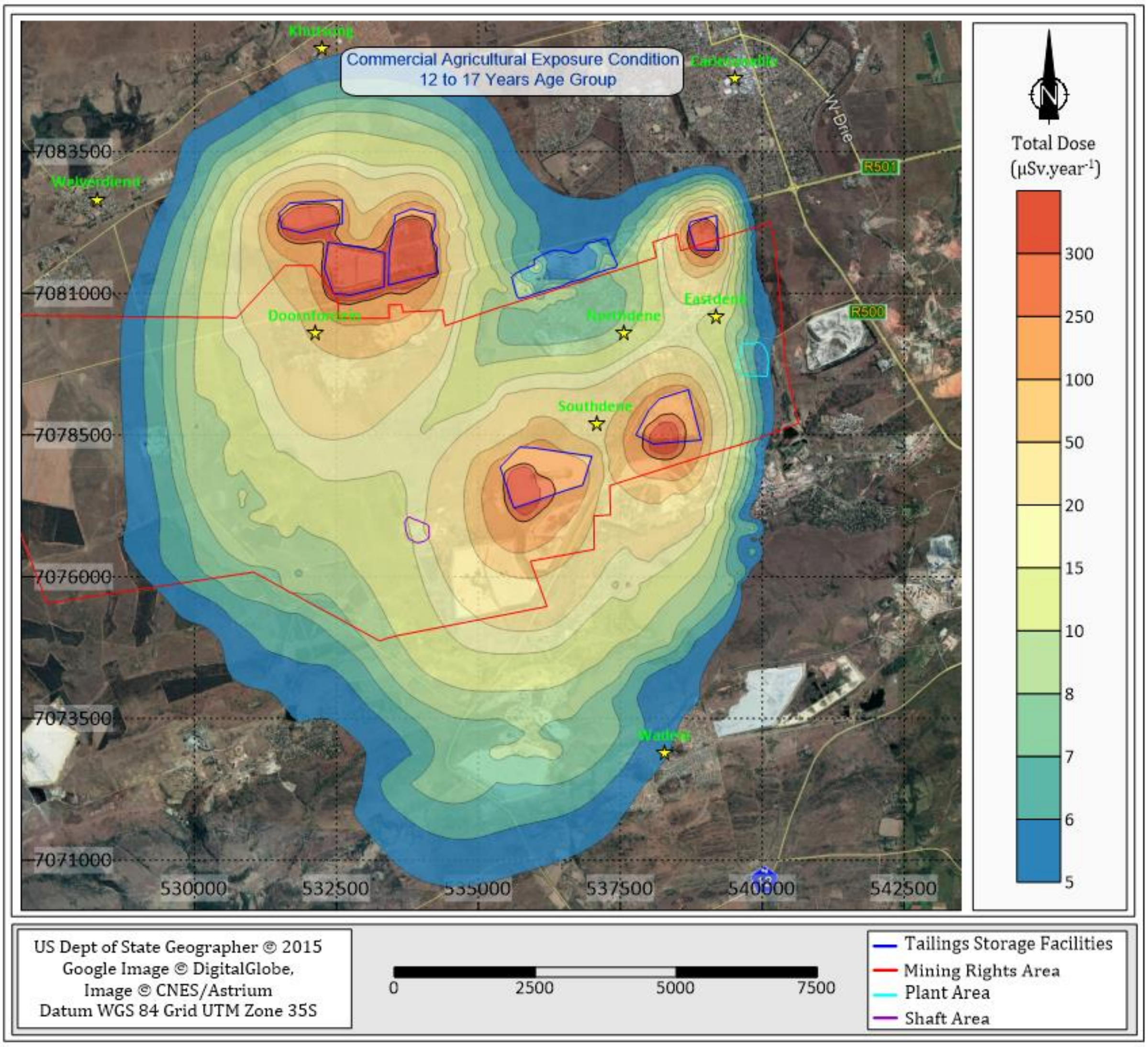



**Figure 8-31: Total Effective Dose Associated with the 12-to-17-Year Age Group for the Commercial Agriculture Exposure Condition (Aquisim, 2018)**

## 8.4.13 Community Health

The baseline information provided herein is summarised from the Community Health Impact Assessment (cHIA) report, attached as Appendix 10. Plan 11 in Appendix 3 shows the social sensitivity areas identified and considered for this report.

### 8.4.13.1 *Baseline Health Status*

The communities of concern include those who still reside in the BGMC mine's residential village areas (Northdene, Southdene, Eastdene, The Village, The Hill and Doornfontein), and other communities within a 6 km radius from Project site; are those who are likely to experience health impacts as a result of the Project.

#### 8.4.13.2 *Environmental Health Areas*

The Environmental Health Areas (EHAs) framework (www.ifc.org/sustainability) defines the types of health impacts and provides a structure for organising and analysing potential proposed Blyvoor Gold Project impacts on the community.

As mentioned previously, health impacts discussed within this report have been based solely on comments as received by the FSE, Dr Phil Tanner, the CRR and the recently conducted specialist reports (September 2018), including an update by Digby Wells to the Social Impact Assessment (SIA) report prepared by Golder and Associates (2016), wherein information from the LHR report (January 2017) was incorporated, for the proposed Blyvoor Gold Operations (report number 1656096-307576-4).

The scope of the cHIA excluded stakeholder engagement with the communities of concern, therefore the possibility exists that key health issues not previously raised associated with the Project, have not been identified or assessed. Based on the above, and in accordance with the EHAs, number 5: *Soil- and water-sanitation related diseases,* number 8: *Exposure to potentially hazardous materials*, and number 9: *Social determinants of health*, have been further assessed and discussed within this report.

#### 8.4.13.3 *EHA 5: Soil-, and Water-Sanitation-Related Diseases*

Prior to liquidation, the majority of houses (around 94%) had access to piped water. Likewise, most houses were connected to electricity. Most (ranging between 85% and 90%) had their refuse removed by a service provider. Almost all the households (between 84% and 92%) had access to a flush toilet connected to a waterborne sewerage system. All of these services were provided by the mine, at a nominal fee, that was deducted from employees' monthly wages. When the mine went into liquidation, these services were threatened. The municipality could not take over the services due to lack of funding and capacity and furthermore stated that the mine village was on "private property" and therefore not within the municipality's jurisdiction. According to the LHR report (January 2017), the community secured a court order requiring the municipality to provide access to water and sanitation, however sewage is still of concern.

According to the updated SIA, uncollected refuse and raw sewage was seen in the streets, which can have negative health impacts on the communities of concern, including but not limited to diarrhoea, eye and skin infections.

##### *8.4.13.3.1 Water and Sanitation Related Diseases*

The most common types of poor sanitation related diseases include:

- **Diarrhoea** is caused by a variety of micro-organisms including viruses, bacteria and protozoans. Diarrhoea causes a person to lose both water and electrolytes, which leads to dehydration and, in some cases, to death. Repeated episodes of diarrhoeal disease make children more vulnerable to other diseases and malnutrition. Diarrhoea is the most important public health problem directly related to water and sanitation. The simple act of washing hands with soap and water can cut diarrhoeal disease by one-third. Next to providing adequate sanitation facilities, it is the key to preventing waterborne diseases.

- **Dysentery and diarrhoea** are often used as similar terms. However, these two conditions are clinically different from each other. The most important difference between dysentery and diarrhoea relates to the affected area. While watery diarrhoea is a disease that affects the small bowel, dysentery affects the colon. The second difference between the two relates to the typical symptoms that are observed. Diarrhoea is presented as watery stool that may or may not be accompanied by cramps or a pain. However, in case of dysentery, the person suffers from a mucoid (resembling/ similar to mucin) stool that may be accompanied by blood. Dysentery is also accompanied by fever at times. Persons suffering from dysentery usually complain of cramps and pain in the lower abdominal area. It is interesting to note that four respondents listed abdominal pains/"stomach pain" as one of the most common illnesses affecting their villages, which could be a possible link to dysentery.
- **Cholera** is an acute bacterial infection of the intestinal tract. It causes severe attacks of diarrhoea that, without treatment, can quickly lead to acute dehydration and death. Cholera is a world-wide problem, especially in emergency situations. It can be prevented by access to safe drinking water, sanitation and good hygiene behaviour (including food hygiene).
- **Trachoma** is an eye infection spread mainly through poor hygiene caused by lack of adequate water supplies and unsafe environmental sanitation conditions.
- **Intestinal worms,** also known as Helminths, in an intestinal parasitic worms, which people come into contract with through contact with soil that has been contaminated with human faeces from an infected person, or by eating contaminated food. Depending upon the severity of the infection, it can lead to malnutrition, anaemia or retarded growth. Children are particularly susceptible and typically have the largest number of worms.

A hygienic environment, clean water and adequate sanitation are key factors in preventing opportunistic infections associated with HIV/AIDS, and in the quality of life of people living with the disease. AIDS-affected people are more susceptible to water-related diseases than healthy individuals, and they become sicker from these infections than people with healthy immune systems. Maintaining a healthy environment is essential to safeguarding the health, quality of life and productivity of people living with HIV/AIDS.

#### 8.4.13.4 *EHA 8: Exposure to Potentially Hazardous Materials*

Health considerations include air, groundwater and surface water pollution.

Wind erosion is a major cause of both loss and dispersion of tailings material from a tailings dam facility to its surrounding environment. Such dust dispersion is not only a nuisance but also a potential health hazard to inhabitants in close proximity and can also cause soil and water pollution. The main pollutant of concern during the Project will be PM including $PM_{10}$ and $PM_{2.5.}$ A detailed Air Quality Impact Assessment Report is appended to the EIA Report.

### *8.4.13.4.1 Health Implications as a Result of Pollutants*

The World Health Organisation (WHO) confirms that particulate air pollution is associated with complaints of the respiratory system (WHO, 2000). PM size is relevant in terms of health because it controls where in the respiratory system a given particle is deposited. Fine particles are thought to be more damaging to human health than coarse particles as larger particles are less respirable in that they do not penetrate deep into the lungs compared to smaller particles (Manahan, 1991). Larger particles are deposited into the extra-thoracic part of the respiratory tract while smaller particles are deposited into the smaller airways leading to the respiratory bronchioles (WHO, 2000). The range of adverse health effects of PM is broad, involving respiratory and cardiovascular systems in children and adults. Both short- and long-term exposures lead to adverse health effects (Table 8-29). Very young children are particularly sensitive to the adverse effects of PM, due to their stage pf physical growth, immature immune system and developing respiratory organs with a more susceptible and reactive respiratory epithelium (Yohannessen, K et al. (2015). Adverse effects of PM on lung development include reversible deficits of lung function as well as chronically reduced lung growth rate and long-term lung function deficit. The available evidence is also sufficient to assume a causal relationship between exposure to PM and aggravation of asthma, as well as cough and bronchitis symptoms. Daily mortality and hospital admissions have been linked with short term variation of PM levels. Increased mortality from cardiovascular and respiratory diseases and from lung cancer has been observed in residents of more polluted areas (WHO, 2011).

WHO revised the Air Quality Guidelines (AQG) for PM based on existing evidence of adverse health effects at lower concentrations (WHO, 2005). For $PM_{2.5}$, the AQG are 10 µg/m$^3$ (annual average) and 25 µg/m$^3$ (24-hour mean) [not to be exceeded for more than 3 days/year]. The corresponding annual and daily guidelines for $PM_{10}$ were set as 20 µg/m$^3$ and 50 µg/m$^3$.

Ambient $PM_{10}$ concentrations are a good approximation of population exposure to PM from outdoor sources. Numerous epidemiological studies conducted in Europe and in other parts of the world have shown adverse health effects of exposure to $PM_{10}$ and $PM_{2.5}$ at concentrations that are currently observed in Europe and the rest of the world. WHO estimated that approximately 700 annual deaths from acute respiratory infections in children aged 0–4 years could be attributed to $PM_{10}$ exposure in the WHO European Region in the late 1990s alone. Population health effects of exposure to PM in adults are dominated by mortality associated with long-time exposure to fine PM ($PM_{2.5}$).

**Table 8-29: Short-term and long-term health effects associated with exposure to PM (WHO, 2004)**

| Pollutant | Short-term exposure | Long-term exposure |
|---|---|---|
| Particulate Matter | Lung inflammatory reactions | Increase in lower respiratory symptoms |
| | Respiratory symptoms | Reduction in lung function in children |
| | Adverse effects on the cardiovascular system | Increase in chronic obstructive pulmonary disease |
| | Increase in medication usage | Reduction in lung function in adults |
| | Increase in hospital admissions | Reduction in life expectancy |
| | Increase in mortality | Reduction in lung function development |

### 8.4.13.5 *EHA 9: Social Determinants of Health*

Social determinants of health are the economic, physical and social conditions that influence the health of individuals, communities and jurisdictions as a whole. Social determinants of health include housing, education, social networks and connections, racism, employment, and law enforcement and the legal and custodial system. The absence or presence of these determinants, and the interaction between them, influence both health outcomes and risk behaviours (www.aph.gov.au).

#### *8.4.13.5.1 Population Influx*

According to the updated SIA (appended to the EIA), the study found no evidence of large-scale in-migration to the area; on the contrary, the population has decreased, more than likely due to the liquidation of the mine. Based on the limited number of job opportunities created by the recommissioning of parts of the mine, it is unlikely that the operation would draw large numbers of job seekers to the area. However, through news coverage it is possible that people who worked at the mine previously might assume that the entire mine has become operational again and decide to return the area in the hope of being reappointed at the new operations. Again, it is expected to be a few individuals rather than large groups. Correct communication, including employment opportunities, type of skills required, and availability of positions will help with regard to employment expectations.

The influx of people could lead to conflict over limited resources both in terms of the number of job opportunities, and the availability and reliability of infrastructure and services. The effect of newcomers has already partially materialised with the arrival of the suspected zama-zamas who lead to conflict and violent clashes with the local community and SAPS.

#### *8.4.13.5.2 Quality of Life*

Quality of Life (QoL) is defined as the general wellbeing of an individual/society. The Public Participation Process, followed by Golder, identified project related areas of concern:

- Uncertainty of future mining plans and further non-adherence to environmental regulatory requirements (e.g. dust suppression at TSFs), leading to negative environmental and health impacts;
- Fear of property damage from blasting and vibration and related noise levels;
- Traffic impacts to the existing road network, on-site vehicular traffic and hazards from hazardous materials;
- Informal shacks constructed on the mine site and tailings dumps that will need to be removed. People have expressed their concern for the health of these shack dwellers who might have been exposed to high levels of toxic substances; and
- Concerns related to the security of the operations and human rights violations, including the use of security personnel to control illegal miners.

Two common themes emerged through the consultation process that influence stakeholders' impact experiences:

- Communication: on-going and regular communication processes must be put in place between Blyvoor Gold and affected communities aimed at building a relationship between the two parties. Meaningful communication will assist in addressing negative perceptions; and
- Governance, monitoring and accountability: The current situation at the mine points to lapses in governance, monitoring and accountability. These have become legacy issues as there is a healthy dose of cynicism amongst residents on how the new owners will deal with historic issues.

### 8.4.14 Cultural Heritage

The baseline information provided herein is summarised from the Heritage report, attached as Appendix 11.

No outcrops of paleontologically sensitive material and no heritage resources were identified during the pre-disturbance survey. Built heritage resources were identified through historical imagery but none of these resources exist within the development footprint area. The infrastructure associated with 5 Shaft and the 5 Sub-vertical Shaft was completed from the 1980s onwards and is therefore not afforded general protection under Section 34 of the NHRA.

Although no heritage resources were identified, the cultural heritage baseline was updated as part of this EIA to provide more accurate data. The baseline description considers the predominant landscape based on the identified heritage resources within the regional-, local- and site-specific study areas and within the development footprint. This is then considered in the context of archaeological periods in South Africa which are summarised in Table 8-30 below.

**Table 8-30: Archaeological periods in South Africa (adapted from Esterhuysen & Smith, 2007)**

| | | |
|---|---|---|
| **The Stone Age** | Early Stone Age (ESA) | 2 mya to 250 thousand years ago (kya) |
| | Middle Stone Age (MSA) | 250 kya to 20 kya |
| | Later Stone Age (LSA) | 20 kya to 500 CE (Common Era[2]) |
| **Farming Communities** | Early Farming communities (EFC) | 500 to 1400 CE |
| | Late Farming Communities (LFC) | 1100 to 1800 CE |
| **Historical Period** | - | 1500 CE to 1994<br>(Behrens & Swanepoel, 2008) |

### 8.4.14.1 *Regional Geology and Palaeontological Sensitives*

Lithologies associated with the Witwatersrand and Transvaal Supergroups underlie the MRA but for the purpose of establishing the Cultural Heritage baseline, the Karoo Supergroup was considered as part of the regional assessment. Within the Witwatersrand Supergroup, the West Rand Group is the most relevant to the Project-specific study area, however; this Supergroup has negligible or zero palaeontological sensitivity and was not considered any further. Within the Transvaal Supergroup are the Chuniespoort and Pretoria Groups. Paleontologically sensitive layers include the Chuniespoort Group (including the Malmani Subgroup), Pretoria Group and Karoo Supergroup (SAHRIS 2013). Many layers of the Transvaal Supergroup are conducive to cave-forming karst topography and a famous example of within these caves is so-called Cradle of Humankind World Heritage Site, approximately 50km from the Project site.

### 8.4.14.2 *Stone Age*

The Stone Age in southern Africa is divided into three broad phases, namely: the ESA, the MSA and the LSA. Cradle of Humankind is associated with the ESA but is the only heritage resource recorded for this period. The MSA accounts for 2% of the heritage resources recorded, which is associated with bone tools, ochre, beads and pendants as well as the use of good-quality raw materials further characterise this period. The LSA is commonly associated with hunter-gatherers but no expressions are recorded in the region. The San (including Barsarwa, Bathwa and hunter-gatherer groups) are generally accepted as the first inhabitants of present-day South Africa (Makhura 2007). Later, the various peoples of the

[2] Common Era (CE) refers to the same period as *Anno Domini* (“In the year of our Lord”, referred to as AD): i.e. the time after the accepted year of the birth of Jesus Christ and which forms the basis of the Julian and Gregorian calendars. Years before this time are referred to as ‘Before Christ’ (BC) or, here, BCE (Before Common Era).

Farming Community, including the ancestors of the modern Sotho-Tswana and Nguni peoples, settled in the area.

#### 8.4.14.3 *Farming Communities*

The Farming Community period correlates to the movements of Bantu-speaking agro-pastoralists moving into southern Africa. The Farming Community is divided into the EFC and LFC periods. No expressions of the EFC were identified within the regional study area.

LFC resources account for 12% of the heritage resources identified in the larger study area (Huffman *et al* 1994; Digby Wells 2015; Van Schalkwyk 2017). LFC settlements are identified through stonewalling or secondary tangible surface indicators such as ceramics. Stonewalls of the era can be divided into categories based on construction technique, coursing, height, shape and internal divisions and so-called ‘Type N’ and ‘Klipriviersburg’ walling is associated the regional and local study area. Similarly, ceramics can also be divided into groups used to identify the ceramic users from archaeological records (Huffman 2007). *Ntsuanatsatsi* (1450 to 1650 CE) and *Uitkomst* (1650 and 1820 CE) are the most common ceramic facies in the study area.

Within the study area, the LFC settlements are thought to be associated ethnographically with the Tswana and Fokeng, ruling over various regions from the 15$^{th}$ century. The Tswana groups appear to have been in the area first and the Fokeng moved into the region later, possibly during the 16$^{th}$ century. From the mid-16$^{th}$ century, communities started to move into condensed settlements wherein all inhabitants allied themselves to chiefs. These settlements included new spatial characteristics with domestic living areas becoming more elaborate and segmented. These further contributed to the increasing political centralisation (Huffman 2007; Anderson 2009).

#### 8.4.14.4 *Historical Period*

The historical period[3] is commonly regarded as the period characterised by contact between Europeans and Bantu-speaking African groups and the written records associated with these interactions. However, the division between the historical period and the LFC is largely artificial and there is a large amount of overlap between the two. An important example of this artificial division is the Mfecane (in the Nguni languages) or the Difaqane (Sotho languages).

The Difaqane refers to the period between approximately 1817 and 1826 which is characterised by violence and political unrest associated with the movement of Mzilikazi and his Ndebele into the interior of South Africa (Anderson 2009; Landau 2010). As the Ndebele migrated, the occupants of settlements which were now abandoned or destroyed were either subdued and joined the Ndebele, abandoning their previous cultural identity or fled. European

[3] In southern Africa, the last 500 years represents a formative period that is marked by enormous internal economic and political invention and experimentation that shaped modern identities and cultural contours outside of European contact. This period is currently not well documented but is being explored through the 500 Year Initiative (Swanepoel *et al* 2008).

missionaries, settlers, traders and travellers moving into the interior further added to the instability and the resulting power struggles. Large tracts of land, some of which abandoned by from the Difaqane became host to the early white migrants (Voortrekkers, and later the Boers) during the 1830s. Soon thereafter, the British moved into the interior of South Africa and sought to rule over the Boer republics which culminated in the Transvaal War of 1880 to 1881. The gold reef on the Witwatersrand was discovered five years later, in 1886.

Within the regional study area, the historical period and the associated built heritage (buildings, complexes and structural remains) represent 22% and 46% of the heritage resources respectively. Burial grounds account for a further 10% of the heritage resources and range from single graves to burial grounds of more than 100 graves (Digby Wells 2015; Van Schalkwyk 2017).

The farm Blyvooruitzicht was originally farmed by Pieter Daniel Roux. The name is a Dutch term, meaning ‘happy outlook’ or ‘happy prospect’. Dr. R. Krahmann successfully completed a geophysical magnetometer survey over the present lease area in the early 1930s. Further explorations confirmed the viability of the mine and BGMC which opened in 1937. BGMC became the first mine to exploit the Carbon Leader Reef. In 1947, following the result of similar exploration activities on the neighbouring farm Doornfontein, the eponymous company became the fifth mine to open along the West Wits Line. Some of the earlier infrastructure associated with the BGMC operations remains standing and is afforded general protection under Section 34 of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA).

### 8.4.15 Socio-Economic

Digby Wells compiled and addendum to the Social Impact Assessment (SIA) Report (Report Number 1656096-307576-4) compiled by Golder in 2016 as part of the Section 11 Mining Right Transfer process. The SIA Addendum is attached as Appendix 12. In this baseline summary section, as well as in the SIA Addendum Report, where information has been sourced directly from the Golder SIA (2016), this is presented in *italics*, and where new data has become available and added to the Golder (2016) information, this is indicated in **bold**.

The baseline section provided below is summarised from the SIA Addendum, and focuses on the primary study area. The SIA Addendum considered four study areas which are further divided into two categories. The primary study and the secondary study area. Figure 8-32 provides the areas considered secondary; Gauteng Province, the West Rand District Municipality (WRDM), and the Merafong City Local Municipality, wherein the Project area lies.

The Primary area comprises of Ward 5 and Ward 27, and both wards are <u>defined by houses, any Project infrastructure, the former BGMC mine residential village areas</u>, and the people who still live there as <u>these settlements are within the closest proximity to the Project</u>. These areas are North Dene, South Dene, East Dene, The Village, The Hillside and Doornfontein, and are most likely to experience direct socio-economic impacts. Ward-level data presented here is based on Census 2011 data but within the new 2016 ward boundaries, unless otherwise specified.

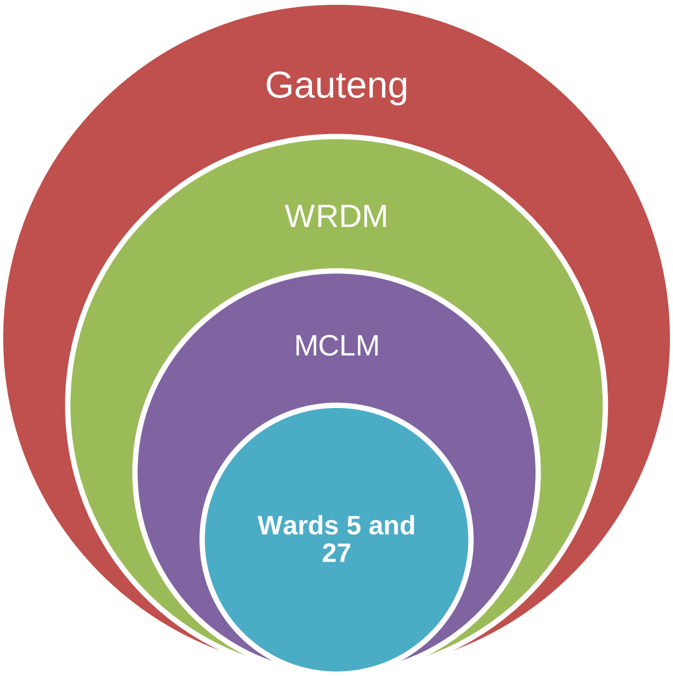



**Figure 8-32: Primary and secondary study areas**

#### 8.4.15.1 *Mine Village History*

In summary, BGMC was established in 1937 and owned by several mining companies until liquidation in 2013. Traditionally, BGMC housed most of their employees in these houses or in hostels. In the villages, BGMC provided various types of recreational facilities but most notably, BGMC provided all basic services including running water, sanitation, electricity, and refuse removal – all the services usually provided by local government.

DRD Gold Limited (DRD) owned the mine from 1997 until selling all DRD shares to Village Main Reef Ltd (VMR) in 2012. Both DRD and VMR stopped providing funding to the mine and neither company took responsibility for maintenance of any of the infrastructure, up until liquidation in 2013. Employees were immediately retrenched, and employees either remained in their village house if they had nowhere else to go, or the houses were abandoned and taken over by squatters.

Five years since liquidation, the MCLM has still not officially taken over responsibility for the villages and the basic services usually provided by a municipality. During recent site visits by the Digby Wells' team, it was recorded that refuse is being piled up by residents on the streets and in the nearby public parks. Blyvoor Gold confirmed that the sewerage systems have broken down. The villages aren't connected to any municipal water supply, so there is no running water to these houses, either. Dust suppression at the mine has not been done since liquidation, which has led to windblown dust from the TSFs blowing into neighbouring villages, and as far as Carletonville. Illegal miners settled in the area to access the operations for gold. Blyvoor Gold has implemented security at the mine to prevent illegal access, however, the mining infrastructure had already been severely vandalised and stripped of any valuable materials (i.e., copper).

#### 8.4.15.2 *Demographic Indicators*

Most residents are part of the Black African population group; 91.6% in Ward 5 and 95% in Ward 27. More recent data for the wards is not available but the report compiled by Lawyers for Human Rights (LHR) (2017) estimates the current population to be around 6,000 people.

Around 85% of the population in the mine villages are in the economically active age group, and 73% of the population for both wards are male. Given the arrival of zama-zamas and the risk associated with illegal mining, it is not unusual that the majority of the population is male. The predominant languages spoken are isiXhosa (around 30%) and Sesotho (around 22%), indicative of a migrant workforce who are from the North and the Eastern Cape.

#### 8.4.15.3 *Economic Indicators*

The education levels in the mine village are extremely low. One per-cent of residents 20 years and older have obtained Matric, one in every 10 individuals has had no schooling. Despite the low education levels, the rate of employment for mostly unskilled and semi-skilled work is high; 82.3% in Ward 5 and 91.6% in Ward 27. Based on the annual household income profile, the majority of households (82.1% in Ward 5 and 84.9% in Ward 27) fall within the lower middle-income bracket or live in absolute poverty (20.6% in Ward 5 compared to 12.7% in Ward 27). LHR (2017) reported worsening conditions since the mine liquidated; 75% of the village residents are unemployed, and 90% of the respondents indicated that training was never provided at BGMC to enable these residents to find work outside of the mining sector.

#### 8.4.15.4 *Infrastructure and Services*

Prior to the mine closing, housing subsidies were provided by BGMC and the villages were nearly bought by a private company after BGMC went into liquidation, but that deal was not realised due the municipality's unwillingness to recognise the villages and incorporate them into the MCLM.

#### 8.4.15.5 *Basic Services*

Prior to mine closure, the majority of houses (around 94%) had access to piped water. Likewise, most houses were connected to electricity. Most (ranging between 85% and 90%) had their refuse removed by a service provider. Almost all the households (between 84% and 92%) had access to a flush toilet connected to a waterborne sewerage system. All of these services were provided by the mine at a nominal fee that was deducted from employees' monthly wages.

No official supply of water to the villages was proved after BGMC closure, and the infrastructure has steadily been declining since. A court order in 2016, instructed MCLM to develop a water and sanitation plan but LHR (2017) reported that 84% of people surveyed claimed that sewage was still a concern, and site visits by Digby Wells confirmed this as recently as September 2018.

Electricity to the mine village was interrupted in the immediate aftermath of mine closure, causing a significant increase in violent crime and infrastructure theft. Electricity was subsequently reconnected but in 2015, Eskom again threatened to disconnect the supply due to non-payment. In 2016, the community reached an agreement with Eskom that stipulated that residents would pay for bulk electricity supply to the mine village while Eskom installed electricity meters to homes. However, it remains a challenge for the residents to pay for electricity in the absence of the ability to monitor individual household usage (LHR Report, 2017).

Two primary schools were observed to be operating, namely Laerskool Blyvooruitsig in the village and Rockland Primary in the Hill. The Gauteng Department of Health runs the Blyvoor Clinic in Northdene. There was a dedicated mine hospital but that closed in 2013. All former recreational facilities are in a state of disrepair.

Respondents in the LHR study reported crime as a major issue. Crime levels decreased somewhat in 2015/16 and again in 2016/17 but in 2017/18, rose to an all-time high. Security in the villages used to be provided by mine security. Crime includes vandalization of the mine property, and clashes between zama-zamas.

Another issue of safety but unrelated to crime is the residents fear of sinkholes caused by groundwater seepage. LHR reported in 2017 that residents are fearful of sinkhole formation as no underground maintenance is being done.

# 9 Item 3(h)(vi): Methodology used in Determining and Ranking the Nature, Significance, Consequence, Extent, Duration and Probability of Potential Environmental Impacts and Risks

Impacts and risks have been identified based on a description of the activities to be undertaken. Once impacts have been identified, a numerical environmental significance rating process will be undertaken that utilises the probability of an event occurring and the severity of the impact as factors to determine the significance of a particular environmental impact.

The severity of an impact is determined by taking the spatial extent, the duration and the severity of the impacts into consideration. The probability of an impact is then determined by the frequency at which the activity takes place or is likely to take place and by how often the type of impact in question has taken place in similar circumstances.

Following the identification and significance ratings of potential impacts, mitigation and management measures will be incorporated into the Environmental Management Programme (EMP).

Details of the impact assessment methodology used to determine the significance of physical, bio-physical and socio-economic impacts are provided below.

The significance rating process follows the established impact/risk assessment formula:

| |
|---|
| Significance = CONSEQUENCE X PROBABILITY X NATURE |

Where

| |
|---|
| Consequence = intensity + extent + duration |

And

| |
|---|
| Probability = likelihood of an impact occurring |

And

| |
|---|
| Nature = positive (+1) or negative (-1) impact |

The matrix calculates the rating out of 147, whereby intensity, extent, duration and probability are each rated out of seven as indicated in Table 9-2. The weight assigned to the various parameters is then multiplied by +1 for positive and -1 for negative impacts.

Impacts are rated prior to mitigation and again after consideration of the mitigation has been applied; post-mitigation is referred to as the residual impact. The significance of an impact is determined and categorised into one of seven categories (The descriptions of the significance ratings are presented in Table 9-3).

It is important to note that the pre-mitigation rating takes into consideration the activity as proposed, (i.e., there may already be some mitigation included in the engineering design). If the specialist determines the potential impact is still too high, additional mitigation measures are proposed.

## Table 9-1: Impact assessment parameter ratings

| Rating | Intensity/ Replacability | | Extent | Duration/Reversibility | Probability |
|---|---|---|---|---|---|
| | **Negative Impacts (Nature = -1)** | **Positive Impacts (Nature = +1)** | | | |
| 7 | Irreplaceable loss or damage to biological or physical resources or **highly** sensitive environments.<br>Irreplaceable damage to **highly sensitive** cultural/social resources. | Noticeable, on-going natural and / or social benefits which have improved the overall conditions of the baseline. | International<br>The effect will occur across international borders. | Permanent: The impact is irreversible, even with management, and will remain after the life of the project. | Definite: There are sound scientific reasons to expect that the impact will definitely occur. >80% probability. |
| 6 | Irreplaceable loss or damage to biological or physical resources or **moderate to highly** sensitive environments.<br>Irreplaceable damage to cultural/social resources of **moderate to highly** sensitivity. | Great improvement to the overall conditions of a large percentage of the baseline. | National<br>Will affect the entire country. | Beyond project life: The impact will remain for some time after the life of the project and is potentially irreversible even with management. | Almost certain / Highly probable: It is most likely that the impact will occur.>65 but <80% probability. |

| Rating | Intensity/ Replacability | | Extent | Duration/Reversibility | Probability |
|---|---|---|---|---|---|
| | **Negative Impacts (Nature = -1)** | **Positive Impacts (Nature = +1)** | | | |
| 5 | Serious loss and/or damage to physical or biological resources or **highly** sensitive environments, limiting ecosystem function.<br>Very serious widespread social impacts. Irreparable damage to highly valued items. | On-going and widespread benefits to local communities and natural features of the landscape. | <u>Province/ Region</u><br>Will affect the entire province or region. | Project Life (>15 years): The impact will cease after the operational life span of the project and can be reversed with sufficient management. | Likely: The impact may occur. <65% probability. |
| 4 | Serious loss and/or damage to physical or biological resources or **moderately** sensitive environments, limiting ecosystem function.<br>On-going serious social issues. Significant damage to structures / items of cultural significance. | Average to intense natural and / or social benefits to some elements of the baseline. | <u>Municipal Area</u><br>Will affect the whole municipal area. | Long term: 6-15 years and impact can be reversed with management. | Probable: Has occurred here or elsewhere and could therefore occur. <50% probability. |

| Rating | Intensity/ Replacability | | Extent | Duration/Reversibility | Probability |
|---|---|---|---|---|---|
| | **Negative Impacts (Nature = -1)** | **Positive Impacts (Nature = +1)** | | | |
| 3 | Moderate loss and/or damage to biological or physical resources of **low to moderately** sensitive environments and, limiting ecosystem function.<br>On-going social issues. Damage to items of cultural significance. | Average, on-going positive benefits, not widespread but felt by some elements of the baseline. | <u>Local</u><br>Local including the site and its immediat surrounding area. | Medium term: 1-5 years and impact can be reversed with minimal management. | Unlikely: Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur. <25% probability. |
| 2 | **Minor loss and/or effects** to biological or physical resources or low sensitive environments, not affecting ecosystem functioning.<br>Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and | Low positive impacts experience by a small percentage of the baseline. | <u>Limited</u><br>Limited extending only as far as the development site area. | Short term: Less than 1 year and is reversible. | Rare / improbable: Conceivable, but only in extreme circumstances. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures. <10% probability. |

| Rating | Intensity/ Replacability | | Extent | Duration/Reversibility | Probability |
|---|---|---|---|---|---|
| | **Negative Impacts (Nature = -1)** | **Positive Impacts (Nature = +1)** | | | |
| | processes not affected. | | | | |
| 1 | **Minimal to no loss** and/or effect to biological or physical resources, not affecting ecosystem functioning.<br>Minimal social impacts, low-level repairable damage to commonplace structures. | Some low-level natural and / or social benefits felt by a very small percentage of the baseline. | Very limited/Isolated<br>Limited to specific isolated parts of the site. | Immediate: Less than 1 month and is completely reversible without management. | Highly unlikely / None: Expected never to happen. <1% probability. |

## Table 9-2: Probability/consequence matrix

Significance

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| -147 | -140 | -133 | -126 | -119 | -112 | -105 | -98 | -91 | -84 | -77 | -70 | -63 | -56 | -49 | -42 | -35 | -28 | -21 | 21 | 28 | 35 | 42 | 49 | 56 | 63 | 70 | 77 | 84 | 91 | 98 | 105 | 112 | 119 | 126 | 133 | 140 | 147 |
| -126 | -120 | -114 | -108 | -102 | -96 | -90 | -84 | -78 | -72 | -66 | -60 | -54 | -48 | -42 | -36 | -30 | -24 | -18 | 18 | 24 | 30 | 36 | 42 | 48 | 54 | 60 | 66 | 72 | 78 | 84 | 90 | 96 | 102 | 108 | 114 | 120 | 126 |
| -105 | -100 | -95 | -90 | -85 | -80 | -75 | -70 | -65 | -60 | -55 | -50 | -45 | -40 | -35 | -30 | -25 | -20 | -15 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 |
| -84 | -80 | -76 | -72 | -68 | -64 | -60 | -56 | -52 | -48 | -44 | -40 | -36 | -32 | -28 | -24 | -20 | -16 | -12 | 12 | 16 | 20 | 24 | 28 | 32 | 36 | 40 | 44 | 48 | 52 | 56 | 60 | 64 | 68 | 72 | 76 | 80 | 84 |
| -63 | -60 | -57 | -54 | -51 | -48 | -45 | -42 | -39 | -36 | -33 | -30 | -27 | -24 | -21 | -18 | -15 | -12 | -9 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 | 39 | 42 | 45 | 48 | 51 | 54 | 57 | 60 | 63 |
| -42 | -40 | -38 | -36 | -34 | -32 | -30 | -28 | -26 | -24 | -22 | -20 | -18 | -16 | -14 | -12 | -10 | -8 | -6 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 32 | 34 | 36 | 38 | 40 | 42 |
| -21 | -20 | -19 | -18 | -17 | -16 | -15 | -14 | -13 | -12 | -11 | -10 | -9 | -8 | -7 | -6 | -5 | -4 | -3 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| -21 | -20 | -19 | -18 | -17 | -16 | -15 | -14 | -13 | -12 | -11 | -10 | -9 | -8 | -7 | -6 | -5 | -4 | -3 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |

Consequence

### Table 9-3: Significance rating description

| Score | Description | Rating |
|---|---|---|
| 109 to 147 | A very beneficial impact that may be sufficient by itself to justify implementation of the project. The impact may result in permanent positive change | Major (positive) (+) |
| 73 to 108 | A beneficial impact which may help to justify the implementation of the project. These impacts would be considered by society as constituting a major and usually a long-term positive change to the (natural and / or social) environment | Moderate (positive) (+) |
| 36 to 72 | A positive impact. These impacts will usually result in positive medium to long-term effect on the natural and / or social environment | Minor (positive) (+) |
| 3 to 35 | A small positive impact. The impact will result in medium to short term effects on the natural and / or social environment | Negligible (positive) (+) |
| -3 to -35 | An acceptable negative impact for which mitigation is desirable. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the natural and / or social environment | Negligible (negative) (-) |
| -36 to -72 | A minor negative impact requires mitigation. The impact is insufficient by itself to prevent the implementation of the project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the natural and / or social environment | Minor (negative) (-) |
| -73 to -108 | A moderate negative impact may prevent the implementation of the project. These impacts would be considered as constituting a major and usually a long-term change to the (natural and / or social) environment and result in severe changes. | Moderate (negative) (-) |
| -109 to -147 | A major negative impact may be sufficient by itself to prevent implementation of the project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects. The impacts are likely to be irreversible and/or irreplaceable. | Major (negative) (-) |

# 10 Item 3(h)(v): Impacts and Risks Identified including the Nature, Significance, Consequence, Extent, Duration and Probability

Potential impacts resulting from mining activities during the construction, operation, decommissioning and closure phases of the Project were assessed based on the new activities being applied for as part of the Environmental Authorisation process. The impact assessment methodology provided in Section 9 above has been applied to the individual environmental aspects investigated for this application. The impact assessment provides a quantifiable comparison between the significance of an impact prior to mitigation measures being applied versus the significance of the same impact after mitigation measures have been applied.

Table 10-1 below indicates which studies were undertaken to provide more recent information pertaining to the actual environmental status on site. Not all studies required an impact assessment and certain studies were undertaken only to provide updated baseline information (as provided in Section 8.4, above).

**Table 10-1: Extent of Updated Specialist Input**

| Study | Extent of Assessment |
|---|---|
| Groundwater | Impact Assessment |
| Surface Water | Impact Assessment |
| Flora and Fauna | Baseline Update |
| Wetlands | Impact Assessment |
| Aquatics | Baseline Update (considered to an extent in Impact Assessment) |
| Geochemical | Baseline Update |
| Radiological | Impact Assessment |
| Community Health | Impact Assessment |
| Cultural Heritage | Baseline Update |
| Socio-Economic | Addendum to Social Impact Assessment |

Table 10-2 provides a breakdown of the activities associated with the recommissioning activities and the aspects affected per activity, in the respective phases of the mining operation.

### Table 10-2: Aspect Affected by Proposed Activities in the Respective Project Phases

| Project Phase | Project Activity | Aspects Affected |
|---|---|---|
| Construction Phase | Site clearing where vegetation has since re-established | ▪ Surface Water<br>▪ Wetlands<br>▪ Air Quality |
| | Reconstruction of metallurgical plants and other mining infrastructure | ▪ Surface Water<br>▪ Wetlands<br>▪ Air Quality<br>▪ Radiological<br>▪ Community Health |
| | Temporary storage of hazardous products, including fuel | ▪ Surface Water<br>▪ Wetlands |
| | Storage of waste and sewage | ▪ Surface Water<br>▪ Wetlands |
| Operational Phase | Operation of the underground mine, conveyors, processing plants, haulage, etc. | ▪ Surface Water<br>▪ Air Quality<br>▪ Radiological<br>▪ Community Health<br>▪ Socio-economic |
| | TSF reclamation | ▪ Groundwater<br>▪ Surface Water<br>▪ Wetlands<br>▪ Air Quality<br>▪ Radiological<br>▪ Community Health |
| | Deposition onto existing TSF | ▪ Groundwater<br>▪ Community Health |

| Project Phase | Project Activity | Aspects Affected |
|---|---|---|
| | Operation activities: Plants and conveyors | ▪ Groundwater<br>▪ Surface Water<br>▪ Wetlands<br>▪ Air Quality<br>▪ Radiological<br>▪ Community Health |
| | Mine water management | ▪ Groundwater<br>▪ Surface Water<br>▪ Wetlands<br>▪ Radiological<br>▪ Community Health |
| | TSF care and maintenance activities for the duration of this current application (TSF No. 1, DTSF No. 1, DTSF No. 2 and DTSF No. 3 will be held in care and maintenance for the 15-year Project life). | ▪ Groundwater<br>▪ Surface Water<br>▪ Wetlands<br>▪ Radiological<br>▪ Community Health |
| Decommissioning Phase | Demolition and removal of all infrastructure, including transporting materials off site | ▪ Surface Water<br>▪ Wetlands<br>▪ Radiological<br>▪ Community Health<br>▪ Socio-economic |
| | Storage, handling and treatment of hazardous products (including fuel, explosives and oil) and waste | ▪ Radiological<br>▪ Socio-economic |
| | Rehabilitation, including spreading of soil, re-vegetation and profiling or contouring, and post-closure monitoring | ▪ Groundwater<br>▪ Surface Water<br>▪ Wetlands<br>▪ Radiological<br>▪ Community Health<br>▪ Socio-economic |

## 10.1 Groundwater

An impact assessment requires water levels, water quality, groundwater flow direction and predictive modelling to indicate the extent and intensity of the potential contamination. The impact assessment takes into consideration all the significant potential impacts and provides mitigation measures to reduce all expected impacts to the receptors discussed in Section 8.4.4.3, above. The project area is expected to have deep water levels resulting in reduced impacts to the groundwater environment. As no recent scientific data was available, preferential groundwater flow paths (faults and dykes), that may connect the potential contamination sources and the local aquifer, were still considered. Due to limited data, the decant associated with the operation could not be modelled and therefore this did not form part of the Groundwater Impact Assessment.

The existing TSFs have the potential to impact the groundwater quality environment negatively due to leaching, resulting in deteriorating groundwater quality. The list of project activities can be found in Table 10-3. Only project activities that are likely to result in a groundwater impact are assessed below.

**Table 10-3: Description of Activities to be assessed**

| Project Phase | Project Activity | Project Structures |
|---|---|---|
| Construction | TSFs under assessment are existing and no new TSFs will be constructed therefore this phase is irrelevant | Not applicable |
| Operations | Waste generation and storage | TSFs |
| Mine Decommissioning and Closure | Waste generation and storage | TSFs |

### 10.1.1 Operational Phase

The TSFs may generate contaminating leachate in the form of Acid Mine Drainage (AMD). As rainwater infiltrates through any of the facilities, metals could be dissolved, and leachate is formed. The leachate then seeps to the groundwater and migrates by advection through the groundwater environment. Material to be stored within the TSFs is classified as Type 3 waste, and acid generating (as discussed in Section 8.4.11). Management measures need to be in place as to eliminate/ reduce any potential impact to the groundwater environment.

Reclamation of TSF No. 4 & 5, TSF No. 6 and TSF No. 7 and deposition of material on DTSF No. 4 & 5, which will be lined will reduce the risk to the groundwater environment as the potential source of contamination will gradually be depleted throughout the reclamation process. Leachate that may be generated on TSF No. 4 & 5 will be prohibited from infiltrating into the groundwater environment because of the liner in place. This is a positive action with regards to impact to the groundwater environment.

#### 10.1.1.1 *Management/ Mitigation Measures*

The following are management objectives defined for the operational phase:

- Maintenance of the inactive TSFs is proposed to be conducted by developing an effective return water system, where these do not exist, to manage excess water that may accumulate at the tailings facilities;
- Installation of a Class C liner on TSF No. 4 & 5 when reclaimed and planned to operate post reclamation;
- Groundwater monitoring must be implemented to assess the time series water level and water quality trends; and
- Affected receptors (if proven through monitoring) should be compensated.

### 10.1.2 Decommissioning and Post-Closure Phase

Post closure, as during operation, potential leachate formation could result in groundwater quality deterioration.

#### 10.1.2.1 *Management/ Mitigation Measures*

The following are management objectives defined for the decommissioning and post-closure phase:

- The TSFs should be rehabilitated;
- Shaped to allow for free draining to reduce infiltration of rain;
- A numerical groundwater model should be done once updated data is available to complete a full risk and impact assessment;
- Groundwater monitoring should be conducted to assess the time series water level and water quality trends; and
- Affected receptors (if proven through monitoring) should be compensated.

## 10.2 Surface Water

Although water is an essential requirement in the mine for various purposes, the use of it has the potential to affect the quality of surrounding resources including surface water, groundwater and other aspects of the environment. All mines are, therefore, required to contain, recycle and re-use dirty water within their operational systems, to avoid discharging contaminated water into the natural environment.

If the dirty water contained within the mine exceeds the mine's water needs, transfer to other users or treatment for discharge into proximal natural water resources, can be considered. Whilst it was operational, the BGMC discharged water from the Mine Plant, this was channelled through canals/drains to the Mooirivierloop (DRD, 2001). The water sources for this discharge included treated sewage effluent, water pumped from underground to the surface and storm water from the catchment area of the Western Deep Levels Mine Shaft (DRD, 2001).

The scope of the Groundwater Impact Assessment was limited to the assessment of the TSFs on site as this impact had not previously been considered in detail in the approved EMP (2000).

### 10.2.1 Construction Phase

Impacts associated with the construction phase are summarised in Table 10-4 and further described in subsections 10.2.1.1 to 10.2.1.3.

**Table 10-4: Interactions and impacts of activity**

| Interaction | Impact |
|---|---|
| Exposure and erosion of soils due to loss of vegetation cover during site clearance. | Siltation of the Mooirivierloop, Wonderfonteinspruit and Greenbelt Streams leading to deterioration of water quality. |
| Reconstruction of metallurgical plants and other mining infrastructure | Contamination of water in the Mooirivierloop, Wonderfonteinspruit and Greenbelt Streams and subsequent deterioration of water quality for downstream water users. |

#### 10.2.1.1 *Impact Description: Siltation of the Mooirivierloop, Wonderfonteinspruit and Greenbelt Streams*

Site clearance for reconstruction purposes could result in the exposure of soils to agents of erosion, mainly wind and water. Wind-blown dust particles and surface runoff-eroded topsoil will end up in nearby watercourses including the Mooirivierloop, the Wonderfonteinspruit and Greenbelt Streams. Sedimentation and resultant siltation of the nearby watercourses will reduce their flow capacity, impact the quality of water, hence the aquatic life and associated functional capabilities. The Project site has a storm water management plan in place which would limit soil erosion and trap silt resulting in an impact of low significance (Table 10-5).

#### 10.2.1.2 *Impact Description: Water Contamination*

Water contamination may occur as a result of accidental fuels and the risk of chemical spillages and leakages from construction vehicles and machinery. These leakages and spillages will lead to the deterioration of water quality, affecting aquatic ecosystems and downstream water users.

#### 10.2.1.3 *Management/Mitigation Measures*

The following mitigation measures are recommended:

- The Project infrastructure already exists. Any future infrastructure development which will need excavation and vegetation clearance should only be limited to the proposed development footprint;

- Any required soil stockpiles should be stabilised, and stockpile slopes should not exceed 1:3 (Vertical: Horizontal) to reduce erosion from the stockpile and subsequent siltation of proximal watercourses;
- Dust suppression measures must be undertaken on the cleared areas during construction to reduce wind erosion; and
- All fuel and other temporary storage of chemicals used for construction should be appropriately bunded and have spill kits in place. Construction workers should be trained in the use of spill kits to contain and immediately clean up any leakages or spills. All used oils should be disposed of by accredited vendors from the mine site.

**Table 10-5: Impact Significance Rating for the Construction Phase**

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Impact: Siltation of surface water resources leading to deteriorated water quality** | | | |
| Duration | 2 | The impact will only likely occur when there is additional construction of infrastructure | 32-Negligible (negative) |
| Intensity | 3 | This will have minor to medium-term intensity resulting in reduction of proximal watercourse flow capacity and poor water quality for immediate downstream users and the aquatic life | |
| Spatial scale | 3 | The impacts will be localised to the nearby watercourses from where the silt is being generated to the immediate downstream | |
| Probability | 4 | Without appropriate mitigation, it is probable that this impact will occur | |
| **Post-mitigation** | | | |
| Duration | 2 | The impact will likely only occur during the construction phase | 6-Negligible (negative) |
| Intensity | 2 | Should the impact occur, it will have minor medium-term impacts resulting in a reduction in water quality for downstream users and the aquatic life | |
| Spatial scale | 2 | The impacts will be localised to the nearby water resources from where the silt is being generated to the immediate downstream | |

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| Probability | 1 | With the existing measures already in place. It will be rare/improbable for this impact to occur. | |

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Impact: Water Contamination** | | | |
| Duration | 2 | The impact will likely only occur during the construction phase | 40- Minor (negative) |
| Intensity | 4 | This will moderately impact the water quality and the ecosystem functionality for downstream users | |
| Spatial scale | 4 | The impacts may extend in the greater surrounding area from where the impact occurred | |
| Probability | 4 | Without appropriate mitigation, it is probable that this impact will occur | |
| **Post-mitigation** | | | |
| Duration | 2 | The impact will likely only occur during the construction phase | 16-Negligible (negative) |
| Intensity | 3 | This will moderately impact the water quality and the ecosystem functionality for downstream users | |
| Spatial scale | 3 | The impacts may extend in the greater surrounding area from where the impact occurred | |
| Probability | 2 | With the existing measures already in place. It will be rare/improbable for this impact to occur. | |

### 10.2.2 Operational Phase

Activities during the operational phase that may have potential impacts on the surface water resources are summarised in Table 10-6 and further described together with recommended management/mitigation measures in the following subsections.

**Table 10-6: Interactions and Impacts of Activity**

| Interaction | Impact |
|---|---|
| ▪ Operation of the underground mine, conveyors, processing plants, haulage, etc;<br>▪ TSF reclamation and deposition | In-stream water quality deterioration through potential runoff from dirty water areas and accidental hydrocarbon spillages |

###### 10.2.2.1.1 Impact Description: Water Contamination from runoff from dirty water areas

Water contamination may occur as a result of runoff from contaminated surfaces and from any dirty water discharges such as treated sewage effluent within the mine into the water course in proximity to the site. The dirty water areas at the Project site include shaft surface area, metallurgical treatment plants TSFs and PCDs. Contamination of surface water resources will lead to the deterioration of water quality affecting aquatic ecosystems and downstream water users.

##### 10.2.2.2 Impact Description: Water Contamination from fuels and chemical spillages and leakages from haulage trucks and machinery

Operational equipment and machinery at the Project site are potential sources of hydrocarbon and chemical spills and leakages. When not properly managed hydrocarbon and chemical spills and leakages will contaminate surface and groundwater resources in proximity to the Project site.

##### 10.2.2.3 Management/Mitigation Measures

The following mitigation measures are recommended:

- Runoff from dirty areas should be directed to the existing storm water management infrastructure (PCDs) and should not be allowed to flow into Wonderfonteinspruit, unless DWS discharge authorisation has been granted upon compliance with relevant effluent discharge standards as stipulated in the NWA. The PCDs and dirty water channels should be lined either by concrete or HDPE to prevent contamination of groundwater through seepage;
- Water quality monitoring should continue downstream and upstream of the mine site, and within all surface water circuits at the mine to detect any contamination arising from operational activities;
- Vehicles must only be serviced within designated service bays;
- The management of general and other forms of waste must ensure collection and disposal into clearly marked skip bins that can be collected by approved contractors for disposal to the appropriate disposal sites; and
- The hydrocarbon and chemical storage areas and facilities must be located on a hard-standing area (paved or concrete surface that is impermeable), roofed and bunded in

accordance with SANS1200 specifications. This will prevent mobilisation of leaked hazardous substances.

**Table 10-7: Impact significance rating for the operational phase**

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Impact: Water Contamination from runoff from dirty water areas** | | | |
| Duration | 6 | The impact will remain for some time after the life of the gold mining project. | 60-Minor (negative) |
| Intensity | 5 | Very serious, long-term environmental impairment of ecosystem function that may take several years to rehabilitate | |
| Spatial scale | 4 | The impacts will be localised to the nearby watercourses and to the immediate downstream water users | |
| Probability | 4 | Without appropriate mitigation, it is probable that this impact will occur | |
| **Post-mitigation** | | | |
| Duration | 3 | The impact will only likely persist in the absence of proper monitoring and maintenance of storm water management plan infrastructure on site. | 14-Negligible (negative) |
| Intensity | 2 | Proper and continued implementation of storm water management plan and water quality monitoring will lower the intensity of the contaminated runoff impact on proximal water resources. | |
| Spatial scale | 2 | The impacts will be localised to the nearby watercourses and to the immediate downstream water users. | |
| Probability | 2 | With continued implementation and improvement of existing mitigation measures the impact probability will be low. | |

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Impact: Water Contamination from hydrocarbon and chemical spillages and leakages** | | | |
| Duration | 2 | The impact will only likely occur during the operational phase of the project | Negligible (negative) -36 |

| | | | |
|---|---|---|---|
| Intensity | 4 | This will moderately impact the water quality and the ecosystem functionality for downstream users. | |
| Spatial scale | 3 | The impacts will be localised to the immediate surroundings of the mine site. | |
| Probability | 4 | Without appropriate mitigation, it is probable that this impact will occur. | |
| **Post-mitigation** | | | |
| Duration | 2 | The impact will only likely occur in the absence of recommended mitigation measures | Negligible (negative) -10 |
| Intensity | 1 | With proper management of hydrocarbon and chemicals on site the impact will rarely be of significance and water quality in nearby watercourses will be maintained for optimal functionality of ecosystems and downstream | |
| Spatial scale | 2 | With proper management, the impact will be localised to relevant operational areas within the mine’s footprint. | |
| Probability | 2 | With the implementation of recommended mitigation measures the impact’s probability of occurrence will be very low. | |

### 10.2.3 Decommissioning and Closure Phase

Activities during the decommissioning and closure phase that are potential impact sources on surface water resources in proximity to the Project are summarised in Table 10-8 and further described together with recommended management/mitigation measures in the following subsections.

**Table 10-8: Interactions and Impacts of Activity**

| Interaction | Impact |
|---|---|
| Demolition and removal of all infrastructure, including transporting materials off site | In-stream water quantity and quality deterioration as a result of siltation of nearby watercourses from demolition of infrastructure and subsequent disturbance of soils. |
| Rehabilitation, including spreading of soil, re-vegetation and profiling or contouring, and post-closure monitoring | In-stream water quality deterioration through AMD decant into proximal watercourses |

#### 10.2.3.1 *Impact Description: In-stream water quantity and quality deterioration from sedimentation and siltation of nearby watercourses*

During the decommissioning phase demolition of infrastructure, which is not planned for third party use, will cause disturbance and subsequent erosion of soils into nearby watercourses. This will result in the sedimentation and siltation of streams and dams thereby reducing their flow/storage capacities and their ability to sustain aquatic ecosystems. The quantity and quality of water for downstream water users will thus be compromised.

#### 10.2.3.2 *Impact Description: Water contamination from Acid Mine Drainage into nearby watercourses*

AMD causes acidification and metal contamination of surface and groundwater bodies when mine materials containing metal sulphides are exposed to oxidizing conditions. Heavy-metal contaminated and acidified groundwater discharges into streams at points where the water table is close to the surface. The oxidation of iron sulphide precipitates sulphuric acid which lowers in-stream water pH. Acidic water environments are detrimental to most aquatic life species, and they affect irrigation and livestock watering functions for downstream water users.

#### 10.2.3.3 *Management/Mitigation Measures*

The following mitigation measures are recommended:

- Disturbance of soils during infrastructure demolition should be restricted to relevant footprint areas;
- Movement of demolition machinery and vehicles should be restricted to designated access roads to minimise the extent of soil disturbance;
- The best option to limit AMD is early avoidance of sulphide oxidation through use of a combination of several techniques which include the following (Sahoo et al., 2013):
  - Electrochemical treatment of the acidified effluent producing re-usable water;
  - Physical barriers using wet or dry covers that retard sulphide oxidation;
  - Chemical passivation, which involves encapsulation of sulphide surfaces using organic and/or inorganic coatings such as silica, phosphate, lipids and humic acid;
  - Desulphurization which separates sulphide minerals into a low-volume stream, that mainly results in non-acid-generating waste with low sulphur content;
  - Use of accredited contractors for removal or demolition of infrastructure is recommended; this will reduce the risk of waste generation and accidental spillages; and

- Should decant occur at a later stage, decant water should be treated to acceptable water quality levels as approved by DWS prior to discharge into the natural stream.

### Table 10-9: Impact significance rating for the decommissioning and closure phase

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Impact: In-stream water quantity and quality deterioration** | | | |
| Duration | 2 | Demolition of infrastructure will occur during the decommissioning phase. | 24-Negligible (negative) |
| Intensity | 2 | This will have minor to medium-term intensity resulting in reduction of proximal watercourse flow capacity and poor water quality for immediate downstream users and the aquatic life | |
| Spatial scale | 2 | The impacts will be localised to the nearby watercourses from where the silt is being generated to the immediate downstream | |
| Probability | 4 | Without appropriate mitigation, it is probable that this impact will occur | |
| **Post-mitigation** | | | |
| Duration | 2 | The impact will likely only occur during the decommissioning phase | 6-Negligible (negative) |
| Intensity | 2 | Should the impact occur, it will have minor medium-term impacts resulting in a reduction in water quality for downstream users and the aquatic life | |
| Spatial scale | 2 | The impacts will be localised to the nearby water resources from where the silt is being generated to the immediate downstream | |
| Probability | 1 | With the existing measures already in place. It will be rare/improbable for this impact to occur. | |

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Impact: Water Contamination from Acid Mine Drainage into surface water resources** | | | |
| Duration | 6 | The impact will remain for some time after the life of the project. | 90-Moderate (negative) |

| | | | |
|---|---|---|---|
| Intensity | 5 | High significant impact on the environment. Irreparable damage to highly valued species, habitat or ecosystem. | |
| Spatial scale | 4 | The impacts will be localised to the immediate surroundings of the mine site. | |
| Probability | 6 | It is most likely that the impact will occur. | |
| **Post-mitigation** | | | |
| Duration | 5 | The impact will remain only for the duration of the life of the project. | 32-Negligible (negative) |
| Intensity | 1 | With effective prevention of the oxidation of iron sulphides the AMD impact will have low to moderate intensity | |
| Spatial scale | 2 | Limited to the site and its immediate surroundings. | |
| Probability | 4 | It is probable the impact will occur. | |

## 10.3 Wetlands

Potential impacts resulting from mining activities during the construction, operation, Decommissioning Phase of the Project were assessed in relation to the freshwater resources in the vicinity of the project area. Impacts to the fauna and flora did not form part of this scope and therefore are excluded from this assessment.

Since the mine footprint is already in existence, the anticipated impacts relating to the proposed project are not considered major. Impacts are limited to those that arise from the development of additional infrastructure as well as potential ongoing impacts associated with the current infrastructures such as seepage and dust from the TSFs entering the freshwater systems. The assessed potential impacts, descriptions and significance ratings are described below, including being shown in Figure 10-1.

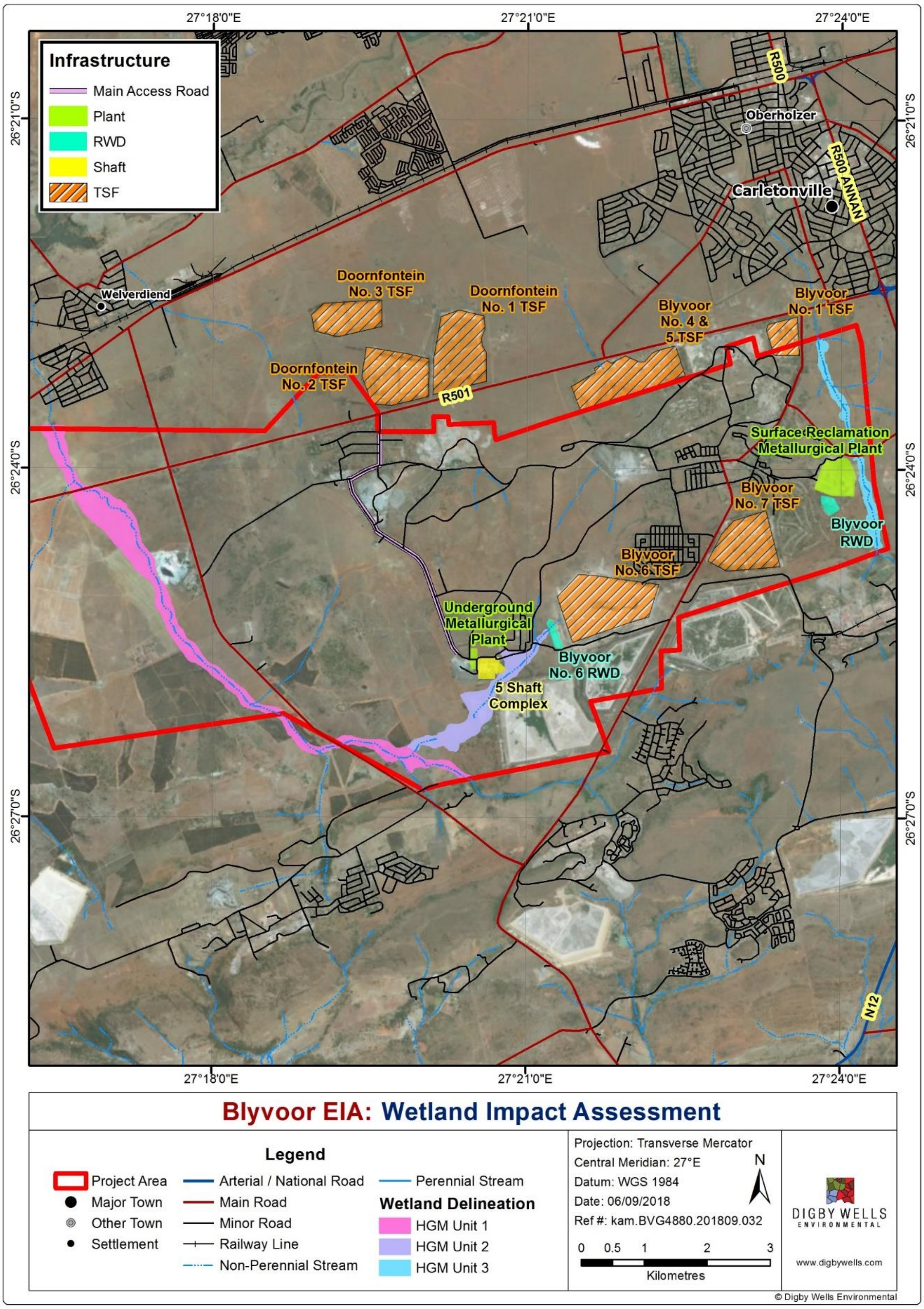



**Figure 10-1: Infrastructure In Relation to the Freshwater Systems**

### 10.3.1 Construction phase

The main activities during the construction phase that could result in impacts to the freshwater ecology of the area are associated with re-construction of the various infrastructures (metallurgical plants, structures at No. 5 Shaft, fencing, etc.), site clearing, soil disturbance, crossing of wetland and river areas, increased vehicular movement, stockpiling of topsoil, storage and dumping of building materials

Among the impacts associated with the proposed construction phase are potential impacts to soil and water quality as a result of the ingress of hydrocarbons.

Larger impacts include compaction of soils, potential loss of natural vegetation and the increased potential for erosion and sedimentation in the vicinity of any areas cleared for stockpiles and resulting in impacts further downstream. Removal of vegetation and disturbance of soils in the vicinity of the construction footprint is likely to give rise to an increased potential for encroachment by robust pioneer species and alien invasive vegetation species, further altering the natural vegetation profiles of the wetlands encountered in the vicinity of the project footprint.

With respect to the underground workings, dewatering may only take place nine years after operations commence and has therefore been discussed in the operational phase.

The impacts of the construction phase to the freshwater ecology are discussed below.

**Table 10-10: Potential Impacts of the Construction Phase**

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Activity and Interactions: Site access, disturbance and construction** | | | |
| ***Prior to Mitigation/Management*** | | | |
| **Duration** | Project life (5) | The impact will cease after the life of the project has been completed | Minor (negative) – 48 |
| **Extent** | Local (3) | Erosion and general scouring from sedimentation, as well as degraded habitat due to water quality deterioration will affect the local watercourse and river reaches directly downstream. | |
| **Intensity x type of impact** | Serious medium-term environmental effects (4) | Due to the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious medium-term impacts. | |

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Probability** | Probable (4) | Should no precautionary measures be implemented, further impacts to the freshwater systems present are considered probable. | |
| **Nature** | Negative | | |
| ***Post-Mitigation*** | | | |
| **Duration** | Project life (5) | The impact will cease after the project has been completed. | Negligible (negative) - 27 |
| **Extent** | Limited (2) | Impacts will be limited only to the project footprint area and will be rehabilitated accordingly on completion of the decommissioning phase. | |
| **Intensity x type of impact** | Minor effects on the biological or physical environment (2) | Due to the impacted nature of the systems present, should the appropriate precautions and management or mitigation measures be employed, the project could result in only a minor ecological impact to the freshwater systems present | |
| **Probability** | Unlikely (3) | Should the proposed project proceed, impacts to the ecological integrity of the systems present are considered unlikely. | |
| **Nature** | Negative | | |

#### 10.3.1.1 *Mitigation measures*

The No. 5 Shaft complex, and metallurgical plant are all in proximity to the HGM Units 2 and 3; therefore, the following mitigation and management measures have been prescribed for the construction phase:

- Ensure soil management programme is implemented and maintained to minimise erosion and sedimentation;
- During the construction phase, erosion berms should be installed on roadways and downstream of stockpiles to prevent gully formation and siltation of the freshwater resources. The following points should serve to guide the placement of erosion berms:
  - Where the track has a slope of less than 2%, berms every 50m should be installed;
  - Where the track slopes between 2% and 10%, berms every 25m should be installed;

  - Where the track slopes between 10%-15%, berms every 20m should be installed; and
  - Where the track has slope greater than 15%, berms every 10m should be installed.

- Limit the footprint area of the construction activities to what is essential to minimise impacts as a result of vegetation clearing and compaction of soils (all areas but critically so in wetland areas);
- Appropriate storm water measures should be in place. It should be ensured that clean and dirty water separation systems are the first infrastructures to be installed on site and these need to be in working order and regularly maintained;
- If it is absolutely unavoidable that any of the wetland or instream areas present (not withstanding those already accounted for in the proposed activities) will be affected, disturbance must be minimised and suitably rehabilitated;
- Conduct weekly observations during construction activities to ensure that no incision and canalisation of the wetland and instream features present takes place;
- All erosion noted within the construction footprint should be remedied immediately and included as part of an ongoing rehabilitation plan;
- Active rehabilitation, re-sloping, and re-vegetation of disturbed areas immediately after construction;
- All soils compacted as a result of construction activities should be ripped/scarified (<300mm) and profiled as soon as the area becomes available for rectification activities;
- Implement and maintain a suitable AIP control programme to prevent further encroachment as a result of disturbance to the surrounding terrestrial zones;
- Permit only essential personnel within the 100m zone of regulation for all freshwater features identified;
- No unnecessary crossing of the wetland features and their associated buffers should take place and the substrate conditions of the wetlands and downstream stream connectivity must be maintained;
- No material may be dumped or stockpiled within any rivers, tributaries or drainage lines;
- No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland or instream areas and their associated zones of regulation (notwithstanding those areas to be directly impacted upon as a result of the proposed activities). All vehicles must remain on demarcated roads and within the construction footprint. The No-go zone should be avoided;
- All vehicles must be regularly inspected for leaks;

- Re-fueling must take place at a diesel facility, on a sealed surface area away from wetlands to prevent ingress of hydrocarbons into topsoil;
- All spills should be immediately cleaned up and treated accordingly;
- Freshwater systems should be monitored monthly during construction; and
- Appropriate sanitary facilities must be provided for the duration of the construction activities and all waste must be removed to an appropriate waste facility.

### 10.3.2 Operational phase

The main activities during the operational phase that could result in impacts to the freshwater ecology of the area are associated with the operation. The proposed activities are restricted to a small footprint of historically disturbed land and includes, but is not limited to the mining, operation of the metallurgical plants, conveying of ore, operation and maintenance of the TSFs (most notably TSF No. 4 & 5, TSF No. 6 and TSF No 7), monitoring and maintenance activities.

Associated potential impacts could include compaction of soils and hardening of surfaces, loss of catchment yield and surface water recharge, erosion and sedimentation, the potential loss of biodiversity and habitat, loss of natural migration routes for instream fauna and further fragmentation of the systems present. Further to this, the potential for ongoing contamination of the freshwater resources present are deemed possible based on the ingress of hydrocarbons associated with increased vehicular activity, albeit limited in extent due to the proposed underground nature of the operations.

Removal of indigenous vegetation is likely to give rise to an increased potential for encroachment by robust pioneer species and AIPs, further altering the natural vegetation profiles of the freshwater resources encountered in the vicinity of the project footprint.

Hardened surfaces have the potential to result in sheet runoff and there is likely to be a loss in wetland service provision in terms of flood attenuation, sediment trapping and assimilation of toxicants and other pollutants. Storage of water, which is an important service, provided by wetlands in this area, may be compromised, if appropriate mitigation is not adopted. Further alterations to the natural flow regimes will take place and is likely to result in the creation of preferential flow paths over time, which may give rise to erosion and sedimentation, thus affecting the instream ecology of the systems and their downstream resources.

Furthermore, the potential for ongoing dust pollution from the TSF No. 1, TSF No. 6 and TSF No. 7 and seepage into freshwater systems, with special mention of HGM unit 2 and 3, and potential for decant from the underground workings thereby contaminating the water quality, is also a potential impact. Contamination from the waste rock dump (not owned by Blyvoor Gold but situated on the MRA described in Section 1.1, above); into HGM unit 2 is also a potential impact.

With respect to the underground workings, dewatering may need to occur 9 years after operations commence, which could potentially result in a cone of depression that may result in an alteration in the water table, thereby causing desiccation of the wetlands and moisture stress to the wetland vegetation, especially in relation to HGM Unit 2. However, as dewatering is expected to occur below 2 400 meters below surface (mds) no impact on the water table is currently anticipated. Table 10-11 summarises potential impacts to the freshwater ecology identified during the operational phase.

**Table 10-11: Impact Ratings for the Operational Phase**

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Activity and Interactions: Operation of the underground mining, TSFs, conveying and processing** | | | |
| ***Prior to Mitigation/Management*** | | | |
| **Duration** | Project life (5) | The impact will cease after the life of the project has been completed. | Moderate (negative) – 78 |
| **Extent** | Greater municipal area (4) | Degraded habitat due to water quality deterioration from maintenance activities, decant, TSF and WRDs will affect entire watercourses and river reaches. | |
| **Intensity x type of impact** | Serious medium-term environmental effects (4) | Due to the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious medium-term impacts. | |
| **Probability** | Highly probable (6) | Should no precautionary measures be implemented, further impacts to the freshwater systems are considered highly probable. | |
| **Nature** | Negative | | |
| ***Post-Mitigation*** | | | |
| **Duration** | Project life (5) | The impact will cease after the project has been completed. | Negligible (negative) – 27 |
| **Extent** | Limited (2) | Impacts will be limited only to the project footprint area and will be rehabilitated accordingly on completion of the operational phase. | |
| **Intensity x type of impact** | Minor effects on the biological or physical environment (2) | Due to the impacted nature of the systems present, should the appropriate precautions and management or mitigation measures be employed, the project could result in only a minor ecological impact to the wetland systems present. | |

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Probability** | Unlikely (3) | Should the proposed project proceed, impacts to the ecological integrity of the systems present are considered unlikely. | |
| **Nature** | Negative | | |

## Table 10-12: Impact assessment parameter ratings for the operational phase

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Activity and Interactions: Potential decant associated with the Blyvoor Gold Mining Rights area** | | | |
| ***Prior to Mitigation/Management*** | | | |
| **Duration** | Permanent (7) | The impact is irreversible, even with management, and will remain after the life of the project. | Major (negative) – 112 |
| **Extent** | Greater municipal area (4) | Degraded water quality and channelization and associated erosion and sedimentation due decant will affect entire watercourses and river reaches. | |
| **Intensity x type of impact** | Serious medium term environmental effects (5) | Due to the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious impacts. | |
| **Probability** | Definite (7) | Decant is expected to occur. | |
| **Nature** | Negative | | |
| ***Post-Mitigation*** | | | |
| **Duration** | Permanent (7) | The impact is irreversible, even with management, and will remain after the life of the project. | Minor (negative) – 70 |
| **Extent** | Limited (2) | Impacts will be limited only to the project footprint area. | |

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Intensity x type of impact** | Minimal effects on the biological or physical environment (1) | Due to the impacted nature of the systems present, should the decant be treated to appropriate standards and discharged diffusely, the project could result in only a minimal ecological impact to the freshwater systems present. | |
| **Probability** | Definite (7) | Decant is expected to occur in the vicinity of the Blyvoor Gold Mining Rights area | |
| **Nature** | Negative | | |

## Table 10-13: Potential Impacts of the Operational Phase

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Activity and Interactions: Dewatering** | | | |
| ***Prior to Mitigation/Management*** | | | |
| **Duration** | Beyond project life (6) | Impacts relating to the water table will remain for some time after the life of the project and is potentially irreversible even with management | |
| **Extent** | Local (3) | Dewatering could potentially result in a cone of depression that may result in alteration in the water table, thereby causing desiccation of the wetlands and moisture stress to the wetland vegetation within the municipal area. | |
| **Intensity x type of impact** | Serious medium-term environmental effects (5) | Due to the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious impacts. | Minor (negative) – 56 |
| **Probability** | Probable (4) | Should no precautionary measures be implemented, further impacts to the freshwater systems present are considered possible. It should be noted, however, that historical dewatering has already taken place in the area with minor impacts to the surface water resources and thus the extent is somewhat reduced. | |
| **Nature** | Negative | | |
| ***Post-Mitigation*** | | | |
| **Duration** | | | |
| **Extent** | | | |
| **Intensity x type of impact** | No mitigation measures possible | | |
| **Probability** | | | |
| **Nature** | | | |

#### 10.3.2.1 *Mitigation measures*

The following mitigation and management measures have been prescribed for the operational phase:

- Ensure proper dust protection mechanisms, such as dust suppressions. are in place to reduce sedimentation and contamination of the wetland systems due to the TSFs, with special mention of TSF No. 1, TSF No. 6 and TSF No. 7;
- Ensure continued testing of the water quality of decant and ensure treatment is of a suitable standard if necessary, before discharging into the Wonderfonteinspruit. Decant qualities must be compared against the Water Quality Objectives for the catchments and adhere to the qualities included in the WUL conditions. Ensure decant is suitably discharged so as not to cause channelization of the wetland;
- Both RWDs are in close proximity to the freshwater resources present. It should be ensured that there is no leaching of harmful substances into the freshwater resources;
- Biomonitoring is recommended to be conducted by suitably qualified wetland and aquatic ecologists;
- Toxicological testing is recommended to take place on the freshwater resources present at least once annually or prior to any planned discharges on at least three trophic levels. This will help to determine any impacts to the aquatic communities present as a result of seepage or spills and in the case of any planned discharges, to determine a safe dilution ratio;
- Limit the footprint area of the operational activities to what is essential in order to minimise impacts as a result of any potential vegetation clearing and compaction of soils (all areas but critically so in freshwater areas);
- If it is unavoidable that any of the freshwater areas present will be affected, disturbance must be minimised and suitably rehabilitated;
- Ensure that no incision and canalisation of the freshwater features present takes place as a result of the proposed operational activities;
- All erosion noted within the operational footprint as a result of any potential surface activities should be remedied immediately and included as part of the ongoing rehabilitation plan;
- A suitable AIP control programme must be put in place so as to prevent further encroachment as a result of disturbance to the surrounding terrestrial zones;
- All areas of increased ecological sensitivity should be designated as “No-Go” areas and be off limits to all unauthorised vehicles and personnel;
- No unnecessary crossing of the wetland features, instream areas and their associated buffers, as well as the constructed berms or canals should take place and the substrate conditions of the wetlands, instream areas and downstream stream connectivity must be maintained;

- No vehicles or heavy machinery may be allowed to drive indiscriminately within any freshwater areas and their associated zones of regulation. All vehicles must remain on demarcated roads;
- All vehicles must be regularly inspected for leaks;
- Re-fuelling must take place on a sealed surface area away from freshwater features to prevent ingress of hydrocarbons into topsoil;
- All spills should be immediately cleaned up and treated accordingly;
- Appropriate sanitary facilities must be provided for the duration of the operational activities and all waste must be removed to an appropriate waste facility;
- Monitor all systems for erosion and incision;
- All erosion noted within the footprint should be remedied immediately and included as part of an ongoing rehabilitation plan;
- Ensure soil management programme is implemented and maintained to minimise erosion and sedimentation;
- All soils compacted as a result of construction activities should be ripped/scarified (<300mm) and profiled (see the Rehabilitation Report for more information);
- Permit only essential personnel within the 100m zones of regulation for all freshwater features identified; and
- Ongoing wetland rehabilitation is necessary during the operational phase as stipulated in the monitoring section.

### 10.3.3 Decommissioning, Closure and Rehabilitation Phase

Among the impacts associated with the decommissioning, closure and rehabilitation phase are minor potential impacts to soil and water quality as a result of the ingress of hydrocarbons and spills associated with moving machinery required for the decommissioning activities.

More significant impacts include compaction of soils, potential loss of natural vegetation and the increased potential for erosion and sedimentation in the decommissioned areas and resulting in impacts further downstream.

Any temporary storage or dumping of decommissioned infrastructure within wetland areas, has the potential to result in loss of stream connectivity, loss of refuge areas, alterations to the terrain profiles of the areas and the creation of preferential flow paths, which may result in sedimentation, alterations to the vegetation structure of the area, encourage alien vegetation encroachment and result in increased erosion and sedimentation potentials.

Removal of vegetation and disturbance of soils in the vicinity of the decommissioning footprint is likely to give rise to an increased potential for encroachment by robust pioneer species and alien invasive vegetation species, further altering the natural vegetation profiles of the wetlands encountered in the vicinity of the decommissioning footprint.

Decant from the underground workings is also a potential impact. Discharge of decant into freshwater systems may degrade water quality and cause channelization and associated erosion and sedimentation. Furthermore, the potential for ongoing dust pollution from TSF No. 1, TSF No. 6 and TSF No. 7 and seepage into freshwater systems, with special mention of HGM Unit 2 and 3, is a potential impact.

**Table 10-14: Impact assessment parameter ratings for the Decommissioning, Closure and Rehabilitation Phase**

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Activity and Interactions: Potential decant associated with the Blyvoor Gold Mining Right area** | | | |
| ***Prior to Mitigation/Management*** | | | |
| **Duration** | Permanent (7) | The impact is irreversible, even with management, and will remain after the life of the project. | Major (negative) – 112 |
| **Extent** | Greater municipal area (4) | Degraded water quality and channelization and associated erosion and sedimentation due decant will affect entire watercourses and river reaches. | |
| **Intensity x type of impact** | Serious medium term environmental effects (5) | Due to the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious impacts. | |
| **Probability** | Definite (7) | Decant is expected to occur. | |
| **Nature** | Negative | | |
| ***Post-Mitigation*** | | | |
| **Duration** | Permanent (7) | The impact is irreversible, even with management, and will remain after the life of the project. | Minor (negative) – 70 |
| **Extent** | Limited (2) | Impacts will be limited only to the project footprint area. | |
| **Intensity x type of impact** | Minimal effects on the biological or physical environment (1) | Due to the impacted nature of the systems present, should the decant be treated to appropriate standards and discharged diffusely, the project could result in only a minimal ecological impact to the freshwater systems present. | |

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Probability** | Definite (7) | Decant is expected to occur in the vicinity of the MRA. | |
| **Nature** | Negative | | |

## Table 10-15: Potential Impacts of the Decommissioning, Closure and Rehabilitation Phase

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Activity and Interactions: Decommissioning of all infrastructure** | | | |
| ***Prior to Mitigation/Management*** | | | |
| **Duration** | Project life (5) | The impact will cease after the decommissioning, rehabilitation and closure phases of the project have been completed. | Minor (negative) – 48 |
| **Extent** | Local (3) | Erosion and general scouring from sedimentation, as well as degraded habitat due to water quality deterioration will affect the local watercourse and river reaches directly downstream. | |
| **Intensity x type of impact** | Serious medium term environmental effects (4) | Due to the sensitivity of wetland systems in general and the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious medium term impacts. | |
| **Probability** | Probable (4) | Should no precautionary measures be implemented, further impacts to the freshwater systems present are considered probable. | |
| **Nature** | Negative | | |
| ***Post-Mitigation*** | | | |
| **Duration** | Project life (5) | The impact will cease after the decommissioning, rehabilitation and closure phases of the project have been completed. | Negligible (negative) – 27 |

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Extent** | Limited (2) | Impacts will be limited only to the project footprint area and will be rehabilitated accordingly on completion of the decommissioning phase. Funding is in place for planned and unplanned closures. | |
| **Intensity x type of impact** | Minor effects on the biological or physical environment (2) | Due to the impacted nature of the systems present, should the appropriate precautions and management or mitigation measures be employed, the project could result in only a minor ecological impact to the freshwater systems present. | |
| **Probability** | Unlikely (3) | Should the proposed project proceed, and the appropriate management and mitigation measures be implemented, impacts are considered unlikely. | |
| **Nature** | Negative | | |

## Table 10-16: Impact assessment parameter ratings for the Decommissioning, Closure and Rehabilitation Phase

| **Activity and Interactions: Rehabilitation measures** | | | |
|---|---|---|---|
| ***Prior to Mitigation/Management*** | | | |
| **Duration** | Project life (5) | The impact will cease after the rehabilitation of the project has been completed. | Minor (negative) – 48 |
| **Extent** | Local (3) | Erosion and general scouring from sedimentation, as well as degraded habitat due to water quality deterioration will affect the local watercourse and river reaches directly downstream. | |
| **Intensity x type of impact** | Serious medium term environmental effects (4) | Due to the sensitivity of the freshwater systems in general and the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious medium term impacts. | |

| | | | |
|---|---|---|---|
| **Probability** | Probable (4) | Should no precautionary measures be implemented, further impacts to the freshwater systems present are considered probable. | |
| **Nature** | Negative | | |
| ***Post-Mitigation*** | | | |
| **Duration** | Project life (5) | The impact will cease after the rehabilitation and closure phases of the project have been completed. | Negligible (negative) – 27 |
| **Extent** | Limited (2) | Impacts will be limited only to the project footprint area and will be rehabilitated accordingly on completion of the decommissioning phase. | |
| **Intensity x type of impact** | Minor effects on the biological or physical environment (2) | Due to the impacted nature of the systems present, should the appropriate precautions and management or mitigation measures be employed, the project could result in only a minor ecological impact to the flora and wetland systems present | |
| **Probability** | Unlikely (3) | Should the proposed project proceed, and the appropriate management and mitigation measures be implemented, impacts are considered unlikely. | |
| **Nature** | Negative | | |

#### 10.3.3.1 *Mitigation measures*

The following mitigation and management measures have been prescribed for the decommissioning, closure and rehabilitation phase:

- Ensure maintenance of TSFs to reduce dust pollution;
- Test the water quality of decant and treat if necessary, before discharging into the Wonderfonteinspruit. Decant should be discharged diffusely so as not to cause channelization of the wetland;
- Ensure that sound environmental management is in place during the proposed decommissioning phase by adhering to the EMP;
- Limit the footprint area of the decommissioning and rehabilitation activities to what is absolutely essential in order to minimise impacts as a result of vegetation clearing and compaction of soils (all areas but critically so in wetland areas);

- All erosion noted within the decommissioning area footprint should be remedied immediately and included as part of the ongoing rehabilitation plan;
- All soils compacted as a result of decommissioning activities should be ripped/scarified (<300mm) and profiled;
- Permit only essential personnel within the zones of regulation for all freshwater features identified;
- Wherever possible, restrict decommissioning activities to the drier winter months to avoid sedimentation of the freshwater resources further downstream;
- No material may be dumped or stockpiled within any wetland areas (or the buffers);
- Freshwater resources and their associated zones of regulation are to be clearly demarcated and avoided wherever possible;
- An AIP management plan to be implemented and managed for the life of the proposed decommissioning, rehabilitation, closure and post-closure phases;
- As much vegetation growth as possible should be promoted within the proposed development area during all phases. To protect soils, vegetation clearance should be kept to a minimum;
- Monitor all freshwater systems for erosion and incision;
- All areas where active erosion is observed should be ripped, re-profiled and seeded with indigenous grasses;
- No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas and their associated zones of regulation. All vehicles must remain on demarcated roads and within the project area footprint;
- Compacted soils should be ripped, re-profiled and re-seeded;
- All vehicles must be regularly inspected for leaks;
- Re-fueling must take place at a diesel facility on a sealed and bunded surface area away from wetlands to prevent ingress of hydrocarbons into topsoil;
- All existing litter, debris should be removed from the freshwater systems and littering should be prohibited on an ongoing basis;
- All spills from machinery should be immediately cleaned up and treated accordingly;
- Appropriate sanitary facilities must be provided for the duration of the rehabilitation activities and all waste must be removed to an appropriate waste facility; and
- Monitoring should be carried out as specified in the monitoring programme.

## 10.4 Air Quality

### 10.4.1 Construction Phase

Blyvoor Gold will be making use of existing infrastructure. Hence, construction activities will be limited to the refurbishment of the existing No 5 Shaft and the upgrade of the existing infrastructure at the Metallurgical Plants (within the existing footprints). In addition, the construction phase will be short-term and the associated impacts will be negligible.

#### 10.4.1.1 *Project activities assessed*

As part of the Construction Phase, the following activities are identified that may result in air emissions but with negligible impact on the background air quality of the project area (Table 10-17).

**Table 10-17: Interactions and Impacts of Construction Phase**

| Interaction | Impact |
|---|---|
| Reconstruction of metallurgical plants and other mining infrastructure | Particulate matter emissions due to the generation of airborne dust (also considering emissions from the ventilation shaft). |

##### 10.4.1.1.1 *Impact Description*

The refurbishment and commissioning of the ventilation shaft and metallurgical plants will lead to the generation of fugitive dust comprising TSP, $PM_{10}$ and $PM_{2.5}$. This activity is short-term and the spatial impacts are considered minimal and impacts on the atmospheric environment will cease once the construction phase ends.

##### 10.4.1.1.2 *Management Objectives*

The management objective is to ensure that emissions on-site and at off-site locations are not in exceedance of the regulatory limits for the protection of the environment, human health and wellbeing.

##### 10.4.1.1.3 *Management Actions and Targets*

The mine management should have action plans in place and targets to ensure that pollution levels are compliant with regulatory standards.

##### 10.4.1.1.4 *Construction Phase Impact Ratings*

The impact rating took cognisance of the duration (how long the impact may be prevalent), the spatial scale (the physical area which could be affected by an impact), the severity (how severe the impact will be) and the probability of the impact occurring (which is related to the likelihood of such an impact happening). The ratings ascribed to each of the impacts are discussed in Table 10-18.

**Table 10-18: Refurbishment of the shaft and Processing Plant**

| **Activity and Interaction: Refurbishment of the Shaft and Processing Plant** | | | |
|---|---|---|---|
| **Dimension** | **Rating** | **Motivation** | **Significance** |
| **Impact Description: Particulate matter emissions to surrounding receptors** | | | |
| ***Prior to mitigation/ management*** | | | |
| **Duration** | Short term (1) | Dust will be generated for the duration of the construction phase | Negligible (negative) – 15 |
| **Extent** | Limited (2) | Limited to the project area and immediate surroundings | |
| **Intensity** | Minor (2) | Minor effect on surrounding area | |
| **Probability** | Unlikely 34) | Unlikely that impact on ambient air quality will occur | |
| **Nature** | Negative | | |
| ***Mitigation/ Management actions*** | | | |
| ▪ The area of disturbance at all times must be minimised, no unnecessary digging or scraping must occur;<br>▪ The drop heights when loading onto trucks and at tipping points should be minimised. | | | |
| ***Post- mitigation*** | | | |
| **Duration** | Short term (1) | Dust generation will be less than 1 year and is reversible | Negligible (negative) – 3 |
| **Extent** | Very Limited (1) | Impacts will be limited to isolated parts of the site | |
| **Intensity** | Minimal (1) | Minimal impacts on air quality after mitigation | |
| **Probability** | Highly Unlikely (1) | Highly unlikely that impacts will occur | |
| **Nature** | Negative | | |

## 10.4.2 Operational Phase

### 10.4.2.1 *Activities Assessed*

As part of the Operational Phase of the Project, the following activities are identified that may impact on the ambient air quality of the area i.e. increasing the concentration of pollutants in the atmosphere (Table 10-19):

- Wind erosion of the dormant and active TSFs; and
- Crushing of ores from underground at the plant.

### Table 10-19: Interactions and Impacts

| Interaction | Impact |
|---|---|
| ▪ Operation of the underground mine, conveyors, processing plants, haulage, etc.<br>▪ TSF reclamation<br>▪ Deposition onto TSF<br>▪ TSF care and maintenance activities for the duration of this current application (TSF No. 1, DTSF No. 1, DTSF No. 2 and DTSF No. 3 will be held in care and maintenance for the 15-year Project life). | Wind Erosion generate airborne dust, with particulates such as TSP, $PM_{10}$, and $PM_{2.5}$ leading to nuisance effect, reduction in the quality of air, with potential health and environmental implications from exposure |

#### *10.4.2.1.1 Impact Description*

The model predictions have showed that emissions associated with wind erosion of the TSFs will lead to increased levels of particulate matter, such as TSP, $PM_{10}$ and $PM_{2.5}$ in the surrounding atmosphere. Dust will be airborne, leading to nuisance effect, reduction in the quality of air, with potential health and environmental implications from exposure.

#### *10.4.2.1.2 Management Objectives*

The management objective is to ensure that emissions on-site and off-site from the operation are not in exceedance of the applicable South African standards for the protection of the environment, human health and wellbeing.

#### *10.4.2.1.3 Management Actions and Targets*

Management will implement mitigation measures (Table 10-20), to ensure emissions are within the South African standards and the mine operates within compliance. TSF No. 6, the most significant contributor to the existing dust problem will be significantly mitigated by the recommissioning of this TSF.

### Table 10-20: Significance Ratings for Wind Erosion

| **Activity and Interaction: Dust Storm from Wind Erosion** | | | |
|---|---|---|---|
| **Dimension** | **Rating** | **Motivation** | **Significance** |
| **Impact Description: Nuisance and health effects from exposure to fine particulate matter** | | | |
| ***Prior to Mitigation / Management*** | | | |
| **Duration** | Project life (5) | Impact will occur for the for the project life | Moderate (negative) – 78 |
| **Extent** | Local (3) | Exposure extent will extend outside the mine footprint. | |

| **Activity and Interaction: Dust Storm from Wind Erosion** | | | |
|---|---|---|---|
| **Dimension** | **Rating** | **Motivation** | **Significance** |
| **Intensity** | Serious (5) | Serious impacts on exposed receptors and environment | |
| **Probability** | Almost Certain (6) | It is almost certain that impact will occur. | |
| **Nature** | Negative | | |
| ***Mitigation / Management Actions*** | | | |
| ▪ Use of water sprays;<br>▪ Use of dust suppressants/binders. Exposed surfaces of dormant and active TSF can be treated with "dust binders. These binders can either be complex natural and synthetic polymers that can integrate into TSF surfaces for effective dust suppression. Often, dust binders are added to the water cart and applied once off as an establishment dose and thereafter on an ad-hoc basis; and<br>▪ In addition, vegetation of exposed surfaces of TSFs can be conducted and some cases re-vegetation to ensure the full establishment of vegetation on the side slopes and the crest of dormant and active TSFs. Due to the nature of tailings material, adding topsoil, accompanied with drip irrigation over the first few months and initial fertilisation, the tailings can support the establishment and growth of a range of plant species. The latter should be monitored regularly to assess the progressive development and functioning of the vegetation cover. | | | |
| ***Post- Mitigation*** | | | |
| **Duration** | Project life (5) | Impact will occur for the for the project life | Negligible (negative) – 27 |
| **Extent** | Limited (2) | The impact footprint will be limited to the immediate surroundings of the TSF | |
| **Intensity** | Minor (2) | Minor impact anticipated after mitigation measures are applied | |
| **Probability** | Unlikely (3) | Impact is unlikely to occur after mitigations are applied. | |
| **Nature** | Negative | | |

## Table 10-21: Interactions and Impacts of the Crusher

| **Interaction** | **Impact** |
|---|---|
| Crusher | Reduction in air quality due to the emission of particulates |

#### 10.4.2.1.4 Impact description

The mining process will involve the use of a crusher to break the ore from underground prior to milling, which will result in dust generation to the ambient environment. The latter will have implication for ambient air quality.

#### 10.4.2.1.5 Management Objectives

The management objective is to ensure that emissions on-site and off-site from the operation of the crusher are not in exceedance of the applicable South African standards for the protection of the environment, human health and wellbeing.

#### 10.4.2.1.6 Management Actions and Targets

Management will implement mitigation measures (Table 10-22) to ensure emissions comply the National Ambient Air Quality Standard and South African Occupational Exposure Limits (OELs).

**Table 10-22: Operation of the Crusher**

| **Activity and Interaction: Operation of the Crusher** | | | |
|---|---|---|---|
| **Dimension** | **Rating** | **Motivation** | **Significance** |
| **Impact Description: Reduction in air quality** | | | |
| ***Prior to mitigation/ management*** | | | |
| **Duration** | Project life (5) | Impact will be for the project life | Minor (negative) – 44 |
| **Extent** | Local (3) | Although ore will be wet, airborne dust will be generated and localized to the surroundings of the activity. | |
| **Intensity** | Local -3 | Moderate change to the baseline. | |
| **Probability** | Probable (3) | Probable impacts will occur. | |
| ***Mitigation/ Management actions*** | | | |
| ▪ Use of water sprays;<br>▪ Enclosure of crushers; and<br>▪ Fitting of dust extraction system. | | | |
| ***Post- mitigation*** | | | |
| **Duration** | Project life (5) | Impact will be for the project life | Negligible (negative) – 7 |
| **Extent** | Very Limited (1) | Impacts will be very limited to the project site. | |
| **Intensity** | Minimal - negative (-1) | Minimal Impacts | |

| Activity and Interaction: Operation of the Crusher | | | |
|---|---|---|---|
| **Dimension** | **Rating** | **Motivation** | **Significance** |
| **Probability** | Highly unlikely (1) | It is unlikely that dust emissions will have an effect on ambient air quality after mitigation. | |

**Table 10-23: Interactions and Impacts of Vent Shaft**

| Interaction | Impact |
|---|---|
| Ventilation shaft | Reduction in air quality due to the emission of particulates and gaseous pollutants |

### *10.4.2.1.7 Impact description*

The mining process will involve the ventilation of pollutants generated underground via the vent shaft up cast to the ambient environment. The impact on ambient air quality is considered minimal and limited to the vicinity of the shaft.

### *10.4.2.1.8 Management Objectives*

The management objective is to ensure that emissions on-site and off-site from the operation of the ventilation shaft are not in exceedance of the applicable standards for the protection of the environment, human health and wellbeing.

### *10.4.2.1.9 Management Actions and Targets*

Management will implement mitigation measures (Table 10-24), to ensure emissions are within the South African standards and the mine operates within compliance.

**Table 10-24: Operation of the Ventilation Shaft**

| Activity and Interaction: Operation of the Ventilation Shaft | | | |
|---|---|---|---|
| **Dimension** | **Rating** | **Motivation** | **Significance** |
| **Impact Description: Reduction in air quality** | | | |
| ***Prior to mitigation/ management*** | | | |
| **Duration** | Project life (5) | Impact will be for the project life | Minor (negative) – 27 |
| **Extent** | Limited (2) | Airborne dust limited to the site of the activity. | |
| **Intensity** | Minor - negative (-2) | Minor. Will result in very little changes to the baseline. | |
| **Probability** | Unlikely (3) | Impacts are unlikely. | |

| Activity and Interaction: Operation of the Ventilation Shaft | | | |
|---|---|---|---|
| **Dimension** | **Rating** | **Motivation** | **Significance** |
| ***Mitigation/ Management actions*** | | | |
| ▪ Ensure fans are in good working condition – so vent emissions are within compliance;<br>▪ Fitting with fume and dust extraction and collection system. | | | |
| ***Post- mitigation*** | | | |
| **Duration** | Project life (5) | Impact will be for the project life | Negligible (negative) – 7 |
| **Extent** | Very Limited (1) | Impacts will be very limited to the source. | |
| **Intensity** | Minimal - negative (-1) | Minimal Impacts | |
| **Probability** | Highly unlikely (1) | It is unlikely that dust emissions will have an effect on ambient air quality after mitigation. | |

## 10.5 Radiological

The main source of radiation exposure that was identified is the various TSFs (eight in total) and the ventilation shaft, while the various TSFs and surface water facilities were identified as sources of concern for the groundwater pathway. The surface water pathway is limited to an extension of the groundwater pathway since no controlled or uncontrolled releases to surface water streams were included as part of the process description. Receptors were identified as those members of the public that reside in formal and informal structures in areas such as Carletonville, Khutsong, Wedela, Doornfontein, Southdene, Northdene and Eastdene, as well as commercial and small-scale farmers near the operation. This led to the definition of two public exposure condition: A Residential Area Exposure Condition and a Commercial Farmer Exposure Conditions.

### 10.5.1 Construction Phase

Existing infrastructure is used as far as possible for the project, which means that construction activities will be limited to the refurbishment of the existing No. 5 Shaft and the upgrade of the existing infrastructure at the Metallurgical Plants (within the existing footprints). The duration of these activities is expected to be short.

In addition, these activities do not involve the handling, processing or releasing radioactive material *per se*, which means that the potential radiological impact on members of the public during the construction phase is negligible. This applies to both the groundwater pathway and the atmospheric pathway.

### 10.5.2 Operational Phase

During the operational phase of the Blyvoor Gold operations, the following activities were identified that may result in a radiological impact to members of the public:

- Operation of the underground mine, conveyors, processing plants, haulage, etc
- TSF reclamation;
- Deposition onto TSF;
- Mine water management; and
- TSF care and maintenance activities for the duration of this current application (TSF No. 1, DTSF No. 1, DTSF No. 2 and DTSF No. 3 will be held in care and maintenance for the 15-year Project life).

Table 10-25 summarises the activities associated with the operational phase that may have a potential radiological impact on the receptors identified for the Project.

**Table 10-25: Summary of the Activities and the Impact of the Activities During the Operational Phase**

| Interaction | Impact |
|---|---|
| Exhalation and dispersion of radon gas to the atmosphere | Radon gas will be vented to the surface as part of the underground ventilated system, while the radon gas generated in the tailings material due to the presence of Ra-226 will be exhaled to the atmosphere. Inhalation of the radon gas contributes to the total effective dose. |
| Emission and dispersion of particulate matter to the atmosphere | Wind erosion at the TSFs and ore crushing will cause particulate matter containing radionuclides to be emitted to the atmosphere. The airborne dust ($PM_{10}$) and deposited dust (TSP) contribute to the total effective dose through inhalation, ingestion and external radiation exposure routes. |
| Controlled and uncontrolled releases of water containing radionuclides into nearby watercourses | Controlled releases refer to authorised discharges of contaminated water into nearby watercourses, whereas uncontrolled releases refer to unauthorised discharges as well as runoff from contaminated areas and dirty water discharges into nearby watercourses. Ingestion of the contaminated water contributes to the total effective dose. |

| Interaction | Impact |
|---|---|
| Reclamation of existing TSFs | The reclamation of existing TSFs means the removal of a source of radiation exposure to receptors identified for the Project that, in principle, means a potential reduction in the total effective dose through all relevant exposure routes. |

### 10.5.2.1 Exhalation and Dispersion of Radon Gas

#### *10.5.2.1.1 Impact Description*

During the operational phase and for the duration of the LOM, radon gas generated underground will be exhaled into the atmosphere from the ventilation shaft and dispersed into the atmosphere. During the same period, radon gas generated in the tailings material due to the presence of Ra-226 will be exhaled from the various TSFs. These TSFs will be subject to different activities, but these activities will not have a significant influence on the rate at which radon gas is exhaled from these facilities.

Following the exhalation and subsequent dispersion of the radon gas into the atmosphere, inhalation of the airborne gas contributes to the total effective dose to receptors identified for the Project.

#### *10.5.2.1.2 Management/Mitigation Measures*

The management objective would be to first ensure that radiation exposure is below the regulatory compliance criteria (i.e., the dose constraint), and secondly to optimise the radiation protection by applying the ALARA principle (As Low As Reasonable Achievable, economic and social factors taken into consideration).

The total effective dose as a contribution from radon gas released from the TSFs and ventilation shaft is well below the regulatory compliance criteria, which means that from a compliance perspective no additional management or mitigation measures are required. From dose optimisation perspective, the following can be noted.

The radon exhalation rate from the ventilation shaft is a function of the radon gas concentration underground and the air flow rate to surface from these areas. The latter is a function of the underground ventilation requirements, both in terms of providing sufficient air and to reduce the radon concentration underground for occupational exposure, which is critical. The only proposed management option for radon gas exhalation from the ventilation shaft is, therefore, to optimise the underground ventilation system in terms of the flow rate and the radon concentration underground.

The radon exhalation rate from the surface of tailings material is determined by several factors, of which moisture content is one. This means that for the area at a TSF that is subject to reclamation, the radon exhalation rate will be reduced marginally. However, it is not effective to wet the TSF deep enough (2 to 4 m) to reduce the radon exhalation rate marginally.

The most effective way to reduce the radon exhalation rate is to provide a covering layer. This will increase the diffusion length to allow for the decay of the radon progeny before being released from the tailings surface.

##### *10.5.2.1.3 Impact Rating*

Table 10-26 presents the impact significant rating for the exhalation and dispersion of radon gas during the operational phase of the Project.

**Table 10-26: Impact significant rating for the exhalation and dispersion of radon gas during the operational phase**

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| Impact Description: Exhalation and dispersion of radon gas to the atmosphere during the operational phase | | | |
| *Prior to Mitigation / Management* | | | |
| Nature | Negative | | Minor (negative) – 66 |
| Duration | Project life (5) | The impact will occur for the duration of the operational phase | |
| Extent | Local (3) | Exposure extent beyond the mining rights area into the immediate surroundings | |
| Intensity | On-going (3) | Impact expected in residential areas and where commercial agriculture is practised is below the regulatory dose constraint | |
| Probability | Almost Certain (6) | It is almost certain that impact will occur in the residential areas and where commercial agriculture is practised | |
| *Post- Mitigation / Management* | | | |
| Nature | Negative | | Minor (negative) – 50 |
| Duration | Project life (5) | The impact will occur for the duration of the operational phase | |
| Extent | Limited (2) | Exposure beyond the mining rights area into the immediate surroundings is limited | |
| Intensity | On-going (3) | Impact expected in residential areas and where commercial agriculture is practised is below the regulatory dose constraint | |
| Probability | Likely (5) | It is likely that impact will occur in the residential areas and where commercial agriculture is practised | |

#### 10.5.2.2 Emission and Dispersion of Particulate Matter

##### 10.5.2.2.1 Impact Description

During the operational phase and for the duration of the LoM, various TSFs will be subject to different activities that will influence the way in which particulate matter containing radionuclides will be dispersed into the environment through the atmospheric pathways. These activities include:

- TSF No. 6 will be operational as a deposition site for tailings material generated from the underground (mining) and surface (reclamation) operations;
- TSF No. 7 will be remined to extract residual gold from the tailings material followed by TSF No. 4 & 5 and TSF No. 6;
- Maintenance will be performed at the inactive TSFs that include TSF No. 1, DTSF No. 1, DTSF No. 2 and DTSF No. 3; while
- TSF No. 4 & 5 is a partially reclaimed TSF that will serves as an alternative deposition site that may become operational during the LoM.

Under worst case conditions, these facilities will serve as a source of windblown dust (i.e., wind erosion) to the atmosphere for the duration of the operational period. Reclamation using hydraulic sluicing will reduce wind erosion only in those areas.

The emission and subsequent dispersion of the particulate matter into the atmosphere results in an airborne radionuclides concentration associated with the $PM_{10}$, and a soil radionuclides concentration following the deposition of the TSP. Through secondary pathways, the radionuclides in the soil may be transferred to crops and animal products. Contributions to the total effective dose to receptors identified for the Project include inhalation of the airborne dust, ingestion of contaminated soil, crops and animal products, and external gamma radiation through cloudshine and groundshine.

##### 10.5.2.2.2 Management/Mitigation Measures

The management objective would be to first ensure that radiation exposure is below the regulatory compliance criteria (i.e., the dose constraint), and secondly to optimise the radiation protection by applying the ALARA principle.

The total effective dose as a contribution from the windblown dust released from the TSFs and ore crushing is well below the regulatory compliance criteria, which means that from a compliance perspective no additional management or mitigation measures are required. From a dose optimisation perspective, the following mitigation measures can be applied. These measures, which are in line with the measures proposed in the air quality impact assessment (Digby Wells Environmental, 2018e), will contribute to a reduction in the total effective dose if applied for the duration of the operational period:

- Develop a dust management plan for the Project;

- Use of electrostatic precipitators and a dust extractor system at the crusher;
- Application of wetting agents, dust suppressant or binders on the exposed area of the TSFs; and
- Vegetation of exposed area of the TSFs.

##### *10.5.2.2.3 Impact Rating*

Table 10-27 presents the impact significant rating for the emission and dispersion of particulate matter that contains radionuclides during the operational phase of the Project.

**Table 10-27: Impact Rating for the Emission and Dispersion of Particulate Matter that Contains Radionuclides**

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| Impact Description: Emission and dispersion of particulate matter that contains radionuclides to the atmosphere during the operational phase. | | | |
| *Prior to Mitigation / Management* | | | |
| Nature | Negative | | Minor (negative) – 66 |
| Duration | Project life (5) | The impact will occur for the duration of the operational phase | |
| Extent | Local (3) | Exposure extent beyond the mining rights area into the immediate surroundings | |
| Intensity | On-going (3) | Impact expected in residential areas and where commercial agriculture is practised is below the regulatory dose constraint | |
| Probability | Almost Certain (6) | It is almost certain that impact will occur in the residential areas and where commercial agriculture is practised | |
| *Post- Mitigation / Management* | | | |
| Nature | Negative | | Minor (negative) – 50 |
| Duration | Project life (5) | The impact will occur for the duration of the operational phase | |
| Extent | Limited (2) | Exposure beyond the mining rights area into the immediate surroundings is limited | |
| Intensity | On-going (3) | Impact expected in residential areas and where commercial agriculture is practised is below the regulatory dose constraint | |
| Probability | Likely (5) | It is likely that impact will occur in the residential areas and where commercial agriculture is practised | |

#### 10.5.2.3 *The Release of Radioactivity to Surface Water Bodies*

##### *10.5.2.3.1 Impact Description*

Authorised discharges of water containing radionuclides into watercourses will be within the regulatory compliance criteria and will not cause a significant radiological impact to downstream users of water. However, nearby watercourses may become contaminated due to unauthorised discharge of contaminated water as well as runoff from contaminated surfaces within the mining rights area into these watercourses. The dirty water areas include the TSFs and associated infrastructure, Mine Plant areas and the pollution control dams.

Contamination of watercourses will lead to the deterioration of water quality and associated sediments. Contributions to the total effective dose to receptors identified (downstream water users) include ingestion of contaminated water, soil, crops and animal products, and external gamma radiation through groundshine.

##### *10.5.2.3.2 Management/Mitigation Measures*

The management objective would be to first ensure that radiation exposure is below the regulatory compliance criteria (i.e., the dose constraint), and secondly to optimise the radiation protection by applying the ALARA principle.

The conditions for authorised discharge into watercourses took into consideration the activity concentration of the water that is released, the volume of water released, the effect of dilution at the point of discharge, and the water use conditions downstream from the discharge point. The potential radiation exposure to members of the public will be below the regulatory compliance criteria for as long as the Project complies with the conditions of authorisation.

From a dose optimisation perspective, the following mitigation measures can be applied for the remainder of the activities. These measures, which are in line with the measures proposed in the surface water impact assessment, will contribute to a reduction in the total effective dose if applied for the duration of the operational period:

- A surface water management plan should be developed to ensure that all runoff from dirty areas are directed to the existing stormwater management infrastructure (PCDs) and should not be allowed to flow into any of the nearby watercourses;
- Discharge of water that can potentially contain radionuclides to the nearby watercourses should only be allowed if discharge authorisation has been granted by the relevant authorities, including the National Nuclear Regulator (NNR);
- The PCDs and dirty water channels should be lined either by concrete or HDPE to prevent contamination of groundwater through seepage; and
- Water quality monitoring should continue downstream and upstream of the mine site, and within all surface water circuits at the mine to detect any contamination arising from operational activities.

#### *10.5.2.3.3 Impact Rating*

Table 10-28 presents the impact significant rating for the release of contaminated water that contains radionuclides into nearby watercourses during the operational phase.

**Table 10-28: Impact Rating for the Release of Contaminated Water Containing Radionuclides into Nearby Watercourses**

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| Impact Description: Release of contaminated water that contains radionuclides into nearby watercourses during the operational phase | | | |
| *Prior to Mitigation / Management* | | | |
| Nature | Negative | | Minor (negative) – 56 |
| Duration | Beyond project life (6) | The impact will remain for some time after the life of the project and is potentially irreversible if not managed | |
| Extent | Municipal area (4) | Exposure potentially extends beyond the mining rights area into the nearby watercourses and their downstream users | |
| Intensity | On-going serious (4) | Impact expected in the nearby watercourses and associated sediments, with potential exposure to downstream users that are above regulatory compliance | |
| Probability | Probable (4) | It is probable that the impact will occur in the nearby watercourses | |
| *Post- Mitigation / Management* | | | |
| Nature | Negative | | Minor (negative) – 14 |
| Duration | Medium term (3) | The impact has not occurred yet and is likely to occur only in the absence of a water management plan, maintenance plan and monitoring plan | |
| Extent | Limited (2) | The impact will be limited to the site itself and its immediate surroundings | |
| Intensity | Minor (2) | The intensity of the impact will reduce significantly with the proper implementation of the water management plan, maintenance plan and monitoring plan | |
| Probability | Improbable (2) | With the implementation of the water management plan, maintenance plan and monitoring plan the probability of the impact to occur is low | |

#### 10.5.2.4 *Reclamation of Existing TSFs*

##### *10.5.2.4.1 Impact Description*

One of the main objectives of the project is the reclamation of the existing TSFs, which by implication means that the facility is removed from the surface. Once removed and provided that the footprint area of the TSF is rehabilitated and clean-up, the implication is that the source of radiation exposure to receptors identified for the Project is removed. Under these conditions, this will result in a reduction of the total effective dose induced by wind erosion and radon exhalation.

##### *10.5.2.4.2 Impact Rating*

Table 10-29 presents the impact significant rating for the reclamation of the existing TSFs during the operational phase.

**Table 10-29: Impact significant rating for the reclamation of the existing TSFs during the operational phase**

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| Impact Description: Reclamation of the existing TSFs during the operational phase | | | |
| *Prior to Mitigation / Management* | | | |
| Nature | Positive | | Minor (positive) – 70 |
| Duration | Permanent (7) | The effective reclamation and rehabilitation of the footprint area will have an irreversible impact that will remain after the life of the project | |
| Extent | Limited (2) | The impact will be limited to the site and its immediate surroundings | |
| Intensity | On-going (5) | The impact on members of the public will be on-going and widespread | |
| Probability | Likely (5) | The reclamation of the TSFs is one of the objectives of the project, while the rehabilitation of the footprint areas is a strong recommendation, which means that the probability that the impact will occur is likely | |

### 10.5.3 Decommissioning, Closure and Rehabilitation Phase

Before the actual closure of mine and as part of the NNR licensing (CoR) conditions and requirements, a decommissioning plan will be prepared for submission and approval by the NNR. This plan will define in detail all the activities that will be performed and how the associated radiological impact during the decommissioning and closure phase will be managed.

#### 10.5.3.1 *Activities*

Decommissioning activities considered for this phase include:

- Demolition and removal of all infrastructure, including transporting materials off site;
- Storage, handling and treatment of hazardous products (including fuel, explosives and oil) and waste; and
- Rehabilitation, including spreading of soil, re-vegetation and profiling or contouring, and post-closure monitoring

Considering that a decommissioning plan is not yet available, but will be defined and implemented, the following interactions were identified that may result in a radiological impact to the receptors identified during the post-closure phase:

- Implementation of the NNR approved decommissioning plan;
- Exhalation of radon gas and the emission of particulates matter ($PM_{10}$ and TSP) that contain radionuclides from the dormant TSFs (including those with unrehabilitated footprint areas); and
- Leaching and migration of radionuclides from the dormant TSFs (including those with unrehabilitated footprint areas).

Table 10-30 summarises the activities associated with the post-closure phase that may have a potential impact on the receptors identified.

**Table 10-30: Summary Interactions and the Impact of the Activities During the Decommissioning and Post-Closure phase.**

| Interaction | Impact |
|---|---|
| Implementation of the decommissioning plan | The execution of the decommissioning plan involves a site-wide plan to demolish, decontaminate and remove all the surface infrastructure that may contain or that are contaminated with radionuclides. These areas and any other area that was contaminated will be rehabilitated and cleaned for clearance by the NNR. |

| Interaction | Impact |
|---|---|
| Exhalation of radon gas and particulate matter from the remaining TSFs to the atmosphere | Radon gas generated in the tailings material due to the presence of Ra-226 will be exhalated to the atmosphere. Inhalation of the radon gas contributes to the total effective dose.<br>Wind erosion at the TSFs will cause particulate matter containing radionuclides to be emitted to the atmosphere. The airborne dust ($PM_{10}$) and deposited dust (TPS) contribute to the total effective dose through inhalation, ingestion and external radiation exposure routes. |
| Leaching and migration of radionuclides from the TSFs | Radionuclides will leach from the TSFs into the underlying aquifer, after which it will migrate in the general groundwater flow direction. Abstraction and use of the contaminated water contribute to the total effective dose through the ingestion and possible external radiation exposure routes. |

### 10.5.3.2 *Implementation of the Decommissioning Plan*

#### *10.5.3.2.1 Impact Description*

The implementation of the decommissioning plan results in a positive impact in the sense that all surface infrastructure that contained or that are contaminated with radionuclides are demolished, decontaminated (to the extent possible), and removed from the site once compliance with clearance criteria has been demonstrated. A gamma radiation survey is performed at the infrastructure sites, followed by rehabilitation and clean-up for conditional or unconditional clearance from the NNR. In addition, an area that becomes contaminated during or because of operational activities will also be rehabilitation and clean-up for conditional or unconditional clearance.

#### *10.5.3.2.2 Impact Rating*

Table 10-31 presents the impact significant rating for the implementation of the decommissioning plan.

**Table 10-31: Impact Rating for Implementation of the Decommissioning Plan.**

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| Impact Description: Implementation of the NNR approved decommissioning plan | | | |
| *Prior to Mitigation / Management* | | | |
| Nature | Positive | | |

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| Duration | Permanent (7) | The effective implementation of the decommissioning plan will have an irreversible impact that will remain after the life of the project | Minor (positive) – 70 |
| Extent | Limited (2) | The impact will be limited to the site and its immediate surroundings | |
| Intensity | On-going (5) | The impact on members of the public will be on-going and widespread | |
| Probability | Almost certain (5) | Within the NNR nuclear authorisation structures, the probability that the impact will occur is likely | |

### 10.5.3.3 *Exhalation of Radon Gas and Particulate Matter from TSFs*

#### *10.5.3.3.1 Impact Description*

During the post-closure phase, some of the TSFs will remain at the surface as deposition sites for tailings generated from the underground operations and surface reclamation. Also, if the decommissioning plan was not implemented to its full extent, then there is a possibility that the unrehabilitated footprint of reclaimed TSFs is still at the surface.

Under worst case conditions, these facilities will serve as a source of windblown dust (i.e., wind erosion) to the atmosphere during the post-closure period. During the same period, radon gas generated in the tailings material due to the presence of Ra-226 will be exhaled from the various TSFs.

The emission and subsequent dispersion of the particulate matter into the atmosphere results in an airborne radionuclides concentration associated with the $PM_{10}$, and a soil radionuclides concentration following the deposition of the TSP. Through secondary pathways, the radionuclides in the soil may be transferred to crops and animal products. Contributions to the total effective dose to receptors identified include inhalation of the airborne dust, ingestion of contaminated soil, crops and animal products, and external gamma radiation through cloudshine and groundshine.

Following the exhalation and subsequent dispersion of the radon gas into the atmosphere, inhalation of the airborne gas contributes to the total effective dose to receptors identified for the Project.

#### *10.5.3.3.2 Management/Mitigation Measures*

The management objective would be to first ensure that radiation exposure is below the regulatory compliance criteria (i.e., the dose constraint), and secondly to optimise the radiation protection by applying the ALARA principle.

The total effective dose as a contribution from the windblown dust and radon gas released from the TSFs is well below the regulatory compliance criteria, which means that from a compliance perspective no additional management or mitigation measures are required. From a dose optimisation perspective, the following mitigation measures that are in line with the measures proposed by the air quality impact assessment (Digby Wells Environmental, 2018e) can be applied for the post-closure phase:

- Vegetation of exposed area of the TSFs to reduce wind erosion; and
- Covering layer over the exposed area of the TSFs to reduce wind erosion and radon exhalation.

###### *10.5.3.3.3 Impact Rating*

Table 10-32 presents the impact significant rating for the exhalation, emission and dispersion of radon gas and particulate matter that contains radionuclides during the post-closure phase of the Project.

#### 10.5.3.4 *Leaching and Migration of Contaminants from the TSFs*

###### *10.5.3.4.1 Impact Description*

From the commissioning of a TSF, radionuclides contained in the tailings material leach from the TSFs to the underlying strata. The rate of leaching is controlled by complex geochemical and hydrological processes but generally are a very slow process. Once in the underlying strata, migration of these radionuclides is equally slow along the groundwater flow path.

Abstraction of groundwater for personal or agricultural purposes may result in a radiological impact to receptors identified through direct ingestion of water or the ingestion of crops and animal products as secondary pathways. The radiological impact along the groundwater pathway only manifest itself during the post-closure period after hundreds to thousands of years after closure.

**Table 10-32: Impact Rating for Exhalation, Emission and Dispersion of Radon Gas and Particulate Matter Containing Radionuclides**

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| Impact Description: Exhalation, emission and dispersion of radon gas and particulate matter that contains radionuclides during the post-closure phase | | | |
| *Prior to Mitigation / Management* | | | |
| Nature | Negative | | Minor (negative) – 66 |
| Duration | Project life (5) | The impact will occur for the duration of the operational phase | |
| Extent | Local (3) | Exposure extent beyond the mining rights area into the immediate surroundings | |
| Intensity | On-going (3) | Impact expected in residential areas and where commercial agriculture is practised is below the regulatory dose constraint | |

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| Probability | Almost Certain (6) | It is almost certain that impact will occur in the residential areas and where commercial agriculture is practised | |
| *Post- Mitigation / Management* | | | |
| Nature | Negative | | Minor (negative) – 50 |
| Duration | Project life (5) | The impact will occur for the duration of the operational phase | |
| Extent | Limited (2) | Exposure beyond the mining rights area into the immediate surroundings is limited | |
| Intensity | On-going (3) | Impact expected in residential areas and where commercial agriculture is practised is below the regulatory dose constraint | |
| Probability | Likely (5) | It is likely that impact will occur in the residential areas and where commercial agriculture is practised | |

##### *10.5.3.4.2 Management/Mitigation Measures*

The management objective would be to first ensure that radiation exposure is below the regulatory compliance criteria (i.e., the dose constraint), and secondly to optimise the radiation protection by applying the ALARA principle.

The total effective dose from the ingestion of groundwater as a contribution from the TSFs was hypothetically illustrated to be below the regulatory compliance criteria, which means that from a compliance perspective no additional management or mitigation measures are required. However, from an optimisation of radiation protection perspective for the post-closure period, the following management/mitigation measures can be implemented if it is assumed that the facility remains at the surface:

- Implementation of a passive groundwater remediation system downstream of the TSF to capture the contaminant plume.

*Note that active remediation systems, such as cut-off trenches or a pump and treat system, might also be effective in the short to medium term. However, the timescales of concern are beyond what can be considered as active institutional control periods.*

Table 10-33 presents the impact significant rating for the leaching and migration of radionuclides from the TSFs the post-closure phase of the Project.

**Table 10-33: Impact Rating for Leaching and Migration of Radionuclides from the TSFs**

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| Impact Description: Leaching and migration of radionuclides from the TSFs the post-closure phase | | | |
| *Prior to Mitigation / Management* | | | |
| Nature | Negative | | Minor (negative) – 66 |
| Duration | Project life (5) | The impact will occur for the duration of the operational phase | |
| Extent | Local (3) | Exposure extent beyond the mining rights area into the immediate surroundings | |
| Intensity | On-going (3) | Impact expected in residential areas and where commercial agriculture practices are below the regulatory dose constraint | |
| Probability | Almost Certain (6) | It is almost certain that impact will occur in the residential areas and where commercial agriculture is practices | |
| *Post- Mitigation / Management* | | | |
| Nature | Negative | | Minor (negative) – 50 |
| Duration | Project life (5) | The impact will occur for the duration of the operational phase | |
| Extent | Limited (2) | Exposure beyond the mining rights area into the immediate surroundings is limited | |
| Intensity | On-going (3) | Impact expected in residential areas and where commercial agriculture practices is below the regulatory dose constraint | |
| Probability | Likely (5) | It is likely that impact will occur in the residential areas and where commercial agriculture is practices | |

## 10.6 Community Health

A cHIA is by nature a multi- and inter-disciplinary endeavour. This is because community health is influenced by a multitude of social, environmental and structural factors, and also because project-related impacts may impact on community health by various indirect means (e.g. by effecting social or environmental changes in the area surrounding the project). For this assessment air quality, water (ground and surface), social and radiological studies were reviewed and where impacts that could affect health were identified, these impacts were further assessed and integrated accordingly. Based on this initial assessment, the Operational Phase and Decommissioning Phase of the mine was found to have the most significant impacts to community health and these impacts are then assessed in the context of EHAs. Construction activities will be limited to the refurbishment of the existing No 5 Shaft and the upgrade of the existing infrastructure at the metallurgical plant (within the existing footprints). The construction phase will be short-term and associated impacts will be negligible, hence have not been considered.

### 10.6.1 EHA 5: Soil- and Water-Sanitation Related Diseases

According to the updated SIA, uncollected refuse and raw sewage was seen in the streets during numerous site visits as part of the impact assessment investigation. This will have a negative health impact on the communities of concern, including but not limited to diarrhoea, eye and skin infections.

Although indicated as negligible, the influx of people may also play a role on water and waste related diseases.

Water contamination may occur as a result of runoff from contaminated surfaces and from any dirty water discharges including treated sewage effluent within the Project area, into the water course in proximity to the site, thereby potentially impacting on the communities within the Project area. The impact of water contamination as a result of the Project, is discussed further in EHA 8.

**Table 10-34: EHA 5: Soil- and Water-Sanitation Related Diseases**

<table>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td colspan="4">Soil- and Water-Sanitation Related Diseases</td></tr>
<tr><td colspan="4">Impact Description: Receptors exposure to refuse and raw sewage resulting in negative health impacts</td></tr>
<tr><td colspan="4">Prior to Mitigation/Management</td></tr>
<tr><td>Duration</td><td>Project Life (5)</td><td>Impact will occur for the life of the Project</td><td rowspan="5">Moderate (negative) – 84</td></tr>
<tr><td>Extent</td><td>Local (2)</td><td>Exposure extent will extend within Project area</td></tr>
<tr><td>Intensity x type of impact</td><td>Very Serious (5)</td><td>Serious impacts on exposed receptors and environment</td></tr>
<tr><td>Probability</td><td>Definite (7)</td><td>The impact is already happening</td></tr>
<tr><td>Nature</td><td>Negative</td><td></td></tr>
<tr><td colspan="4">Mitigation/Management Actions</td></tr>
</table>

<table>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td colspan="4"><ul>
<li>Manage the influx of people;</li>
<li>The quality of groundwater and surface water must be monitored to ensure that the Project does not have any detrimental effects on community water sources;</li>
<li>Conduct baseline water and sanitation studies on communities based on accepted health indicators;</li>
<li>Monitor for groundwater organics, bi-annually, including: Total Coliform, E. Coli and Heterotrophic plate count;</li>
<li>Ensure proper disposal of human waste that is generated from the Project;</li>
<li>Ensure proper waste management from Project generated waste according to waste management principles;</li>
<li>Support the local authority in supporting and improving water and sanitation services, including the collection and disposal of waste in the communities;</li>
<li>Establish water and sanitation committees in the communities to manage their own water and sanitation services. This will improve sustainability of any outreach support;</li>
<li>Support information campaigns in the community on water use, hygiene and general sanitation; and</li>
<li>Depending on the results of the baseline data gathering, support the government’s school deworming programme in partnership with local authorities.</li>
</ul></td></tr>
<tr><td colspan="4">Post-Mitigation</td></tr>
<tr><td>Duration</td><td>Project Life (5)</td><td>Impact will occur for duration of Project</td><td rowspan="5">Minor (negative) – 36</td></tr>
<tr><td>Extent</td><td>Local (2)</td><td>Exposure extent will extend within Project area</td></tr>
<tr><td>Intensity x type of impact</td><td>Minor (2)</td><td>Minor impact anticipated after mitigation measures have been applied</td></tr>
<tr><td>Probability</td><td>Probable (4)</td><td>It is still probable that the impact may still occur, after mitigation measures are applied</td></tr>
<tr><td>Nature</td><td>Negative</td><td></td></tr>
</table>

## 10.6.2 EHA 8: Exposure to Potentially Hazardous Materials

### 10.6.2.1 *Operational Phase*

#### *10.6.2.1.1 Air Pollution*

A detailed Air Quality Impact Assessment (AQIA) has been conducted (attached as an appendix to the EIA). The model predictions showed that emissions associated with wind erosion of the TSFs will lead to increased levels of Particulate Matter (PM), including Total Suspended Particulates (TSP), $PM_{10}$ and $PM_{2.5}$ in the surrounding atmosphere. Dust will be airborne, leading to nuisance effect, reduction in the quality of air, with potential health and environmental implications from exposure. Exposure to the pollutants will be worse for receptors within a 6 km radius from the centre of origin. Findings from the AQIA are summarised as follows:

The problem with wind erosion is it can affect tailings dams in all types of climate but becomes worse as climatic aridity increases. Because clouds of dust are often observed billowing across the top surfaces of tailings dams in dry windy weather, there is a common misconception that the dust arises from wind erosion of the top surface. As a result, much effort and money is vainly spent on treating the tops of tailings dams (planting grasses/spraying water) to prevent dust generation, whereas the slopes of the dams are the true major dust source. The upper windward slopes, and particularly the area just below windward crests, are the most susceptible to wind erosion. The top surfaces are less susceptible to significant wind erosion.

With correct mitigation and management measures, the emissions can be reduced to be within the South African standards.

**Table 10-35: EHA 8: Exposure to Potentially Hazardous Materials**

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Deposition and reclamation of TSFs** | | | |
| **Impact Description:** Exposure to potentially hazardous PM in the air | | | |
| ***Prior to Mitigation/Management*** | | | |
| **Duration** | Project Life (5) | Impact will occur for the life of the Project | Moderate (negative) – 91 |
| **Extent** | Local (3) | Exposure extent will extend outside the mine footprint | |
| **Intensity x type of impact** | Very Serious (5) | Serious impacts on exposed receptors and environment | |
| **Probability** | Definite (7) | It is almost certain that the impact will occur | |
| **Nature** | Negative | | |
| ***Mitigation/Management Actions*** | | | |

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| ▪ Develop a dust management plan;<br>▪ Apply wetting agents, dust suppressant or binders on the exposed area;<br>▪ Vegetate, with grass or a gravel monolayer, the exposed areas;<br>▪ Reduce erosion loss by roughening slope surface - this dissipates energy of water or wind moving over the slope;<br>▪ Assess the angle of the slope, as maximum erosion occurs on slopes with angles between 30° and 35°;<br>▪ Improve upon the surface strength of a slope, which will lower the rate of erosion;<br>▪ Implement PM monitoring and continue with ongoing dust fallout monitoring;<br>▪ Collect data on a longitudinal basis from the local health centres on incidence of increased respiratory disease - especially respiratory tract infections that could be ascribed to dust. While these may not be specifically ascribed to the Project, the prevailing trends are useful to monitor so that any concerns could be addressed. This may require health systems strengthening to support recording; and<br>▪ Establish a monthly and annual reporting structure to appraise performance, compliance and complaints. | | | |
| ***Post-Mitigation*** | | | |
| **Duration** | Project Life (5) | Impact will occur for duration of Project | Minor (negative) – 40 |
| **Extent** | Local (3) | Exposure extent will extend within Project area | |
| **Intensity x type of impact** | Minor (2) | Minor impact anticipated after mitigation measures have been applied | |
| **Probability** | Probable (4) | It is still probable that the impact may still occur, after mitigation measures are applied | |
| **Nature** | Negative | | |

### *10.6.2.1.2 Groundwater*

A basic impact assessment was conducted, resulting in the identification of impacts and resultant management/mitigation measures, but there is insufficient data to rate the impacts. The mineralogy results show no or very low carbonate mineral content (only found in trace minerals). Carbonates are beneficial as they have the potential to buffer acid. However, no sulphide bearing minerals (such as pyrite or arsenopyrite) have been detected, therefore reducing the risk of acid generation. Acid-Base Accounting indicated representative samples, from the Project area to have acid generating potential, however TSF No. 6 showed to have a low acid generating potential. Therefore, the reactions would be of short duration due to the low sulphide content. According to the NEM:WA waste classification and management regulations, Total Concentration Results classed all samples as Type 3 waste, requiring a Class C liner, whereas Leachable Concentration Results again classed all samples as Class C, but TSF No. 6 as Type 4 waste requiring a Class D liner.

Results indicate TSF No. 6 does not pose an environmental risk based on the laboratory results yielding the following outcomes:

- Acid-base-accounting results consistently show that the material at TSF No. 6 does not show evidence of acid generation; and
- The leachate quality is found to be inert.

Surrounding communities including Carletonville, Welverdiend, Wedela and Khutsong may be impacted negatively if the groundwater quality deteriorates as a result of the TSFs. Dams and non-perennial streams (draining towards the Mooiriverloop), within the Project area may be affected should the groundwater be contaminated, and they receive baseflow. Although, due to limited groundwater occurrence, impacts to the groundwater by the TSFs may be less.

*Impact*

The TSFs may generate contaminating leachate. As rainwater infiltrates through any of the facilities, metals could be dissolved, and leachate is formed. The leachate then seeps to the groundwater and migrates by advection through the groundwater environment.

*Management/Mitigation Measures*

- Deposition of tailings, for TSF No. 4 & 5, should be on a Class C liner and therefore this footprint should be completely cleared of existing materials and a liner installed prior to deposition; alternatively, a comprehensive risk assessment should be carried out for a new TSF in accordance with the amended Regulations for managing TSFs;
- It is proposed, that the maintenance of the inactive TSFs be conducted by developing an effective return water system to manage excess water that may accumulate at the tailings facilities;
- Groundwater monitoring must be implemented to assess the time series water level and water quality trends;
- A numerical groundwater model needs to be conducted, once updated data is available, to complete a full risk and impact assessment;
- Affected receptors (if proven through monitoring) should be compensated; and
- Ensure that the hazardous materials response plan includes response to offsite proposed Project related spills and effluent discharge into the nearby communities.

##### *10.6.2.1.3 Surface Water*

Although water is an essential requirement in the mine for various purposes, the use of it has the potential to affect the quality of surrounding resources. All mines are, therefore, required to contain, recycle and re-use dirty water within their operational systems, to avoid discharging contaminated water into the natural environment.

Water contamination may occur as a result of runoff from contaminated surfaces and from any dirty water discharges including treated sewage effluent within the mine into the water course in proximity to the site. The dirty water areas at the Project site include TSFs, Mine Plant area and Pollution Control Dams (PCDs). Contamination of surface water resources will lead to the deterioration of water quality affecting aquatic ecosystems and downstream water users.

On-site and surrounding Project area, surface water was tested for and results indicated:

- pH – showed alkaline water quality, within acceptable levels with respect to DWS irrigation target values. A considerable drop in pH was noted for one monitoring on the eastern side of the Project area, showing acid contamination, which is not suitable for irrigation;
- Electrical Conductivity – showed acceptable levels, except for one monitoring point on the eastern side of the Project area, possibly due to a spill of pollutants from upslope waste water dams;
- Nitrates – acceptable levels were noted, indicating faecal pollution in the water is absent or minimal, thereby providing a suitable environment for aquatic ecosystems;
- Metal Toxins (Lead (Pb), Cadmium (Cd), Uranium (U), Selenium (Se) and Aluminium (Al)) – Pb was slight above acceptable level for all monitoring points, Cd, U and Se indicated higher concentrations at the one monitoring point on the eastern side of the Project area, which could be attributed to spillage from waste water dams upslope or from the Savuka Mine. Al levels fluctuated but declined to an acceptable limit; and
- Cyanide Dissolved – indicated the levels were lower (<0.02 mg/L) than the DWS target water quality range of 0.1 mg/L.

**Table 10-36: Water Contamination Health Impact**

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Surface Water Contamination** | | | |
| **Impact Description:** Water Contamination from runoff from dirty water areas | | | |
| ***Prior to Mitigation/Management*** | | | |
| **Duration** | Beyond Project Life (6) | Impact will remain for some time after the life of the Project | Minor (negative) – 60 |
| **Extent** | Municipal (4) | Impacts will be localized to the nearby watercourses and to the immediate downstream water users | |
| **Intensity x type of impact** | Very Serious (5) | Very serious, long-term environmental impairment of ecosystem function that may take several years to rehabilitate | |

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Probability** | Probable (4) | Without appropriate mitigation, it is probable that this impact will occur | |
| **Nature** | Negative | | |
| ***Mitigation/Management Actions*** | | | |
| • Runoff from dirty areas should be directed to the existing storm water management infrastructure (PCDs) and should not be allowed to flow into the stream, unless DWS discharge authorisation has been granted upon compliance with relevant effluent discharge standards as stipulated in the National Water Act (NWA). The PCDs and dirty water channels should be lined either by concrete or HDPE to prevent contamination of groundwater through seepage; and<br>• Water quality monitoring should continue downstream and upstream of the mine site, and within all surface water circuits at the mine to detect any contamination arising from operational activities. | | | |
| ***Post-Mitigation*** | | | |
| **Duration** | Medium Term (3) | The impact will only likely persist in the absence of proper monitoring and maintenance of storm water management plan infrastructure on site | Negligible (negative) – 14 |
| **Extent** | Limited (2) | The impact footprint will be limited to the nearby watercourses and to the immediate downstream water users | |
| **Intensity x type of impact** | Minor (2) | Minor impact anticipated after mitigation measures have been applied | |
| **Probability** | Unlikely (2) | Impact is unlikely to occur, after mitigation measures are applied | |
| **Nature** | Negative | | |

### 10.6.2.2 Decommissioning Phase

#### *10.6.2.2.1 Surface Water*

Acid Mine Drainage (AMD) causes acidification and metal contamination of surface and ground water bodies when mine materials containing metal sulphides are exposed to oxidizing conditions. Heavy-metal contaminated and acidified groundwater discharges into streams at points where the water table is close to the surface. The oxidation of iron sulphide precipitates sulphuric acid which lowers in-stream water pH. Acidic water environments are detrimental to most aquatic life species, in addition they affect irrigation and livestock watering functions for downstream water users.

Many of the components and pollutants in AMD are dangerous to humans. It is also known that the heavy metals, found in AMD, accumulate in plant and animal tissue. Continued exposure leads to high levels of the pollutant in an organisms tissues, potentially causing damage.

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Acid Mine Drainage** | | | |
| **Impact Description:** Water Contamination from Acid Mine Drainage into Surface Water Resources | | | |
| ***Prior to Mitigation/Management*** | | | |
| **Duration** | Beyond Project Life (6) | Impact will remain for some time after the life of the Project | Moderate (negative) – 90 |
| **Extent** | Municipal (4) | Impacts will be localised to the immediate surroundings of the mine site | |
| **Intensity x type of impact** | Very Serious (5) | Highly significant impact on health and the environment. Irreparable damage to highly valued species, habitat or ecosystem | |
| **Probability** | Almost Certain (6) | Without appropriate mitigation, it is almost certain that this impact will occur | |
| **Nature** | Negative | | |
| ***Mitigation/Management Actions*** | | | |
| The best option to limit AMD is early avoidance of sulphide oxidation through use of a combination of several techniques which include the following (Sahoo et al., 2013):<br>▪ Electrochemical treatment of the acidified effluent producing re-usable water;<br>▪ Physical barriers using wet or dry covers that retard sulphide oxidation;<br>▪ Chemical passivation, which involves encapsulation of sulphide surfaces using organic and/or inorganic coatings such as silica, phosphate, lipids and humic acid;<br>▪ Desulphurization which separates sulphide minerals into a low-volume stream, that mainly results in non-acid-generating waste with low sulphur content;<br>▪ Use of accredited contractors for removal or demolition of infrastructure is recommended; this will reduce the risk of waste generation and accidental spillages; and<br>▪ Should decant occur at a later stage, decant water should be treated to acceptable water quality levels prior to discharge into the natural stream. | | | |
| ***Post-Mitigation*** | | | |
| **Duration** | Project Life (5) | The impact will remain for the duration of the life of the Project | Minor (negative) – 36 |
| **Extent** | Limited (2) | Limited to site and its immediate surroundings | |
| **Intensity x type of impact** | Minor (2) | With effective prevention of the oxidation of iron sulphides, the AMD impact will have minor intensity | |

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Probability** | Unlikely (4) | It is probable the impact will occur | |
| **Nature** | Negative | | |

### 10.6.3 EHA 9: Social Determinants of Health

It is not the intention of the cHIA to address social issues in detail as they are covered in more detail in the Social Impact Assessment (SIA). However, it is important to recognise the wellbeing and perceptions on quality of life have both a social and health basis. The SIA is appended to the EIA.

#### 10.6.3.1 *Population Influx and Quality of Life*

Based on the limited number of job opportunities created by the recommissioning of parts of the mine, it is unlikely that the operation would draw large numbers of job seekers to the area.

Nevertheless, there is the potential for negative impacts to arise as a result of population influx:

- Limited resources, in terms of the number of job opportunities, could result in a change of social cohesiveness amongst the community members which potentially could result in acts of violence, including crime, substances abuse (smoking, drugs, alcohol, etc.) and interpersonal violence as well as an increase in psychosocial ills such as depression. The effect of newcomers has already partially been experienced with the arrival of zama-zamas after the liquidation process commenced which led to conflict and violent clashes with the local community and the SAPS;
- Increased demand for municipal services, including, but not limited to: housing, water, electricity, sanitation, refuse removal and health care; and
- Overcrowding can result in the transmission of communicable diseases (respiratory infections, TB, etc.). In addition, living without an income, or receiving an income, when previously not, can result in substance abuse, which has been related to the transmission of sexually transmitted infections, including HIV.

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Population Influx and Quality of Life** | | | |
| **Impact Description:** Population Influx and Quality of Life | | | |
| ***Prior to Mitigation/Management*** | | | |
| **Duration** | Medium Term (3) | It is expected that population influx will occur just before and during the re-instatement of the mine | Minor (negative) - 60 |

<table>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td>Extent</td><td>Local (3)</td><td>Impacts will be localised to the immediate communities surrounding and within the Project area</td><td rowspan="4"></td></tr>
<tr><td>Intensity x type of impact</td><td>Significant health issues (4)</td><td>The impact will lead to significant negative health impacts, which can be managed/mitigated</td></tr>
<tr><td>Probability</td><td>Highly Probable (6)</td><td>Impact is already happening (zama-zamas) and will continue to happen as the project is re-instated, impacting QoL including negative health impacts</td></tr>
<tr><td>Nature</td><td>Negative</td><td></td></tr>
<tr><td colspan="4">Mitigation/Management Actions</td></tr>
<tr><td colspan="4"><ul><li>Social management plans and recommendations as part of the SIA;</li><li>Support information programmes in the community on the effects of alcoholism, drug abuse, communicable diseases, sexually transmitted disease and HIV;</li><li>Extensive communication and management of expectations to be conducted with stakeholders, including the communities;</li><li>Community communications needs to be managed in a transparent manner. Communication needs to be on-going and regular. Issues and concerns as raised by the communities need to be addressed; and</li><li>Health impacts emanating from insufficient basic services needs to be addressed with solutions (sanitation, water, electricity and health care).</li></ul></td></tr>
<tr><td colspan="4">Post-Mitigation</td></tr>
<tr><td>Duration</td><td>Project Life (5)</td><td>If mitigation/management measures are practised, QoL of the communities can be positive for the duration of the Project</td><td rowspan="5">Minor (positive) +52</td></tr>
<tr><td>Extent</td><td>Local (3)</td><td>Impacts will be localised to the immediate communities surrounding and within the Project area</td></tr>
<tr><td>Intensity x type of impact</td><td>Benefits (5)</td><td>Minor impacts will continue but positive impacts to the community can result through the effective implementation of the proposed mitigation/management measures, thereby enhancing the communities</td></tr>
<tr><td>Probability</td><td>Probable (4)</td><td>It is possible that the communities are enhanced as a result of the Project</td></tr>
<tr><td>Nature</td><td>Positive</td><td></td></tr>
</table>

## 10.7 Socio-Economic

As more recent socio-economic data is available, the impact assessment undertaken by Golder (2016) was evaluated to determine:

- Whether the impacts are still valid or require amendment; and
- Where impacts are valid, whether the significance rating is still relevant.

Table 10-37 provides the impacts identified and assessed as part of the Golder SIA and the impacts identified as part of the addendum. In the subsections that follow, a summary description of the Golder SIA impact is first presented, and an update presented thereafter, if applicable.

**Table 10-37: Golder Impacts and Addendum Impacts**

| Impacts Assessed by Golder in 2016 | Impacts Included in this Addendum |
|---|---|
| ▪ Employment opportunities;<br>▪ Population influx;<br>▪ Economic benefits;<br>▪ Community development;<br>▪ Safety and security;<br>▪ Quality of Life impacts; and<br>▪ Environmental impacts | Risk for social disintegration and conflict. |

### 10.7.1 Employment Opportunities

#### 10.7.1.1 *Impact Description – Golder (2016)*

Approximately 30-50 positions would be created during the refurbishment phase, which will gradually increase as mining operations ramp up. It is expected that the mine will employee 421 people within the second year of operations, 674 in the third year and in the order of 842 people from year 5 onwards. The significance of the impact was deemed high without mitigation and moderate with mitigation, but the report does not make a distinction between positive and negative impacts.

#### 10.7.1.2 *Impact Description – Updated Information*

Based on the LHR Report, the primary study area (the 'mine village') consists of approximately 6,000 people. Of these, 72.2% are in the economically active age range, which amounts to roughly 4,332 people. According to Blyvoor Gold, approximately 1,612 people were employed by the mine in April 2013 (prior to liquidation proceedings) and will therefore have been subject to summary loss of jobs. Of the 4,332 people in the economically active age range, roughly 75% (or 3,249) are still unemployed. Blyvoor Gold committed in its SLP that 70% of its labour force will be recruited from the local area, which means that roughly 590 employment opportunities will be created for the local area at the mine itself.

Several media reports and in the LHR report (2017) mention that retrenched workers remained in the area not only due to no other options and the hope of the mine restarting and rehiring them. This is now a reality, but job opportunities are very limited – only about 18% of the local workforce would be able to secure employment at the recommissioned mine, assuming they have the right skills and experience. The impact is regarded as positive, but the limited number of opportunities does mean that Blyvoor Gold will not be able to rely on job creation alone but would have to consider additional measures that could benefit the wider community as well in an attempt to reduce the risk for social disintegration and conflict (see Section 10.7.8).

Blyvoor Gold also intends to hire local labour for use in their LED projects as part of their SLP commitments. This will create a further 60 temporary positions and 16 longer term positions. Although temporary work creates immediate economic benefits to the worker and his/her family, the impact is not sustainable due to the transiency of employment. The 16 more permanent positions are grouped with the operational staff, bringing the total number of positions created at the mine to 606.

#### 10.7.1.3 *Management Objectives*

Enhance the job opportunities created by the recommissioning of the mine as much as possible to the benefit of the local community.

#### 10.7.1.4 *Management Actions and Targets*

As much of the 70% local employment as possible should be awarded to residents in the ‘mine village’. This will have to be preceded by extensive stakeholder engagement with village residents and could include a high-level skills survey to determine the available skills in the village. Establish a local labour desk run by an independent party to reduce the risk of nepotistic or otherwise fraudulent local recruitment. Blyvoor Gold has indicated that the list of past employees still held by the liquidator will be used to achieve this management objective.

#### 10.7.1.5 *Impact Rating*

Table 10-38 provides an assessment of the new information and data collected for the SIA addendum.

### Table 10-38: Potential Impacts of Job Creation

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Jobs and income generation** | | | |
| **Impact Description:** Employment and income generation that could assist in uplifting an estimated 606 households in the local village. | | | |
| ***Prior to Mitigation/Management*** | | | |
| **Duration** | Project life (5) | It is expected that jobs will be sustained for the operational lifespan of the mine | Minor (positive) +40 |
| **Extent** | Municipal area (4) | The SLP states that 70% of job opportunities will be offered to the local municipal area | |
| **Intensity** | Low-level impacts (1) | Jobs offered to people who are not from the area detracts opportunities from the local community | |
| **Probability** | Probable (4) | Blyvoor Gold has committed in their SLP to the DMR to source 70% local labour but in the absence of a skills database, it is not known if required skills are available. | |
| **Nature** | Positive (+1) | | |
| ***Mitigation/Management Actions*** | | | |
| ▪ Develop and implement a Stakeholder Engagement Plan (SEP), inclusive of a communications plan for the 'mine village'.<br>▪ Undertake a skills survey in the local community, allowing local residents to register their interest and particular skills for upcoming job opportunities.<br>▪ Reduce the 30% employment target for Gauteng (as per the SLP) based on the outcome of the skills survey, i.e. if required skills are found in the mine village, rather increase the 70% local employment target to ensure maximum uptake of local residents.<br>▪ Establish a local labour desk where interested work seekers can register and provide proof of qualifications and experience. The labour desk must consider previous employees. The desk should be operated by an independent party to prevent nepotistic requirement and increase local confidence that the mine is following a fair and transparent process.<br>▪ Explore the possibility of expanding job opportunities beyond mining-related work to also include hiring contract workers to assist with LED projects.<br>▪ Comply with minimum wage requirements for unskilled labour and all other requirements of the Employment Equity Act to ensure maximum benefits accrue to workers. | | | |
| ***Post-Mitigation*** | | | |
| **Duration** | Project life (5) | It is expected that jobs will be sustained for the operational lifespan of the mine | Minor (positive) +52 |

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Extent** | Municipal area (4) | The SLP states that 70% of job opportunities will be offered to the local municipal area | |
| **Intensity** | Average (4) | Average social benefits to some elements of the baseline. | |
| **Probability** | Probable (4) | Minimum of 70% local labour committed to in SLP, assuming required skills are available. | |
| **Nature** | Positive (+1) | | |

## 10.7.2 Population Influx

### 10.7.2.1 *Impact Description – Golder (2016)*

Golder (2016) described an expected influx of job seekers but did not consider other factors contributing to population influx (e.g. refurbishment and operational staff). Golder based the possibility of this impact materialising on the fact that a number of informal settlements around the local municipality have expanded, in part believed to have been because of perceived employment opportunities within the mining sector. The SIA also mentioned the possibility of migrant workers returning home post mine closure, but also the arrival of new migrants who are suspected of engaging in illegal mining activities.

### 10.7.2.2 *Impact Description – Updated information:*

The current study found no evidence of large-scale in-migration to the area; on the contrary, the population has decreased. Based on the limited number of job opportunities created by the recommissioning of parts of the mine, it is unlikely that the operation would draw large numbers of job seekers to the area. However, through news coverage it is possible that people who worked at the mine previously might assume that the entire mine has become operational again and decide to return the area in the hope of being reappointed at the new operations. Again, it is expected to be a few individuals rather than large groups.

It should be noted that the actual presence of newcomers (or returnees) is not an impact in itself, but a process that could lead to conflict over limited resources both in terms of the number of job opportunities, and the availability and reliability of infrastructure and services. The effect of newcomers has already partially materialised with the arrival of the suspected zama-zamas that lead to conflict and violent clashes with the local community and SAPS.

### 10.7.2.3 *Management Objectives*

Prevent opportunistic project-induced in-migration as far as possible.

#### 10.7.2.4 *Management Actions and Targets*

Develop and implement a communication plan that details the extent of job creation and where labour will be sourced from. Communicate the mine's employment policy in simple terms to also discourage local community members from (mis)informing relatives and friends of job opportunities. This must be managed by Blyvoor Gold's community liaison officer.

#### 10.7.2.5 *Impact Rating*

Table 10-39 represents the impact rating for potential in-migration of job seekers and illegal miners.

**Table 10-39: Project-induced in-migration**

<table>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td colspan="4">Influx of people to the area</td></tr>
<tr><td colspan="4">Impact Description: Project-induced in-migration can have ripple impacts on social cohesion and place additional strain on limited resources (e.g. housing and basic services)</td></tr>
<tr><td colspan="4">Prior to Mitigation/Management</td></tr>
<tr><td>Duration</td><td>Medium (3)</td><td>In-migration can last the first 5 years as people hope to secure employment.</td><td rowspan="5">Negligible (negative) -30</td></tr>
<tr><td>Extent</td><td>Municipal (4)</td><td>Unemployment job seekers likely to settle in informal settlements in the wider municipal area.</td></tr>
<tr><td>Intensity</td><td>Discernible (3)</td><td>On-going social issues can be expected.</td></tr>
<tr><td>Probability</td><td>Unlikely (3)</td><td>No historic evidence of large-scale in-migration to the area, bar migrants who engage in illegal mining – these tend to be small groups.</td></tr>
<tr><td>Nature</td><td>Negative (-1)</td><td></td></tr>
<tr><td colspan="4">Mitigation/Management Actions</td></tr>
<tr><td colspan="4">▪ No hiring at the gate.<br>▪ Maximise the use of local labour to the fullest extent possible, even if this implies increasing the 70% local hire commitment made in the SLP by reducing the 30% provincial hire.<br>▪ Develop and implement a communication plan for the local community (the 'mine village') as part of a wider SEP for the Project, which should include, inter alia, progress on the recommissioning process, employment opportunities available linked to skills required, and when positions will be available. Factual information might not always be received favourably but will assist in managing unrealistic expectations - one of which is currently that the mine will go back to operating on its previous scale and re-hire all retrenched workers.</td></tr>
<tr><td colspan="4">Post-Mitigation</td></tr>
</table>

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Duration** | Short-term (2) | Migrants are less likely to travel to site if they know there is now work available. | Negligible (negative) -15 |
| **Extent** | Very limited (1) | Some returnees might be expected within the 'mine village'. | |
| **Intensity** | Minor (2) | Very little change expected to the baseline. | |
| **Probability** | Unlikely (3) | Individuals might still travel to site despite knowing beforehand that job opportunities are not available. | |
| **Nature** | Negative (-1) | | |

## 10.7.3 Economic Benefits

### 10.7.3.1 *Impact Description – Golder (2016)*

Based on the MPRDA guideline for mining royalties, it was estimated that the Project would generate approximately R 31M over the next 10 years in royalties payable to the local and district municipalities as well as the provincial government. Blyvoor Gold would also be paying taxes as applicable to the various levels of government. In addition, they will also be contributing approximately R 1.7M over 10 years to the National Skills Fund. Part of the mine's SLP is to participate in LED projects, with spend in the order of R 56m over a 10-year period.

### 10.7.3.2 *Impact Description – Updated Information*

The impact as described in the Golder SIA (2016) remains unchanged. This report does, however, include a significance impact table based on the Golder variables to ensure uniformity with other impacts assessed.

### 10.7.3.3 *Management Objectives*

Ensure that economic benefits derived from the mining operations flow on to directly impacted communities in the form of employment and local economic development.

### 10.7.3.4 *Management Actions and Targets*

Support local economic development of directly affected communities (the 'mine village') through SLP committed LED projects. Augment legislated fiscal contribution through wider social development initiatives.

### 10.7.3.5 *Impact Rating*

Table 10-40 provides an updated impact rating of the project's economic benefits.

## Table 10-40: Economic Benefits

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Economic benefits to the local area** | | | |
| **Impact Description:** The Project will generate income in the form of wages, taxes and royalties that all add to economic benefits to the local area. | | | |
| ***Prior to Mitigation/Management*** | | | |
| **Duration** | Project life (5) | The mine will cease investing in LED projects post LoM. | Minor (positive) +48 |
| **Extent** | Municipal (4) | LED projects are mainly focused on the local municipal area. | |
| **Intensity** | Average (3) | LED projects will provide average social benefits to some of the local communities | |
| **Probability** | Probable (4) | Blyvoor Gold has to invest in LED projects as per the commitments made to the DMR in their SLP | |
| **Nature** | Positive (+1) | | |
| ***Mitigation/Management Actions*** | | | |

**(From the Golder SIA):**

- Promote the employment of locals that was affected by the provisional liquidation from Blyvoor Gold first and thereafter from the MCLM wherever possible: the creation of employment opportunities within the WRDM as per the requirements of the mining charter.
- Promote local procurement of goods and services wherever possible: besides providing employment, expenditure in a local economy is one of the other important ways an operation such as the proposed facility can contribute to a positive economic impact (including direct, indirect and induced impacts). The more money spent locally, the better the local economy.
- Support the diversification of the local economy: given that the MCLM local economy is heavily dependent on the mining sector, focus should be on supporting community projects that can assist in diversifying the local economy of the area beyond the LoM and an appropriate portable skills training.
- Support LED projects that are feasible, sustainable and promotes job creation: investing in projects that are feasible, sustainable and promotes job creation will mean that once decommissioning of operations is imminent, the supported project can continue without continued support from the plant.
- Ensure that a process of on-going communication and dialogue should be implemented to ensure that unrealistic expectations are addressed as a matter of course and that the Blyvoor Gold operations allow a mutually beneficial process to be put in place.

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| ***Post-Mitigation*** | | | |
| **Duration** | Beyond project life (6) | Investing in sustainable community projects beyond LED commitments without further intervention from the mine. | Minor (positive) +64 |
| **Extent** | Region (5) | Voluntary community development projects can extend to the region. | |
| **Intensity** | Widespread (5) | On-going social benefits to local communities within the region. | |
| **Probability** | Probable (4) | Community development projects in addition to LED projects are voluntary | |
| **Nature** | Positive (+1) | | |

## 10.7.4 Community Development

### 10.7.4.1 *Impact Description – Golder (2016)*

The MCLM experiences a number of development challenges, which include aspects such as unemployment, low levels of education, high levels of crime and vandalism, expanding informal settlements, environmental damage and challenges around municipal functioning. Community development initiatives as part of the mine's SLP could promote development and provide a foundation of positive change in the municipal area – particularly to those communities in close proximity to the mine.

### 10.7.4.2 *Impact Description – Updated Information*

The mine could aid the upliftment of the 'mine village' by contributing to the repair of services, particularly refuse removal and the sewerage network. The preliminary SLP (2017) has already identified and described a number of LED projects, including:

- The refurbishment of the Ekuphakameni waste water treatment works;
- Cleaning storm water channels to support the drainage network and prevent the formation of sinkholes;
- Removing dumped waste from the mine village; and
- Rendering financial support to the Harmony orphanage with identified projects such as building upgrades, etc.

Blyvoor Gold is entering an area with a negative legacy left by its predecessors, and although the company's willingness to support noteworthy causes is encouraged, it is also important that the company considers investing in sustainable longer-term community development projects in an effort to build and sustain a so-called SLTO, especially in view of the fact that

Blyvoor Gold would not be able to re-employ all workers from the previous operation. Community development projects also aid in curbing the 'honey-pot' effect by investing wider than just the immediate area, preventing people from focusing all their attention solely on the mining operation itself, which in turn curbs project-induced in-migration. However, it is important that Blyvoor Gold's Community Liaison Officer engage the local community to advise on the urgent needs. It will be counterproductive to a SLTO process to approach community development from a top-down approach. Although this SIA would therefore recommend that the mine develop and implement a voluntary Social Investment Strategy, the actual content of such a strategy cannot be determined within the current scope of work.

#### 10.7.4.3 *Management Objectives*

Extend positive benefits that the mining operation returns to the area to as many affected people as possible.

#### 10.7.4.4 *Management Actions and Targets*

Appoint a consultant to determine community needs through a consultative process and based on these, develop a Social Investment Strategy for Project that can extend economic benefits to the wider community and assist the mine in proactively managing the negative legacy inherited from their predecessors.

#### 10.7.4.5 *Impact Rating*

Table 10-41 assess the impact of extending the Blyvoor Gold's current LED, should the company proceed with this recommendation.

**Table 10-41: Community Development**

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Formalise community development initiatives** | | | |
| **Impact Description:** The mine can extend their LED commitments to the wider community by voluntary investing in philanthropy and more sustainable community and regional development projects. | | | |
| ***Prior to Mitigation/Management*** | | | |
| **Duration** | Project life (5) | Pure LED investment will cease after LoM. | Minor (positive) +72 |
| **Extent** | Municipal (4) | LED investment limited to local municipal area. | |
| **Intensity** | Average (3) | Although positive benefits, it is only felt by some of the baseline. | |
| **Probability** | Almost certain (6) | The mine is required by commitments in the SLP to invest in LED projects. | |
| **Nature** | Positive (+1) | | |

<table>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td colspan="4">Mitigation/Management Actions</td></tr>
<tr><td colspan="4"><ul>
<li>Develop a Social Investment Strategy. This is additional voluntary investment that the mine makes in the sustainable development of the local communities and can include supporting development projects on a regional (district or province) level (often this can be done by financing a certain project through a local NGO).</li>
<li>Avoid investing in philanthropy projects only (i.e. building or repairing infrastructure, providing food parcels, etc.) – although these projects are ‘quick wins’ necessary for the mine to win the trust of the local community, it creates the expectation that the mine will continue to, for example, maintain the infrastructure they built, which ceases when the mine suspends operations (as is currently experienced in the mine village).</li>
<li>Local developmental NGOs who have the experience to implement sustainable development projects are key stakeholders in determining community development projects that are not mine dependent and can continue past the LoM.</li>
<li>Be slow in making promises to the community to first ensure that commitments are well researched and feasible.</li>
</ul></td></tr>
<tr><td colspan="4">Post-Mitigation</td></tr>
<tr><td>Duration</td><td>Beyond project life (6)</td><td>Sustainable community development projects eventually create their own sources of funding and can therefore continue past LoM.</td><td rowspan="5">Moderate (positive) +102</td></tr>
<tr><td>Extent</td><td>Region (5)</td><td>Certain projects can benefit the wider region (district and province)</td></tr>
<tr><td>Intensity</td><td>Great (6)</td><td>Great improvements to the overall condition of a large percentage of the baseline.</td></tr>
<tr><td>Probability</td><td>Almost certain (6)</td><td>LED projects have to be implemented. These can be augmented with wider SI projects.</td></tr>
<tr><td>Nature</td><td>Positive (+1)</td><td></td></tr>
</table>

### 10.7.5 Safety and Security

The Golder SIA identified a number of safety and security impact areas, which included:

- Secure access to the mine in general and the working sites specifically to ensure that the mine is cleared of illegal miners and prevent further trespassing;
- Control of illegal mining activity, specifically at sites and components that will not be reinstated; and

- Control of vandalism and scavenging – even though Blyvoor Gold does not intend to take over the housing in the mine village, it could take a stance of zero tolerance to curb vandalism and have a positive knock-on effect.

The identified safety and security issues currently experienced at the mine are considered an element of the existing baseline conditions and as such not an impact likely to be caused by Blyvoor Gold's operations. However, the issue still holds an element of risk for the continued success of the mine.

Blyvoor Gold has reportedly implemented a concerted safety and security strategy which has shown significant success in reducing the zama-zama activity in and around the Project and the Blyvooruitzicht village. A significant security barricade has been erected around the No. 5 Shaft surface infrastructure and metallurgical plant site together with the introduction of 24-hour security guarding. Reported zama-zama activity has been all but eliminated on the Project site

### 10.7.6 Quality of Life Impacts

#### 10.7.6.1 *Impact Description – Golder (2016)*

Golder (2016) defined quality of life (QOL) as the general wellbeing of a person or society, which in turn is largely based on people's perceptions. Although QOL is difficult to measure quantitatively, the WHO developed a system to measure QOL based on factors such as physical and psychological health, independence, social relationships, environment and spirituality/religion/personal beliefs. Golder used the public consultation process at the time to identify areas of concern related to the Project. These were:

- Uncertainty of future mining plans and further non-adherence to environmental regulatory requirements (e.g. dust suppression at TSFs), leading to negative environmental and health impacts;
- Fear of property damage from blasting and vibration and related noise levels;
- Traffic impacts to the existing road network, on-site vehicular traffic and hazards from hazardous materials; and
- Concerns related to the security of the operations and human rights violations, including the use of security personnel to control illegal miners.

Two common themes emerged through the consultation process that influence stakeholders' impact experiences:

- Communication: Continue on-going and regular communication processes between Blyvoor Gold and affected communities aimed at building a relationship between the two parties. Meaningful communication will assist in addressing negative perceptions.
- Governance, monitoring and accountability: The current situation at the mine points to lapses in governance, monitoring and accountability. These have become legacy

issues as there is a healthy dose of cynicism amongst residents on how the new owners will deal with historic issues.

#### 10.7.6.2 *Impact Description – Updated Information*

The social specialist did not visit the top of the TSFs but satellite imagery dated July 2018 shows no evidence of informal settlement on the TSF 1, 6 or 7. However, the presence of shack dwellers cannot be definitively excluded based on satellite imagery and therefore the SIA emphasises the need for a formal relocation process should human settlement have occurred on top of any of the mine's TSFs prior to recommissioning the TSF. Apart from this issue, the Golder SIA found no further evidence to expand on the impacts already identified, and therefore these impacts and their mitigation measures are upheld.

#### 10.7.6.3 *Management Objectives*

Enhance local communities' quality of life by addressing issues and concerns raised.

#### 10.7.6.4 *Management Actions and Targets*

Develop and implement a Stakeholder Engagement Plan for the Project, inclusive of a communications plan for the mine village. Endeavour to meet with the community at least once a quarter to address their issues and concerns. Establish a formal grievance mechanism as part of the SEP and undertake to resolve grievances within 14-21 days.

#### 10.7.6.5 *Impact Rating*

Table 10-42 presents the impacts associated with quality of life for surrounding communities.

**Table 10-42: Quality of Life Impacts**

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Quality of life impacts** | | | |
| **Impact Description:** Mining activities impacts on people's sense of wellbeing, some of which is a direct cause of how their complaints are being managed. | | | |
| ***Prior to Mitigation/Management*** | | | |
| **Duration** | Project life (5) | Based on Golder's assessment that the duration of the impact will last 8-15 years. | Minor (negative) – 60 |
| **Extent** | Local (3) | Based on Golder's assessment that the impact will be local. | |
| **Intensity** | On-going serious social issues (4) | Based on Golder's assessment that the magnitude of the impact will be high. | |
| **Probability** | Likely (5) | Based on Golder's assessment that it is highly probable that the impact will occur. | |

<table>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td>Nature</td><td>Negative (-1)</td><td></td><td></td></tr>
<tr><td colspan="4">Mitigation/Management Actions</td></tr>
<tr><td colspan="4">(From the Golder SIA):<br>
- Establish a sound communication strategy that includes newspaper articles and radio broadcasts, regular community meetings, a 24-hour hotline service that residents can call, and individual communication with residents, service providers and business owners via letter, phone or face-to-face as and when required. Of particular importance will be the need to put an effective complaints management process in place (termed a grievance mechanism in this SIA).<br>
- Public health concerns need to be addressed at a design level, taking into consideration the specific recommendations emanating from specialist studies. The includes the need to identify institutions that may be drawn in to assist with testing, monitoring and arranging appropriate health interventions for shack dwellers once moved from the mine site.<br>
- Measures identified in the Environmental Management Plan Report (EMPR) be followed accordingly to reduce the occurrence of any health and safety impacts flowing from blasting activities, vibration and mining-related noise (these issues will typically be addressed through the grievance mechanism, which again highlights the importance of developing and implementing such a system as part of the mine’s SE activities).<br>
- Measures identified in the EMPR related to the control of traffic and vehicular movement be implemented to reduce hazards and impacts from on and off-site traffic and road networks. Traffic rules are currently not followed because of the absence of road markings and the expectation of no to little traffic. The mine should reinstate road markings when mining related traffic increases, especially around sensitive receptors such as the two primary schools in close proximity to the TSFs (and therefore likely to experience an increase in traffic volumes).</td></tr>
<tr><td colspan="4">Post-Mitigation</td></tr>
<tr><td>Duration</td><td>Project life (5)</td><td>Impact will have to be managed through mitigation for the LoM.</td><td rowspan="5">Negligible (negative) – 27</td></tr>
<tr><td>Extent</td><td>Limited (2)</td><td>Grievances that are addressed timeously can limit its influence on the site or immediate surroundings.</td></tr>
<tr><td>Intensity</td><td>Minor (2)</td><td>Minor impacts will continue but can be addressed effectively.</td></tr>
<tr><td>Probability</td><td>Unlikely (3)</td><td>Widespread QOL impacts are unlikely if they are addressed within a realistic timeframe as they appear. Proactive management will prevent QoL impacts occurring regularly.</td></tr>
<tr><td>Nature</td><td>Negative (-1)</td><td></td></tr>
</table>

### 10.7.7 Environmental Impacts

#### 10.7.7.1 *Impact Description – Golder (2016)*

Golder have identified environmental impacts that could have a ripple effect on the socio-economic environment. The following impacts are described:

- Potential flooding events and tailings dam spillage: stakeholders expressed their concerns that TSF No. 6 will be increased through continued slimes dumping and as a result, spillage/flooding can occur during extreme weather events and/or as a result of inadequate care. The RWD for this TSF has been confirmed to have a capacity to withstand a one in 50 year 24 hour storm event.
- Surface and ground water pollution: Stakeholders pointed out that run-off from the TSFs have polluted surface water streams and groundwater. Given the presence of a significant number of wetlands in the area, this was considered a serious impact.
- Reactivation of sinkholes: community members indicated that a number of sinkholes have been reactivated in recent years. As an example, it was mentioned that a local old age home in Carletonville was being evacuated due to the formation of a sinkhole. Stakeholders were therefore concerned that any hydraulic mining will have a knock-on effect and cause more sinkholes. Sinkholes were deemed a serious safety hazard.
- Noise pollution: Construction and refurbishment activities will likely give rise to temporary physical impacts, such as an increase in noise.
- Dust pollution: Inadequate dust suppression from the disused TSFs have created significant dust pollution that has led to complaints from adjacent land users.
- Water pollution: stakeholders indicated that certain underground mining shafts run above the water table. In addition, the run-off from TSFs is unacceptable and regarded as a significant health risk.

#### 10.7.7.2 *Impact Description – New Information*

The biophysical (environmental) impacts identified by Golder are maintained. In support of these findings, the independent LHR study (2017) also found that inadequate environmental rehabilitation post-closure led to serious fears amongst community members about their health – residents are exposed to toxic dust, contaminated water and the risk of sinkholes. The primary health concerns amongst surveyed residents in the LHR study was the exposure to dust blowing off the unrehabilitated TSF No. 6 – up to 86% of the respondents listed dust inhalation as a worry. Blyvoor Gold introduced a dust monitoring program in January 2018 focussed on TSF No. 6.

**Figure 10-2: Wind-blown dust from Blyvoor TSF No.6**
Source: LHR Report (2017)

### 10.7.7.3 *Management Objectives*

Minimise community health impacts by implementing sound environmental management processes.

### 10.7.7.4 *Management Actions and Targets*

**(From the Golder SIA):**

- Blyvoor Gold will need to ensure that there is a thorough understanding of the factors impacting the formation of sinkholes and put specific mechanisms in place to address this.
- During the (refurbishment) phase, dust pollution should be minimised by regularly wetting dirt roads and considering the prevailing wind conditions.

It is noted that Blyvoor Gold have instituted a dust monitoring system consisting of 7 measuring points in and around TSF No. 6 and TSF No. 7.

### 10.7.7.5 *All measures identified in the EMPR should be followed to reduce the occurrence and impact of any environmental impacts. Impact Rating*

Table 10-43 assesses the community's perception of the impacts associated with wind-blown dust from TSF No.6.

**Table 10-43: Environmental Impacts**

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Quality of life impacts** | | | |
| **Impact Description:** Lack of environmental mitigation measures has caused fear amongst local residents and impacted on their health. | | | |
| ***Prior to Mitigation/Management*** | | | |

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| **Duration** | Project life (5) | Environmental impacts will continue for the LoM. | Moderate (negative) – 91 |
| **Extent** | Municipal area (4) | Pollution from the mine is not currently managed and impacts are widespread. | |
| **Intensity** | On-going serious (4) | Stakeholders are complaining of on-going serious health impacts. | |
| **Probability** | Definite (7) | The impact is currently experienced by local residents. | |
| **Nature** | Negative (-1) | | |
| ***Mitigation/Management Actions*** | | | |
| **(From the Golder SIA):**<br>▪ Blyvoor Gold will need to ensure that there is a thorough understanding of the factors impacting the formation of sinkholes and put specific mechanisms in place to address this.<br>▪ During the (refurbishment) phase, dust pollution should be minimised by regularly wetting dirt roads and considering the prevailing wind conditions.<br>▪ All measures identified in the EMPR should be followed to reduce the occurrence and impact of any environmental impacts. | | | |
| ***Post-Mitigation*** | | | |
| **Duration** | Project life (5) | Environmental impacts will continue for the LoM. | Minor (negative) – 40 |
| **Extent** | Limited (2) | With the implementation of appropriate environmental mitigation measures (such as dust suppression), impacts will be limited to the mine and its immediate area. | |
| **Intensity** | On-going social issues (3) | Although issues will be on-going, they can be managed and are not as widespread as before. | |
| **Probability** | Probable (4) | The impact will be contained to certain segments of the area under unfavourable conditions (e.g. wind). | |
| **Nature** | Negative (-1) | | |

### 10.7.8 Social Disintegration and Conflict

This issue was not assessed in the Golder SIA.

#### 10.7.8.1 *Impact Description*

Social disintegration occurs when rapid change threatens the social cohesion of a local community. Because of the hardship that the local community endured together since liquidation of the mine in 2013, it can be expected that the community has a strong sense of group (or social) cohesion. Although cohesion is a multi-faceted process, it can be broken down into the following main components:

- Attraction: According to Hogg (1992), group cohesiveness is based on social attraction, which refers to "attraction among members of a salient social group", i.e. individuals look at others' similarities and differences and mentally categorise themselves and others as part of a group. In the case of mine village residents, they initially shared a cohesiveness in that they all worked at the mine, likely had similar benefits and shared a similar form of housing. Post mine closure, they all endured the same hardship in unemployment and facing the same risks (dust, contaminated water, sinkholes, etc.) The group is therefore quite homogenous in this regard, despite different cultural backgrounds.
- Group pride: Theorists believe that group cohesion result from a deep sense of "we-ness", which is evident in the residents of the mine village. Large numbers of residents have become involved in the group's efforts to get their issues heard and addressed by forming the Blyvooruitzicht Residents Committee (LHR, 2017).
- Task commitment: Group members' commitment to work together to complete a task enforces their cohesion. Mine village residents have shown a concerted effort to achieve a common goal of a safer environment in which to live.
- Similarity of group members: Lott and Lott (1965) who refer to interpersonal attraction as group cohesiveness conducted an extensive review of literature and found that individuals' similarities in background (e.g. race, ethnicity, occupation, age), attitudes, values and personality traits have generally positive association with group cohesiveness. In addition, similar backgrounds make it likely that members share similar views on various issues.

It is likely that community members will view new employees (those that fall in the 30% provincial appointment) as taking away their jobs. Most of the Blyvooruitzicht village residents who have mining experience at the BGMC operations have borne the brunt of the previous operator's neglect. Also, despite the sense of strong group cohesion, intra-conflict in the group is also likely to occur around the limited number of job opportunities available versus the large supply of workers currently in the labour pool.

Continued conflict situations will erode social cohesion and lead to social disintegration. This can lead to social mobilisation against Blyvoor Gold, which will threaten the mine's SLTO.

#### 10.7.8.2 *Management Objectives*

Preserve social cohesion in the local community by preventing conflict situations as far as possible.

#### 10.7.8.3 *Management Actions and Targets*

Address grievances within a set timeframe to reduce the risk of conflict and social mobilisation.

#### 10.7.8.4 *Impact Rating*

Table 10-44 assesses the impact of social disintegration and social conflict resulting in community unrest.

**Table 10-44: Social Disintegration and Conflict**

<table>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td colspan="4" align="center">Quality of life impacts</td></tr>
<tr><td colspan="4">Impact Description: Conflict can give rise to social mobilisation that can threaten the continued operation of the mine.</td></tr>
<tr><td colspan="4">Prior to Mitigation/Management</td></tr>
<tr><td>Duration</td><td>Project life (5)</td><td>The risk for conflict will continue for the LoM.</td><td rowspan="5">Minor (negative) – 52</td></tr>
<tr><td>Extent</td><td>Local (3)</td><td>Conflict situations can have spill over effects.</td></tr>
<tr><td>Intensity</td><td>Very serious (5)</td><td>Social unrest can lead to destruction of property and work stoppages.</td></tr>
<tr><td>Probability</td><td>Probable (4)</td><td>Conflicts between communities and mines are well documented.</td></tr>
<tr><td>Nature</td><td>Negative (-1)</td><td></td></tr>
<tr><td colspan="4">Mitigation/Management Actions</td></tr>
</table>

| Dimension | Rating | Motivation | Significance |
|---|---|---|---|
| ▪ Employ a competent and experienced community relations team to manage continued interaction between Blyvoor Gold and its mining impacted communities and hold them to strict performance criteria.<br>▪ Acknowledge and remedy past grievances and act on outstanding commitments.<br>▪ Establish meaningful avenues of two-way communication.<br>▪ Build relationships through goodwill and understanding. Be upfront and straightforward about potential issues and difficulties, including environmental risks and limited job opportunities.<br>▪ Be responsive and adaptive to complaints and other issues.<br>▪ Listen to and act on community concerns.<br>▪ Involve communities in shaping community development projects.<br>▪ Design and implement a grievance mechanism. Monitor grievances to allow for eventual proactive actions instead of reactive addressing of complaints. | | | |
| ***Post-Mitigation*** | | | |
| **Duration** | Project life (5) | The risk for conflict will continue for the LoM. | Negligible (negative) – 27 |
| **Extent** | Limited (2) | Contain conflict and prevent it from spilling over to the larger area. | |
| **Intensity** | Minor (2) | If issues are addressed timeously, it will not cause on-going social issues. | |
| **Probability** | Unlikely (3) | If issues are addressed at individual or small group level, groups will not feel the need to mobilise a larger group. | |
| **Nature** | Negative (-1) | | |

## 10.8 Cumulative Impacts

Cumulative impacts consider the impacts for each environmental aspect associated with the Blyvoor Gold mining operation in a local, regional, and/or national context. This section provides the cumulative impacts where Specialist investigations identified such impacts.

### 10.8.1 Groundwater

The cumulative impacts are assessed considering the MRA and its surroundings within a 10 km radius, presented in Figure 10-3. The area is at the Vaal WMA, located within quaternary catchment C23E.

Mining related activities are observed to be prevalent within the immediate surroundings, mostly saturated in the east and south in relation to the project area, however, mining activities are observed to be limited north-east of the project area.

The TSFs at the project area are an expected source of contamination. Private borehole users and surface water bodies (through baseflow) are potential receptors. The intensity of the potential impact to the groundwater is reduced by an observed limited occurrence of groundwater at the project area. This is likely assumed to be an impact of dewatering activities originating from the project area and surrounding mines.

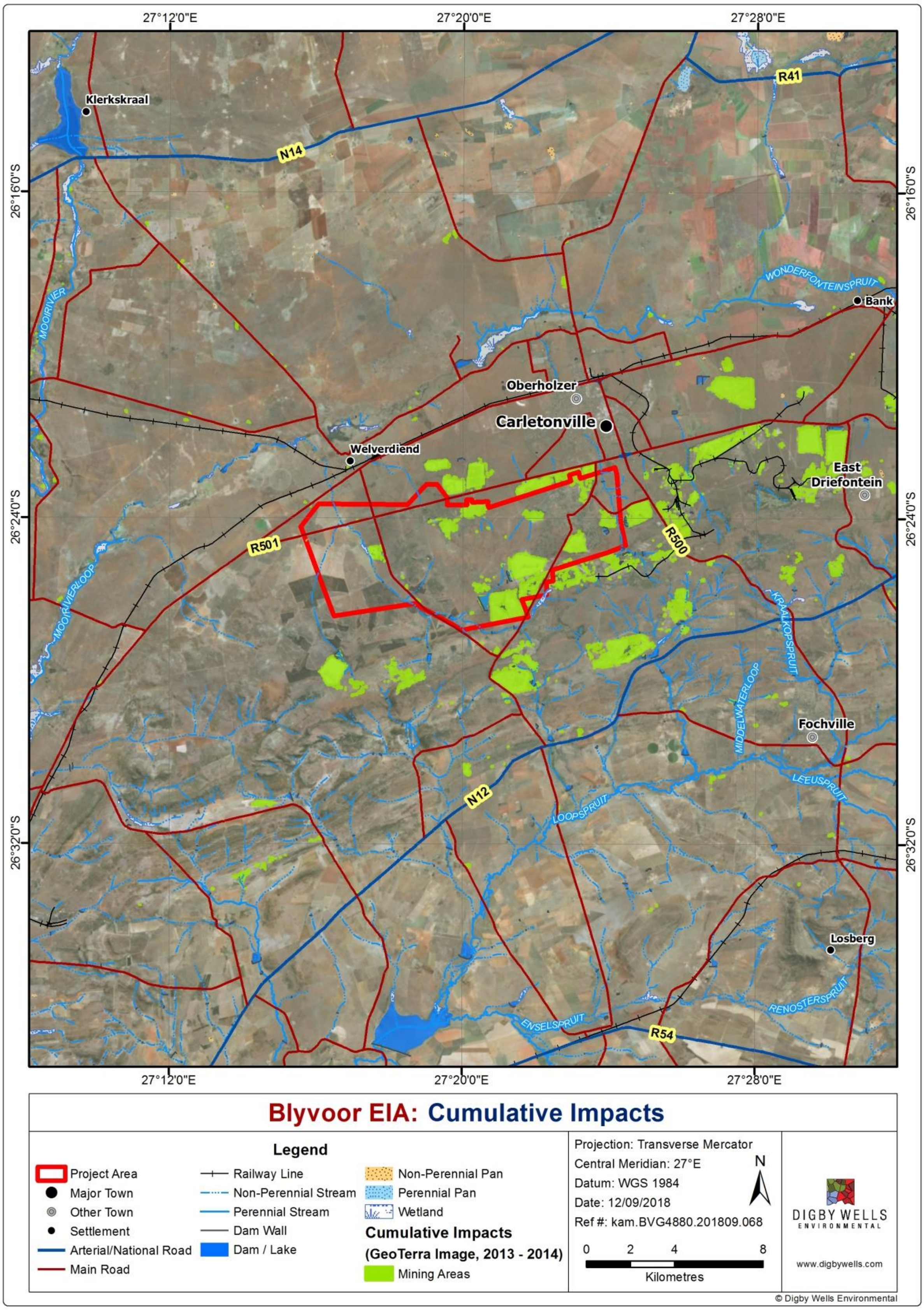



**Figure 10-3: Mining activity with 10 km radius of project area**

### 10.8.2 Biodiversity (Wetlands and Aquatic Ecology)

The freshwater resources in this area are currently impacted as a result of extensive historical and current mining activities in the area including illegal mining. This has significant impacts on water quality within these freshwater systems as well as sedimentation from TSFs. In addition, other impacts to freshwater resources present in the vicinity of the proposed project include agricultural cultivation, urban settlements, road construction, powerlines and associated servitudes and grazing activities.

### 10.8.3 Community Health

The cumulative impacts take into consideration the Project area and its surroundings (within a 6 km radius). Mining related activities are observed to be prevalent within the immediate surroundings of the Project, mostly saturated in the east and south, however, mining activities are observed to be limited north-east of the project area. Taking this into account and given the predominant wind direction is north/north-east, the TSFs, at the Project area, are the main contamination sources to human health in the surrounding environment. TSP, $PM_{10}$ and $PM_{2.5}$ levels all exceeded the South African Standards and extended to a 6 km radius of influence). A recent study has shown there is a strong association between higher levels of asthma, and other respiratory tract infections, among communities residing in close proximity to mine dumps (within 1 – 2 km) (Nkosi V et al. (2015). PM size is relevant in terms of health because it controls where in the respiratory system a given particle is deposited. The finer particles are thought to be more damaging to human health than coarse particles, as larger particles are less respirable in that they do not penetrate deep into the lungs compared to smaller particles. Very young children are particularly sensitive to the adverse effects of PM, due to their stage of physical growth, immature immune system and developing respiratory organs with a more susceptible and reactive respiratory epithelium.

Regardless to the scale of a project, there will always be an influx of people into a project area. An influx of people can result in health impacts, including but not limited to: a person’s well-being; the cohesiveness within a community; increased demand on basic municipal services (currently an issue); and an increase in a number of diseases, including the transmission of respiratory diseases. This increase in transmission of respiratory diseases is due to individuals residing in closer proximity to each other, therefore the contagious droplets are more easily inhaled. Transmission can also occur by touching the nose or mouth by hand or other objects exposed to the virus. Poor sanitation would assist with a high rate of transmission.

It is expected that the Project will contribute towards an improvement in air and water quality, specific to the Project area and a 6 km radius from the Project site, as stringent environmental management practices will be implemented as required by the mine’s updated EMPr in compliance with the NEMA and MPRDA. The intensity of the potential impact to the groundwater is reduced by an observed limited occurrence of groundwater at the Project area. This is likely assumed to be an impact of dewatering activities originating from the Project area and surrounding mines.

The MRPDA aims to achieve socio-economic upliftment of mining impacted communities by requiring that mining right applicants submit and adhere to a SLP, which is approved and then monitored by the DMR. The SLP will describe how the mine will ensure that affected communities benefit from their operations, including post-closure. All the mining rights holders in the area are therefore required to aid the diversification of skills unrelated to mining activities to avoid creating dependency on the mining sector. In addition, mining operators must identify and support certain LED projects that further aid the general socio-economic upliftment of the local area.

#### 10.8.4 Socio-Economic

Cumulative impacts are defined as impacts arising from the combined effects of two or more Projects or actions. The importance of identifying and assessing cumulative impacts stems from the fact that, in social as well as natural systems, the whole is often more than the sum of its parts – implying that the total effect of multiple stressors or change processes acting simultaneously on a system may be greater than the effects when acting in isolation. Cumulative impacts usually relate to large-scale and more extensive impacts rather than primary concentrated impacts that tend to increase the intensity of impacts already predicted for the Project. The following cumulative impacts were identified in the original SIA (Golder, 2016):

- Dependency on mining to sustain the local economy;
- Biophysical impacts; and
- Historic legacy impacts.

In addition, this SIA Addendum report identified the following two cumulative impacts:

- Socio-economic upliftment; and
- Illegal mining activities.

##### 10.8.4.1 *Dependency on mining to sustain the local economy*

*Economic activities in the broader municipal area are dominated by the mining sector, which creates a much larger number of jobs than any other sector. In general, mine workers tend to earn better salaries than those employed in other sectors and therefore it is fair to deduce that the local economy is heavily dependent on the mines. Because all mines have an infinite lifespan, it is inevitable that mining operations in the area will at some point in the future begin to scale down and close. Unless significant investment is made into economic diversification, the area is destined for a considerable economic slump once this process begins.*

**This SIA Addendum maintains this notion: the dependency of the local area on the mining sector is clearly illustrated, albeit on a relatively small scale, by the current condition of the mine village within the Blyvooruitzicht mining complex. Not only did the village fall into a state of degradation when the mine withdrew its financial support, but workers were left unemployed with limited or no prospects of finding other**

**employment because their skills and experience were limited to one sector. Although the MCLM recently took over supplying some services to the area, it was mostly unplanned and over-exerted the municipal system resulting in uncollected refuse and raw sewage in the streets.**

#### 10.8.4.2 *Biophysical impacts*

*Golder (2016) stated that the (then) EMPR should make adequate provision for the management of potential cumulative impacts related to impacts on air quality and water quality.*

**With the introduction of recommissioned elements at the Project, it is expected that the Project would contribute to an improvement in the air and water quality of the general area, as stringent environmental management practices would be implemented as required by the mine's updated EMPR in compliance with the MPRDA. For example, it is expected that air quality would improve with the reinstatement of dust suppression practices at the TSFs.**

#### 10.8.4.3 *Historic legacy impacts*

Golder (2016) pointed to a significant history of mismanagement, exploitation and crime, amongst other issues, and stated that a directed process of communication and trust building would be required in an attempt to overcome resistance and allow residents to understand the significant benefits that could be derived from a mining processes that is managed responsibly and with due diligence.

**This SIA Addendum agrees with the Golder SIA on the issue of this historic legacy, it is important to bear in mind that cumulative impacts consider the combined effects of two or more projects or actions in an impacted area. In this regard, it would not be Blyvoor Gold alone that must demonstrate due diligence but all the mines in the area. The issue at hand is therefore the negative legacy of the mining industry in general and not one mine specifically. This does not however absolve Blyvoor Gold of it's social responsibility.**

#### 10.8.4.4 *Socio-economic upliftment*

The MRPDA aims to achieve socio-economic upliftment of mining impacted communities by requiring that mining right applicants submit and adhere to a SLP, which is approved and then monitored by the DMR. The SLP must describe how the mine will ensure that affected communities benefit from their operations, including post-closure. An SLP must therefore detail "specific programmes to save jobs and manage downscaling and/or closure" (aimed at mine employees) and "ameliorate the social and economic impact" of the operation in general (aimed at impacted communities). All the mining rights holders in the area are therefore required to aid the diversification of skills unrelated to mining activities to avoid creating dependency on the mining sector. In addition, mining operators must identify and support certain local economic development (LED) projects that further aid the general socio-economic upliftment of the local area.

#### 10.8.4.5 *Illegal mining activities*

In the absence of formal employment, illegal mining creates an avenue for people to earn huge sums of money. A presentation prepared by the Chamber of Mines (2017) states that illegal mining activities are directly linked to lucrative illicit trade – not only in precious metals, but also wildlife, weaponry and drug trade at a global level. The illegal mining trade consists of a complex syndicate, as illustrated below:


**Figure 10-4: Value chain in illegal mining**

The Chamber of Mines (2017) estimates that illegal mining costs the industry and fiscus more than R 20bn per year in lost sales, taxes and royalties. It is further estimated that up to 90% of illegal miners are undocumented immigrants and that the presence of illegal miners has led to an increase in crime and illegal trade such as explosives, diesel, copper cables and other equipment from the mine. It also erodes the social fabric of mining communities as fear, coercion, human rights abuses, prostitution and substance abuse become commonplace.

All the afore-mentioned are present in the mine village, which supports the Chamber of Mines' assessment of the impact of illegal mining. It can therefore be expected that as mines in the area scale down and eventually close, it would attract an influx of illegal miners to the area, which would negatively affect the safety and security of local communities. Blyvoor Gold has indicated that strategies have are in place which have significantly reduced zama-zama activity.

## 10.9 Unplanned Events and Low Risks

This section proposes scenarios for unforeseen events that may occur on a mine site, the risks associated with the operation which are not significant enough to be considered an impact, and the proposed mitigation of these unplanned events and risks. Refer to Table 10-45, below.

**Table 10-45: Unplanned events, low risks and their management measures**

| Unplanned event | Potential impact | Mitigation / Management / Monitoring |
|---|---|---|
| Hydrocarbon spills from vehicles and heavy machinery | Hydrocarbon contamination of the groundwater, soils, surface water and wetlands | ▪ Vehicles and heavy machinery should be serviced and checked in a demarcated area on a regular basis to prevent leakages and spills;<br>▪ Hydrocarbon spill kits must be available on site at all locations where hydrocarbon spills could take place;<br>▪ Monitoring boreholes, particularly those located within the construction area, have to be monitored for both water level and quality to detect any changes; and<br>▪ If a considerable amount of fuel is accidentally spilled, the contaminated soil should be removed and disposed of at an acceptable dumping facility. The excavated area should be backfilled with soil of good quality. |
| Tailings Dam Failure | ▪ Siltation and contamination of surface water streams<br>▪ Extended footprint covered by tailings;<br>▪ Possible loss of property and human lives | ▪ Proper water management on top of TSF to ensure stability of walls and base layers;<br>▪ Regular monitoring as well as maintenance;<br>▪ Ensure TSF operation and deposition is in line with design criteria |

# 11 Item 3(g)(vii): The Positive and Negative Impacts that the Proposed Activity (in terms of the initial site layout) and Alternatives will have on the Environment and the Community that may be affected

No alternate site layouts were considered for this application, as this application essentially applies to reinstating a previously operational mine, and this associated EIA/EMP report allows for an aligned report for all activities to take place on site. Only the existing mine footprint was considered, but since the baseline information in the previously approved EMP is outdated, Digby Wells conducted studies to assess the status quo on site, and apply updated mitigations to the status quo, in-line with the NEMA EIA Regulations, 2014 (as amended).

The majority of the impacts were found to have a significance of Negligible Negative after mitigation measures are applied. As these are significance ratings for existing environmental impacts, neither the pre-mitigation or post mitigation ratings are considered high. All negative impacts are reduced to Negligible or Minor Negative.

Positive impacts relate to mining operations recommencing and are all related to positive socio-economic impacts. Refer to Section 8.4.15 above, where the current poor conditions of the affected surrounding villages are discussed in length.

Although the impact assessment has resulted in the majority of impacts being negative, it is argued that reinstating the mine will have an overall positive impact, not only the communities affected by the mine's liquidation, but also positive environmental impacts in terms of the EMP mitigation and management measures being reinstated on site.

# 12 Item 3(g)(viii): The possible Mitigation Measures that could be applied and the level of risk

The mitigation measures are discussed in detail in Section 10, above.

# 13 Item 3(g)(ix): Motivation where No Alternatives Sites were considered

This application pertains to the reinstatement of a mine that was in operation from 1937 to 2013, this section or the consideration of alternative sites for the operation is not applicable.

# 14 Item 3(g)(x): Statement motivating the Alternative Development Location within the Overall Site

The preferred alternative utilises the existing infrastructure which was operational up until liquidation in 2013. This is the preferred alternative as the majority of environmental impacts have been established within this footprint, thereby reducing any unnecessary additional environmental degradation.

# 15 Item 3(h): Full Description of the Process undertaken to Identify, Assess and Rank the Impacts and Risks the Activity will impose on the Preferred Site (In respect of the Final Site Layout Plan) through the Life of the Activity

Refer to Table 16-1 for the list of activities and the correlating pre- and post-mitigation measure significance ratings. The methodology applied to the impact assessment is provided in Section 9, above.

# 16 Item 3(i): Assessment of each identified potentially significant impact and risk

Table 16-1 provides the significance rating for each project activity, a description of the impact, the environmental aspect affected, the project phase the impact relates to, the pre-mitigation significance rating, the type of mitigation applied, and the post-mitigation significance rate. This table excludes groundwater aspects as no significance rating could be provided (refer to Section 10.1 above for the groundwater impact discussion and the proposed mitigation measures).

**Table 16-1: Significant Impacts and Risks**

| Activity | Potential Impact | Aspects Affected | Phase | Significance (Pre-mitigation) | Mitigation Type | Significance (Post-mitigation) |
|---|---|---|---|---|---|---|
| Site clearing where vegetation has re-established | Siltation of the Mooirivierloop, Wonderfonteinspruit and Greenbelt Streams leading to deterioration of water quality | Surface Water | Construction | Negligible (negative) – 32 | Reduce through limiting vegetation clearance and stockpile maintenance | Negligible (negative) – 6 |
| Site clearing where vegetation has re-established<br><br>Reconstruction of metallurgical plants and other mining infrastructure | Compaction of soils, increased potential for erosion and sedimentation loss of natural vegetation, and increased invasive/alien vegetation | Wetlands | Construction | Minor (negative) – 48 | Reduce through limiting vegetation access, avoid by preventing alien species establishment | Negligible (negative) – 27 |

| Activity | Potential Impact | Aspects Affected | Phase | Significance (Pre-mitigation) | Mitigation Type | Significance (Post-mitigation) |
|---|---|---|---|---|---|---|
| Reconstruction of metallurgical plants and other mining infrastructure | Refurbishment of the ventilation shaft and Plant will lead to the generation of fugitive dust comprising TSP, $PM_{10}$ and $PM_{2.5}$ | Air Quality | Construction | Negligible (negative) – 15 | Avoid through responsible construction activity management | Negligible (negative) – 3 |
| | Project-induced in-migration can have ripple impacts on social cohesion and place additional strain on limited resources (e.g. housing and basic services) | Socio-economic | Construction | Negligible (negative) -30 | Avoid through sufficient and clear communication with the local communities | Negligible (negative) -15 |
| | Negative perceptions of the mine affecting resident's sense of well-being | Socio-economic | Construction | Minor (negative) – 60 | Rectify through frequent and transparent communication with the community | Negligible (negative) – 27 |
| | Conflict as a result of limited opportunities and sudden change can give rise to social mobilisation that can threaten the continued operation of the mine | Socio-economic | Construction | Minor (negative) – 52 | Avoid and/or reduce through proper employment advertisement and re-employing as many staff | Negligible (negative) – 27 |

| Activity | Potential Impact | Aspects Affected | Phase | Significance (Pre-mitigation) | Mitigation Type | Significance (Post-mitigation) |
|---|---|---|---|---|---|---|
| | | | | | from the previous operation as possible | |
| | Quality of life deteriorating due to influx of job seekers | Socio-economic | Construction | Minor (negative) - 60 | Reduce through effective advertising to deter job-seekers | Minor (positive) + 52 |
| | Exposure to refuse and raw sewage | Community Health | Operational | Moderate (negative) – 84 | Reduce – ensure all services are effectively implemented, such as sewerage plant reimplementation | Minor (negative) – 36 |
| Temporary storage of hazardous products, including fuel | Contamination of water in the Mooi River Loop, Wonderfonteinspruit and Greenbelt Streams and subsequent deterioration of water quality for downstream water users. | Surface Water | Construction | Minor (negative) – 40 | Avoid through effective surface water management infrastructure monitoring and maintenance | Negligible (negative) – 16 |

| Activity | Potential Impact | Aspects Affected | Phase | Significance (Pre-mitigation) | Mitigation Type | Significance (Post-mitigation) |
|---|---|---|---|---|---|---|
| All construction activities | Employment and income generation that could assist in uplifting households in the local village | Socio-Economic | Construction | Minor (positive) +40 | Rectify through effective implementation of locally sourced labour | Minor (positive) +52 |
| Operation of the underground mine, conveyors, processing plants, haulage, etc. | Reduction in air quality due to the emission of particulates | Air Quality | Operational | Minor (negative) – 44 | Avoid through effective dust suppression and TSF management | Negligible (negative) – 7 |
| | Reduction in air quality due to the emission of particulates through the ventilation shaft | Air Quality | Operational | Minor (negative) – 27 | Reduce through improved ventilation technology to reduce surface emissions without trapping underground | Negligible (negative) – 7 |
| | Exposure to potentially hazardous PM in the air | Community Health | Operational | Moderate (negative) – 91 | Rectify and avoid through implementing mitigation measures and monitoring plans | Minor (negative) – 40 |

| Activity | Potential Impact | Aspects Affected | Phase | Significance (Pre-mitigation) | Mitigation Type | Significance (Post-mitigation) |
|---|---|---|---|---|---|---|
| | The Project will generate income in the form of wages, taxes and royalties that all add to economic benefits to the local area | Socio-economic | Operational | Minor (positive) +48 | Enhance through local economy support such as local procurement | Minor (positive) +64 |
| | Implementation of LED projects will address some legacy issues | Socio-economic | Operational | Minor (positive) +72 | Enhance through sustainable, long-term LED projects which can operate independently of the mine | Major (positive) +102 |
| | Exhalation and dispersion of radon gas to the atmosphere during the operational phase of the Blyvoor Gold Operations | Radiology | Operational | Minor (negative) – 66 | Reduction through TSF management and technologies to reduce emissions | Minor (negative) - 50 |
| Mine water management | In-stream water quality deterioration from runoff contaminated areas and any dirty water discharges such as treated sewage effluent into nearby watercourses | Surface Water | Operational | Minor (negative) – 60 | Rectify through implementing monitoring programme and addressing issues as they arise | Negligible (negative) – 14 |

| Activity | Potential Impact | Aspects Affected | Phase | Significance (Pre-mitigation) | Mitigation Type | Significance (Post-mitigation) |
|---|---|---|---|---|---|---|
| | Hydrocarbon and chemical spillages and leakages from haulage trucks and machinery resulting in water quality deterioration | Surface Water | Operational | Negligible (negative) – 36 | Avoid through vehicle maintenance and proper storage of hazardous materials, such as cyanide | Negligible (negative) – 10 |
| | Contamination of water resources resulting in reduced quality | Wetlands and Aquatic Ecology | Operational | Moderate (negative) – 78 | Rectify through reinstatement of water management infrastructure | Negligible (negative) – 27 |
| | Decant, erosion, sedimentation reducing water quality | Wetlands and Aquatic Ecology | Operational | Major (negative) – 112 | Rectify by reinstating surface water management on site, implementing effective water management around TSFs, implement monitoring programmes and | Minor (negative) – 70 |

| Activity | Potential Impact | Aspects Affected | Phase | Significance (Pre-mitigation) | Mitigation Type | Significance (Post-mitigation) |
|---|---|---|---|---|---|---|
| | | | | | address issues timeously | |
| | Consuming contaminated water | Community Health | Operational | Minor (negative) – 60 | Avoid by having sufficient water quality data prior to dewatering into Wonderfonteinspruit | Negligible (negative) – 14 |
| | Release of contaminated water that contains radionuclides into nearby watercourses during the operational phase of the Blyvoor Gold Operations. | Radiology | Operational | Minor (negative) – 56 | Reduction through TSF reclamation | Negligible (negative) – 14 |
| All operational activities | Dewatering; reducing water quality, increasing turbidity, altering ecology | Wetlands and Aquatic Ecology | Operational | Minor (negative) – 56 | Avoid and rectify by having sufficient water quality data prior to dewatering into Wonderfonteinspruit | No mitigation possible |

| Activity | Potential Impact | Aspects Affected | Phase | Significance (Pre-mitigation) | Mitigation Type | Significance (Post-mitigation) |
|---|---|---|---|---|---|---|
| Operation of the underground mine, conveyors, processing plants, haulage, etc. | Dust will be airborne, with particulates such as TSP, $PM_{10}$, and $PM_{2.5}$ leading to nuisance effect, reduction in the quality of air, with potential health and environmental implications from exposure | Air Quality | Operational | Moderate (negative) – 78 | Avoid or reduce through responsible management practices and effective monitoring | Negligible (negative) – 27 |
| Demolition and removal of all infrastructure, including transporting materials off site | In-stream water quantity and quality deterioration | Surface Water | Decommissioning | Negligible (negative) – 24 | Avoid through effective on-site management and planning prior to any decommissioning activities commence | Negligible (negative) – 6 |

| Activity | Potential Impact | Aspects Affected | Phase | Significance (Pre-mitigation) | Mitigation Type | Significance (Post-mitigation) |
|---|---|---|---|---|---|---|
| | Erosion and general scouring from sedimentation, as well as degraded habitat due to water quality deterioration will affect the local watercourse and river reaches directly downstream. | Wetlands | Decommissioning | Minor (negative) – 48 | Avoid through effective on-site management and planning prior to any decommissioning activities commence | Negligible (negative) – 27 |
| | Exhalation, emission and dispersion of radon gas and particulate matter that contains radionuclides during the post-closure phase of the Blyvoor Gold Operations and Leaching and migration of radionuclides from the TSFs the post-closure phase of the Blyvoor Gold Operations | Radiology | Decommissioning | Minor (negative) – 66 | Reduce through mitigation | Minor (negative) – 50 |
| Rehabilitation, including spreading of soil, re-vegetation and profiling or contouring, and post-closure monitoring | In-stream water quality deterioration | Surface Water | Decommissioning | Moderate (negative) – 90 | Avoid/rectify through responsible and thorough monitoring programmes | Negligible (negative) – 32 |

| Activity | Potential Impact | Aspects Affected | Phase | Significance (Pre-mitigation) | Mitigation Type | Significance (Post-mitigation) |
|---|---|---|---|---|---|---|
| | Decant resulting in degraded water quality | Wetlands | Decommissioning | Major (negative) – 112 | Rectify through decant management for the assumed period when decant is expected to occur | Minor (negative) – 70 |
| | Erosion and general scouring from sedimentation, as well as degraded habitat due to water quality deterioration will affect the local watercourse and river reaches directly downstream | Wetlands | Decommissioning | Minor (negative) – 48 | Avoid/rectify through responsible and thorough monitoring programmes | Negligible (negative) – 27 |

| Activity | Potential Impact | Aspects Affected | Phase | Significance (Pre-mitigation) | Mitigation Type | Significance (Post-mitigation) |
|---|---|---|---|---|---|---|
| All activities | Continued lack of environmental mitigation measures has caused fear amongst local residents and impacted on their health | Socio-economic | All phases | Moderate (negative) -91 | Rectify legacy issues through continued and transparent communication with the affected community | Minor (negative) – 40 |
| Rehabilitation, including spreading of soil, re-vegetation and profiling or contouring, and post-closure monitoring | Implementation of the NNR approved decommissioning plan for the Blyvoor Gold Operations | Radiology | Decommissioning | n/a | Implementation of rehabilitation | Minor (positive) + 70 |

# 17 Item 3(j): Summary of specialist reports

This section provides a summary of the specialist reports which informed the baseline and impact assessment, and includes recommendations made which must be considered by the DMR for authorisation.

**Table 17-1: Specialist Recommendations and Inclusion into this Report**

| List of studies undertaken | Recommendations of specialist reports | Mark if included in EIA report (X) | Cross-reference relevant section in EIA report |
|---|---|---|---|
| Groundwater<br>Appendix 5 | It is recommended that the proposed monitoring boreholes are drilled to a level where water is found or to a maximum depth of 150m during project initiation (within the first year of operation). The groundwater impact assessment report should be updated upon project initiation in terms of; groundwater levels and groundwater quality. This data will be obtained from the proposed monitoring boreholes to be drilled.<br>The contamination source is understood, based on the geochemical assessments. It is proposed that a numerical groundwater flow and contaminant transport model be done once updated data is available. This will serve as a predictive tool, identifying the future impacts of the potential contamination plume associated with the TSFs, i.e. flow direction, extent and to identify receptors that are at the highest risk as a result of the existence of the TSFs, (if any).<br>The following are management objectives defined for the operation phase:<br>▪ Maintenance of the inactive TSFs is proposed to be conducted by developing an effective return water system to manage excess water at that may accumulate at the tailings facilities;<br>▪ Installation of a Class C liner on Blyvoor TSF 4 when reclaimed and planned to operate post reclamation; | X | Part A Sections 8.4.11.3 and 10.1<br>Part B Section 7.1 |

| List of studies undertaken | Recommendations of specialist reports | Mark if included in EIA report (X) | Cross-reference relevant section in EIA report |
|---|---|---|---|
| | ▪ Installation of a Class C liner on Blyvoor TSF 6 & 7 once reclaimed, if required to use for future deposition;<br>▪ Groundwater monitoring should be conducted to assess the time series water level and water quality trends; and<br>▪ Affected receptors (if proven through monitoring) should be compensated.<br>The following are management objectives defined for the decommissioning and post-closure phase:<br>▪ The TSFs should be rehabilitated;<br>▪ Shaped to allow for free draining to reduce infiltration of rain;<br>▪ Groundwater monitoring should be conducted to assess the time series water level and water quality trends; and<br>▪ Affected receptors (if proven through monitoring) should be compensated.<br>All samples fell within the Type 3 waste, requiring a Class C liner. TSF6 material is recommended to be placed within a Class D liner facility as laboratory results show that it is not expected to pose an environmental risk.<br>All TSFs within the project area were constructed prior to the National Environmental Management: Waste Act, 2008 (Act 59 of 2008). Therefore, the type of material on each cannot be deposited on the required liner due to the pre-existence of the facilities and volumes of material already deposited at various TSFs. However, all these pre-existing facilities are not lined and therefore operations at TSF6 will continue without a liner in place.<br>The area is known to have a limited shallow aquifer and the groundwater encountered by Golder (2003) may potentially be drainage from the existing TSFs. This drainage is likely to be contaminating | | |

| List of studies undertaken | Recommendations of specialist reports | Mark if included in EIA report (X) | Cross-reference relevant section in EIA report |
|---|---|---|---|
| | leachate and it recommended that boreholes are drilled at the existing TSFs for the acquisition of water samples from which the chemistry of the potential contamination emanating from the facilities may be known. | | |
| Surface Water<br>Appendix 6 | ▪ Any dirty water discharges into the natural environment should be monitored for compliance to IWUL or RWQO for the Mooi River catchment. It has been noted that Blyvoor Gold is currently not discharging any waste water into the environment.<br>▪ It is a requirement of the National Water Act 1998 (Act 36 of 1998) that water quality monitoring be undertaken throughout the Life of Mine regardless of any or no discharges from mining operations. This ensures that any potential sources of pollution are detected and rectified before severe environmental damage occurs. Blyvoor Gold should, therefore, continue with the current surface water monitoring programme covering the sampling suite as described in the water quality monitoring programme subsection.<br>▪ Any infrastructure development which will need excavation and vegetation clearance should be limited to the proposed development footprint;<br>▪ Any required soil stockpiles should be stabilised, and stockpile slopes should not exceed 1:3 (V:H) to reduce erosion from the stockpile and subsequent siltation of proximal watercourses;<br>▪ Dust suppression measures must be undertaken on the cleared areas during construction to reduce aeolian erosion;<br>▪ All fuel and other chemical storage areas should be appropriately bunded and have spill kits in place. Relevant mine workers should be trained in the use of spill kits to contain and immediately clean up any leakages or spills. All used oils should be disposed of by accredited vendors from the mine site. | X | Part A<br>Section 8.4.5<br>Part B<br>Section 7.1.1 |

| List of studies undertaken | Recommendations of specialist reports | Mark if included in EIA report (X) | Cross-reference relevant section in EIA report |
|---|---|---|---|
| | ▪ Runoff from dirty areas should be channelled and contained in HDPE or concrete lined storm water infrastructure (drains and PCDs).<br>▪ Vehicles must only be serviced within designated service bays.<br>▪ The management of general and other forms of waste must ensure collection and disposal into clearly marked skip bins that can be collected by approved contractors for disposal to the appropriate disposal sites.<br>▪ The storm water management plan for the mine should be optimised to ensure that the clean and dirty water separation systems are updated for the refurbished mine plant. This will include the following:<br>  ▪ Placement of a perimeter berm and channel around TSFs No. 7 and 6;<br>  ▪ Confirmation of the RWD capacity and sizing of the perimeter berm; and<br>▪ Channelling of polluted runoff from the RWD and associated dirty catchment to a PCD. | | |
| Biodiversity (Wetlands, Aquatics, Fauna and Flora)<br>Appendix 7 | Although Blyvoor Gold mining activities are anticipated to directly affect only a small portion of the wetland and instream aquatic integrity of the systems observed at the time of the assessment, some indirect impacts are deemed possible and it is highly recommended that ongoing monitoring of the instream integrity in the vicinity of the Project continue. This will identify any emerging trends in terms of improvements or degradations in the ecological integrity and functioning of these systems as Blyvoor Gold is ultimately responsible for the MRA on which these systems occur. | X | Part A Section 10.3<br>Part B Section 0 |
| Air Quality<br>Appendix 8 | Based on the results presented in this report, the following recommendations should be applied: | X | Part A Section 8.4.10 |

| List of studies undertaken | Recommendations of specialist reports | Mark if included in EIA report (X) | Cross-reference relevant section in EIA report |
|---|---|---|---|
| | ▪ Administer mitigation measures in line with current best engineering practice, as described in the impact assessment above i.e. use of dust suppressants/binders, vegetation of exposed surfaces of TSFs, fitting of dust extraction system at the crusher;<br>▪ Establish codes of practice for good housekeeping with respect to dust management and mitigation for open areas;<br>▪ Monitor the air quality of the project area to ensure compliance with regulatory standards onsite, and at offsite locations for the life of mine; and<br>▪ Establish a monthly and annual reporting structure to appraise performance and compliance. | | Part B Section 7.4 |
| Radiological Appendix 9 | The radiological impact assessment made extensive use of assumptions for conditions and parameter values required for the dose assessment, which is not ideal. To improve this situation and to facilitate a more detailed assessment of the potential radiological impact that is consistent with the requirements for the NNR, the following is recommended:<br>▪ Perform a full spectrum analysis of representative samples of the each of the TSFs that can be used in the source term analysis;<br>▪ Perform radon exhalation rate measurements of each of the TSFs that can be used in the radon gas source term analysis;<br>▪ Monitor the releases of radon gas from the ventilation shafts once it becomes operational;<br>▪ Implement a public radiation protection programme that is based on, and is consistent with the outcome and results of the radiological impact assessment; and<br>▪ Perform a land use, human behaviour and interaction with the environmental study that can be used for a more comprehensive definition of the public exposure conditions. | X | Part A Section 8.4.12<br>Part B Section 7.5 |

| List of studies undertaken | Recommendations of specialist reports | Mark if included in EIA report (X) | Cross-reference relevant section in EIA report |
|---|---|---|---|
| Community Health Appendix 10 | cHIA is an instrument that is used for preparing reasonable recommendations for the management of probable health impacts as a result of a project. The intention of a cHIA is to make recommendations supported by evidence that modifies a project, to safeguard and enhance the population health of communities.<br>This cHIA report has been compiled solely on a desktop review and environmental specialist studies, with no engagement with the communities who will be impacted upon. Findings, from all specialist studies, indicate air quality to be a major source of contamination, within a six km radius from the Project site.<br>▪ It is recommended that the communities, who will be impacted upon, be engaged with, to understand the current health baseline, the current health impacts and to minimise, if possible, the impacts when the Blyvoor Project commences; and<br>▪ It is recommended that health data, relating to respiratory infections, be collected from the clinics/hospitals, most frequented by community members. | X | Part A Sections 8.4.13 and 10.6 |
| Cultural Heritage Appendix 11 | As no heritage resources were identified that will be impacted by the Project, Digby Wells requested exemption from further heritage assessment in terms of Section 38 of the NHRA. This recommendation and request is made on condition that:<br>▪ Blyvoor Gold develops a project-specific Chance Finds Protocol (CFP) and Fossil Finds Protocol (FFP) for implementation during the establishment and construction phase of the Project; and<br>▪ Blyvoor Gold immediately informs SAHRA of any chance finds identified and enlists the services of a qualified and accredited archaeologist to assess and recommend appropriate mitigation measures. | N/A | N/A |

| List of studies undertaken | Recommendations of specialist reports | Mark if included in EIA report (X) | Cross-reference relevant section in EIA report |
|---|---|---|---|
| Addendum to Social Impact Assessment<br>Appendix 12 | ▪ Develop and implement a stakeholder engagement plan for the Project, inclusive of a communications plan for liaising with residents of the mine village specifically. Open, transparent and continuous two-way engagement with stakeholders are of utmost importance in establishing a relationship with the mine's impacted communities. In this regard, Blyvoor Gold should appoint a community relations team consisting of competent and experienced team members who can implement and report on the SEP.<br>▪ Establish a transparent labour recruitment process by publicising the mine's employment needs, number of jobs available, timing of labour needs, and skills levels required. Consider establishing a local labour desk. The labour desk can also serve as a registration point for a local labour database.<br>▪ It is not sufficient to reverse the negative socio-economic impacts currently experienced by the mine village residents as it builds dependency on the mining sector. Over-and-above the SLP commitments and where possible, the underlying issues should also be considered and addressed by Blyvoor Gold. This could be done through a **voluntary** social investment strategy that focuses on sustainable development projects aimed at uplifting socio-economic conditions through non-mining related activities. These projects should be identified and developed in consultation with the local community; for example, assist the community in establishing food gardens. Also, the Project is one of many operators in the area and as such, can liaise with other mining operators in establishing a 'basket fund' for sustainable community development projects.<br>▪ The mine's focus should not be on short-term philanthropy LED projects (e.g. building a community hall). Often these infrastructure projects turn into 'white elephants' that are not used by the local community, yet the mine should continue the upkeep and maintenance. However, | | Part A Section<br>Part B Section |

| List of studies undertaken | Recommendations of specialist reports | Mark if included in EIA report (X) | Cross-reference relevant section in EIA report |
|---|---|---|---|
| | initial assistance in the mine village (e.g. refuse removal and repairing the sewerage network) would facilitate in building initial trust within the community.<br>▪ Blyvoor Gold should consider appointing a specialised security consultant to develop a strategy for clearing the MRA of illegal miners and preventing their return. It is believed that the local community's sense of safety and security would also increase if the illegal mining issue is addressed. | | |

# 18 Item 3(k): Environmental Impact Statement

The sections below provide a summary and consolidated view of the impact assessment process appropriate to this particular project scope.

## 18.1 Item 3(k)(i): Summary of the Key Findings of the Environmental Impact Assessment

The majority of the post-mitigation impact assessment findings show **Negligible Negative** impacts related to the proposed project which is somewhat incongruent when considering the actual positive benefits of mining operations recommencing. This is attributed to the retrospective assessment of established impacts, based on new mine ownership and best environmental practice, to address legacy issues. Three factors have compounded the negative outcome of the impact assessment, namely:

- Legacy impacts established prior to national environmental laws being promulgated;
- Inherent degradation that has taken place on site since liquidation in 2013; and
- The lack of critical data required to provide accurate assessments of certain environmental aspects.

The key findings form the impact assessment, based the most significant pre-mitigation ratings is provided below.

## Table 18-1: Impacts with Most Significant Ratings

| Activity | Potential Impact | Aspects Affected | Phase | Significance (Pre-mitigation) | Significance (Post-mitigation) |
|---|---|---|---|---|---|
| Reconstruction of metallurgical plants and other mining infrastructure | Quality of life deteriorating due to influx of job seekers | Socio-economic | Construction | Minor (negative) - 60 | Minor (positive) + 52 |
| Reconstruction of metallurgical plants and other mining infrastructure | Exposure to refuse and raw sewage | Community Health | Operational | Moderate (negative) – 84 | Minor (negative) – 36 |
| All construction activities | Employment and income generation that could assist in uplifting households in the local village | Socio-Economic | Construction | Minor (positive) +40 | Minor (positive) +52 |
| Operation of the underground mine, conveyors, processing plants, haulage, etc. | Exposure to potentially hazardous PM in the air | Community Health | Operational | Moderate (negative) – 91 | Minor (negative) – 40 |
| Operation of the underground mine, conveyors, processing plants, haulage, etc. | The Project will generate income in the form of wages, taxes and royalties that all add to economic benefits to the local area | Socio-economic | Operational | Minor (positive) +48 | Minor (positive) +64 |

| Activity | Potential Impact | Aspects Affected | Phase | Significance (Pre-mitigation) | Significance (Post-mitigation) |
|---|---|---|---|---|---|
| Operation of the underground mine, conveyors, processing plants, haulage, etc. | Implementation of LED projects will address some legacy issues | Socio-economic | Operational | Minor (positive) +72 | Major (positive) +102 |
| Mine water management | Contamination of water resources resulting in reduced quality | Wetlands and Aquatic Ecology | Operational | Moderate (negative) – 78 | Negligible (negative) – 27 |
| Mine water management | Decant, erosion, sedimentation reducing water quality | Wetlands and Aquatic Ecology | Operational | Major (negative) – 112 | Minor (negative) – 70 |
| Operation of the underground mine, conveyors, processing plants, haulage, etc. | Dust will be airborne, with particulates such as TSP, $PM_{10}$, and $PM_{2.5}$ leading to nuisance effect, reduction in the quality of air, with potential health and environmental implications from exposure | Air Quality | Operational | Moderate (negative) – 78 | Negligible (negative) – 27 |

| Activity | Potential Impact | Aspects Affected | Phase | Significance (Pre-mitigation) | Significance (Post-mitigation) |
|---|---|---|---|---|---|
| Rehabilitation, including spreading of soil, re-vegetation and profiling or contouring, and post-closure monitoring | In-stream water quality deterioration | Surface Water | Decommissioning | Moderate (negative) – 90 | Negligible (negative) – 32 |
| Rehabilitation, including spreading of soil, re-vegetation and profiling or contouring, and post-closure monitoring | Decant resulting in degraded water quality | Wetlands | Decommissioning | Major (negative) – 112 | Minor (negative) – 70 |
| All activities | Continued lack of environmental mitigation measures has caused fear amongst local residents and impacted on their health | Socio-economic | All phases | Moderate (negative) -91 | Minor (negative) – 40 |

| Activity | Potential Impact | Aspects Affected | Phase | Significance (Pre-mitigation) | Significance (Post-mitigation) |
|---|---|---|---|---|---|
| Rehabilitation, including spreading of soil, re-vegetation and profiling or contouring, and post-closure monitoring | Implementation of the NNR approved decommissioning plan for the Blyvoor Gold Operations | Radiology | Decommissioning | n/a | Minor (positive) + 70 |

### 18.2 Item 3(k)(ii): Final Site Map

The final site layout is presented in Plan 2 of Appendix 3.

### 18.3 Item 3(k)(iii): Summary of the Positive and Negative Implications and Risks of the Proposed Activity and Identified Alternatives

The only relevant risk of an alternative will be if the No-Go alternative is applied. This will allow for the mine site and all eight associated TSFs to continue to degrade, without any means for mitigation to be applied. The resultant health risks and lack of economic stimulation in the surrounding communities will continue. Water management and the updated monitoring programmes which will allow for the Project to be compliant with the NEMA would not be realised.

## 19 Item 3(l): Proposed Impact Management Objectives and the Impact Management Outcomes for Inclusion in the EMPR

The EMP seeks to achieve a required end state and describes how activities that have, or could have, an adverse impact on the environment and surrounding communities will be mitigated, controlled and monitored.

The EMP will address the environmental impacts and possible unplanned events during each phase of the Project (Construction, Operational, Decommissioning and Post-closure). Due regard must be given to environmental protection during the entire Project; a number of environmental recommendations are made to achieve environmental protection. These recommendations are aimed at ensuring that there is adequate control over the Project to:

- Minimise the extent of an impact during the life of the Project;
- Ensure appropriate restoration of areas affected by the Project; and
- Prevent long term environmental degradation.

## 20 Item 3(m): Final Proposed Alternatives

The final proposed and preferred alternative is provided in Plan 2 of Appendix 3. The preferred alternative utilises the existing infrastructure, most of which was operational up until liquidation in 2013. This is the preferred alternative as the majority of environmental impacts have been established within this footprint, thereby reducing any unnecessary additional environmental degradation.

## 21 Item 3(n): Aspects for Inclusion as Conditions of Authorisation

This is provided in detail in Section 23.2, below.

# 22 Item 3(o): Description of any Assumptions, Uncertainties and Gaps in Knowledge

This EIA process excluded studies which were not requested by the DMR to be updated, including a Traffic Impact Assessment, Noise Impact Assessment, Soil and Land Use Impact Assessment, Fauna and Flora Impact Assessment (only baseline provided), and Heritage Impact Assessment (only baseline provided).

The baseline hydrologic environment (groundwater and surface water) has been assessed from the perspective of existing and historic impacts to the receiving environment. Management and monitoring ceased with liquidation, and valuable data to accurately assess groundwater impacts, either did not exist and/or was lost /destroyed and could not be provided by Blyvoor Gold. The impact assessment has highlighted concerns regarding current water quality, water management, and continued water contamination related to the unmanaged TSFs. Borehole data was not available to provide baseline hydrogeological characteristics of the shallow aquifer, or the potential contamination from the unlined TSFs. This has affected the outcomes of other specialist reports, such as the Radiological and Community Health assessments, reliant on the groundwater impact assessment to provide accurate impact outcomes, especially regarding assumptions applicable to decant.

The socio-economic impact assessment outcomes (health and social assessments) also present majority negative outcomes due to a cautious approach and the complications regarding the villages neighbouring the mine.

The assumptions made by specialists in their impact assessments, and any identified uncertainties or gaps in information, are categorised per the environmental aspect assessed.

## 22.1 Groundwater

The limitation of the groundwater studies is that; neither groundwater samples nor water levels were acquired from the Project area as identified boreholes were either found to be dry or destroyed. Therefore, the groundwater levels are defined according to the outcomes of a drilling programme conducted in 2003; however, no groundwater quality data is available to define the groundwater status from that study. Groundwater levels will be updated, and the groundwater quality will be obtained from the monitoring boreholes recommended. The current groundwater quality conditions will serve to define the presence or absence of contamination and provide a basis on which to define future impacts.

A basic impact assessment is undertaken in this section considering the construction, operational and closure phase. Not enough information is available to undertake a detailed impact assessment that includes ratings i.e. water levels, water quality, groundwater flow direction and predictive modelling to indicate the extent and intensity of the potential contamination. The impact assessment however takes into consideration all the significant potential impacts and provides mitigation measures to reduce all expected impacts.

Furthermore, no geochemical sampling was done on TSF No. 4 & 5 as these TSFs were added to the project scope after site visits had been undertaken. These TSFs will be reclaimed and a liner placed prior to re-deposition on these footprints, and sample analysis is still required. Material on this TSF is assumed to be represented by the majority of the tailings material sampled and analysed.

## 22.2 Surface Water

The following assumptions and limitations are applicable to the Surface Water Impact Assessment:

- The provided historical water quality monitoring information was assumed to have been correctly sampled and analysed;
- If the data were correctly sampled and analysed, the findings provide a representative reflection of typical conditions for the Project as at April 2014 to August 2018; and
- The draft water balance was not available during the compilation of the Surface Water Report and was therefore not included or considered in this report.

## 22.3 Biodiversity (Wetlands, Aquatic Ecology, Fauna and Flora)

The following limitations were encountered during this study:

- Access to HGM unit 3 was restricted due to safety reasons;
- A Fauna and Flora Impact Assessment was not conducted as it did not form part of the Scope of Work, however an updated baseline for fauna and flora has been included;
- The current fauna and flora baseline is based on available literature sources, and no field work was carried out;
- The composition of freshwater resources in the study area prior to major disturbance is unknown. For this reason, reference conditions are hypothetical, and are based on professional judgement and/or inferred from limited data available;
- With ecology being dynamic and complex, certain aspects, some of which may be important, may have been overlooked. It is, however, expected that the study area has been accurately assessed and considered, based on the field observations undertaken and the consideration of existing studies and monitoring data in terms of freshwater ecology; and
- To obtain a comprehensive understanding of the dynamics of the aquatic biota present within a watercourse (e.g. migratory pathways, seasonal prevalence, breeding cycles, etc.), studies should include investigations conducted during different seasons, over several years and through extensive sampling efforts. Given the time constraints of the baseline assessment, such long-term research was not feasible and could not be conducted. Consequently, the findings presented are based on professional experience, supported by a literature review, and extrapolated from the data collected at the time of the field survey.

## 22.4 Air Quality

Limitations and assumptions pertaining to the project include:

- Predicted air pollution impacts only include those air emissions associated with the proposed Project, being TSF No. 1, TSF No. 6 and TSF No. 7, and the DTSF No. 1, DTSF No. 2 and DTSF No. 3 and those associated with the underground operations which considered the crusher and the ventilation shaft;
- The dispersion model assessed worst case scenarios which considered, for example, the existing TSFs not being vegetated or maintained;
- Generator emissions were not considered, as the Project will be relying on power from the national grid. If emergency generators are used, this will be intermittent and associated emissions will be negligible;
- Most of the activities at the No. 5 Shaft Treatment Plant, such as screening, ball milling and leaching will be wet processes. While the calcining and smelting furnace will be fitted with a dry fume extractor and dust extraction and collection system (Blyvooruitzicht EMP, 2007). With all of the above taken into cognisance, impacts associated with these activities were not assessed, because impact on ambient air quality was considered negligible; and
- Emission limits from the South African Occupational Exposure Limits (OELs) (worst case scenario) published in the Mine Health and Safety Act (MHSA), 1996 (Act No. 29 of 1996) was used in this study.

## 22.5 Radiological

Very little site-specific data and information related to the radiological characteristics of the mine were available. The results and conclusion from this study are, therefore, for the conditions and parameter values assumed for the assessment.

The assessment is based on site-specific data as far as practically possible and justified. Where appropriate and justified, the site-specific data and information were supplemented with values from the literature. However, all the assumptions and conditions used in the assessment were documented accordingly.

## 22.6 Community Health

The intention of a cHIA is to make recommendations supported by evidence that modifies a project, to safeguard and enhance population health of communities. This cHIA report has been compiled solely on a desktop review and environmental specialist studies, with no engagement with the communities who will be impacted upon.

The health impacts discussed within this report are based solely on comments as received by the FSE (September 2016), Dr Phil Tanner (October 2016), the CRR from Golder Associates (2016, Report Number: 1656096-307577-5) and the recently conducted specialist reports

(September 2018), including the Social Impact Assessment Addendum Report, incorporating information from the Lawyers for Human Rights (LHR) report (January 2017).

Based on this, and in accordance with the EHAs, number 5: *Soil- and water-sanitation related diseases,* number 8: *Exposure to potentially hazardous materials*, and number 9: *Social determinants of health*, have been assessed and discussed within this report.

Not all the data that is crucial in obtaining a robust baseline of the area was collected, as stakeholder engagement with the communities of concern (including clinical health data, etc.) was not conducted for this report, therefore key health issues which ordinarily would have been identified through the engagement process have not been identified nor assessed.

A fine particulate matter (PM) sampler was set up near the existing plant in August 2018 to monitor $PM_{10}$ and $PM_{2.5}$ records. PM monitoring was conducted for a period of three weeks only and therefore limits the assessment of actual health impacts in this regard.

No recent groundwater quality data is available to define the groundwater status from that study. Therefore, the presence or absence of contamination and the impact on community health cannot be accurately assessed.

## 22.7 Socio-Economic

Although all reasonable efforts were made to provide an updated and representative picture of socio-economic impacts relevant to the study areas, this report is subject to the following assumptions and limitations:

- This report is based on available information obtained from Blyvoor Gold, secondary data sources, and other specialists. The study was conducted within available timeframes and budget. The sources consulted are in no way exhaustive, although deemed sufficient to meet the ToR for the current study. No information has been deliberately excluded from this report, and it is assumed that no party withheld relevant information from the specialists.
- In an effort to curb further speculations and expectations around job opportunities and the reinstatement of mine workers that were retrenched in 2013 when the BGMC was liquidated, the SIA team did not conduct any interviews or focus group meetings with neighbouring residents – instead information related to the socio-economic impacts on these communities were derived from observational studies and the Lawyers for Human Rights' report who surveyed 600 households as part of their research.
- It was assumed that the specialist who originally compiled the Golder SIA had sufficient knowledge and experience to undertake the study and that the findings of that report were based on solid research.
- It is assumed that Blyvoor Gold intend to implement international best practice in mitigating their socio-economic impact and therefore this study has included recommendations for further (voluntary) social management plans to help them achieve this goal, and in the process maintain their Social Licence to Operate.

- Socio-economic impacts associated with the eventual decommissioning of the mine at the end of its life have been omitted from this study. This omission is motivated by the fact that predictions concerning the characteristics of the receiving socio-economic environment at the time of decommissioning (more than 30 years into the future) are subject to a large margin of error, thus significantly reducing the accuracy of the impact assessment.

# 23 Item 3(p): Reasoned Opinion as to whether the Proposed Activity should or should not be authorised

This section details the EAP's opinion regarding the authorisation of this application.

## 23.1 Item 3(p)(i): Reasons why the activity should be authorised or not

The EAP is of the opinion that this application approval must be prioritised. Currently, the Applicant is the holder of the Mining Right and is therefore responsible for implementing mitigation measures on site. Due this outstanding Environmental Authorisation, the current environmental degradation on site is perpetuated, and could unfairly impact the Applicant by increasing the scope and effort required for effective rehabilitation. If the Authorisation is not approved, this will be in contravention with the South African Constitution and citizens' rights to an environment that is not harmful to their health or well-being. Blyvoor Gold is not responsible for the current state of the site (the previous owners have created the current situation) but is obligated to manage the financial and environmental liabilities associated therewith. Should this application not be approved, there is no clear strategy to address either the negative environmental impacts emanating from site, or the limited employment opportunities for Ward 5 or Ward 27.

Furthermore, Blyvoor Gold has committed to recommission a sewerage treatment plant which previously serviced the BGMC mining village. The Applicant, in the EAP's opinion, has shown commitment in terms of social responsibility and social licence to operate, through on-going communication with neighbouring communities and ex-BGMC employees. In addition, the surrounding communities currently dealing with high levels of unemployment, expressed disappointment in the NEMA timeframe for approval, during the Scoping Phase of this project, at the public meeting held in February 2018. Further delays may result in increased community unrest.

Digby Wells met with the DMR in May 2018, after the Scoping Report was approved, to discuss the status of historic EMPs associated with the BGMC operation. At this meeting, DMR informed Digby Wells that none of the EMPrs since the 2000 EMPr, had been approved. Furthermore, none of the EMPrs, not even the approved EMPr had included Specialist investigations. It was therefore decided, for Blyvoor Gold to be compliant, new specialist investigations would be undertaken to provide updated baseline information in this report, as well as provide relevant impacts and mitigations suited to the current environmental status on site. The Applicant secured funding to adhere to this request and has fulfilled the requirements to a satisfactory level. Identified gaps in information can be addressed without jeopardising the receiving environment.

Blyvoor Gold cannot recommence operations without Environmental Authorisation. If Authorisation is granted, only then can construction activities commence which has limited positive socio-economic benefits. The most significant positive benefits will be realised during the operational phase, and the construction activities are planned to require up to 18 months to be completed. It is therefore imperative that the Environmental Authorisation for the Project be expedited to the extent possible.

Due to the limitation of certain information as detailed in Section 22 above, and resultant limitations to the specialist investigations undertaken for this application, Digby Wells recommends that Environmental Authorisation be granted, including the conditions provided in Section 23.2 hereunder.

## 23.2 Item 3(p)(ii): Conditions that must be included in the authorisation

The following conditions are recommended in support of Environmental Authorisation being granted. Timeframes for implementation have been considered to coincide with the Construction Phase so not to delay the project implementation.

- Groundwater:
  - The recommended groundwater monitoring boreholes identified to facilitate relevant groundwater data must be drilled during the Construction Phase;
  - The groundwater monitoring programme must commence as soon as possible to establish sufficient data to generate a groundwater conceptual model which could not be completed for this scope;
  - Once the conceptual model is generated, the EMPr must be amended to include the findings of this assessment and provide an appropriate monitoring programme;
- Geochemical analysis:
  - Geochemical analysis of the tailings material for TSF No. 4 & 5 must be completed, as these TSFs were not owned by Blyvoor Gold at the time sampling was undertaken. Should the outcome of this analysis deliver a result that differs from the assumptions made on this material, these findings must also form part of the EMPr amendment;
- Surface Water:
  - The Water Balance must be updated based on the data collected from both the surface water and groundwater monitoring data;
  - The final Water Balance must be submitted with the amended EMPr;
- Rehabilitation:

- The rehabilitation report must be updated to include the groundwater monitoring data to refine the rehabilitation plan to address contamination related to the TSFs;

- Financial Provision:

The annual financial provision update must consider the updated groundwater impacts and mitigations, when available, to factor into the cost of rehabilitation for the entire mine site.

# 24 Item 3(q): Period for which the Environmental Authorisation is required

The scope of this application is focused on reinstating the underground workings, the tailings retreatment operation and maintaining TSFs which will not be deposited on or reclaimed, and therefore the applicant requires environmental authorisation for a period of 15 years.

# 25 Item 3(r): Undertaking

The undertaking required to meet the requirements of this section is provided at the end of the EMPr, in Part B Section 11 and is applicable to the environmental management programme report.

# 26 Item 3(s): Financial Provision

The Rehabilitation and Closure Report is attached as Appendix 13.

The estimated overall financial provision required for the rehabilitation and closure of all three categories of assets associated with the Mining Right of Blyvoor Gold is **R 383 738 316.00** (Excl. VAT). The financial provision per entity is provided in Table 26-1.

**Table 26-1: Financial Provision per Entity**

| | |
|---|---:|
| Blyvoor Gold Capital | R 47 858 994 |
| Blyvoor Gold Operations | R 221 443 958 |
| “The Orphans” | R 114 435 363 |
| **TOTAL** | **R 383 738 316.00** |

## 26.1 Item 3(s)(i): Explain how the aforesaid amount was derived

Digby Wells calculated the financial provision for Blyvoor Gold Mine according to the Department of Mineral Resources (DMR) guidelines set out by the 2005 *“Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provision Provided by a Mine”*. The guidelines outline the methods for infrastructure removal and rehabilitation required for closure.

### 26.1.1 Methodology

The DMR calculation model was compiled using Microsoft Excel. The standard DMR unit rates were escalated with consumer price index (CPI) from 2005 to 2018 (refer Table 26-2)

**Table 26-2: Annual Escalation Rates**

| Year | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CPI X (%) | 4.70 % | 7.10 % | 11.5 % | 7.10 % | 4.30 % | 5.00 % | 5.60 % | 5.70 % | 6.10 % | 4.60 % | 6.40 % | 5.28 % | 4.46 % |

The DMR Guideline Document classifies a mine according to a number of factors which allows one to determine the appropriate weighting factors to be used during the quantum calculation. The following factors are considered:

- The mineral mined;
- The risk class of the mine;
- Environmental sensitivity of the mining area;
- Type of mining operation; and
- Geographic location.

The Project classification was done with a risk rating table as specified in the DMR guidelines (refer Table 26-3 to Table 26-7 below).

**Table 26-3: Primary Risk Class for Type of Mineral Mined (Project Risk Class Highlighted in Red)**

| Mineral | Ore | Size: Large if > than (tpm) | Primary Risk Class | | | |
|---|---|---|---|---|---|---|
| | | | Large Mine | | Small Mine | |
| | | | Mine and Mine waste | Mine, Mine Waste, Plant and Plant Waste | Mine and Mine Waste | Mine, Mine Waste, Plant and Plant Waste |
| Antimony | | 1000 | A | A | C | C |
| Asbestos | | 0 | A | A | A | A |
| Base metals (Copper, Cadmium, Cobalt, Iron ore, Molybdenum, Nickel, Tin, Vanadium) | Sulphide | 10 000 | A | A | C | A |
| | Oxide | 10 000 | C | A | C | A |

| Mineral | Ore | Size: Large if > than (tpm) | Primary Risk Class | | | |
|---|---|---|---|---|---|---|
| | | | Large Mine | | Small Mine | |
| | | | Mine and Mine waste | Mine, Mine Waste, Plant and Plant Waste | Mine and Mine Waste | Mine, Mine Waste, Plant and Plant Waste |
| Coal | | 0 | A | A | A | A |
| Chrome | | 10 000 | C | A | C | C |
| Diamonds and precious stones | | 10 000 | C | B | C | C |
| Gold, silver, uranium | | 10 000 | B | A | B | A |
| Phosphate | | 10 000 | C | B | C | C |
| Platinum | | 10 000 | C | B | C | B |
| Mineral sands (Ilmenite, Titanium, Rutile, Zircon) | | 10 000 | C | B | C | C |
| Zinc and Lead | | 10 000 | C | A | C | A |
| Industrial Minerals (Andalusite, Barite, Bauxite, Cryolite, Fluorspar) | | 10 000 | C | C | C | C |

## Table 26-4: Criteria Used to Determine the Area Sensitivity

| Sensitivity | Sensitivity criteria | | |
|---|---|---|---|
| | **Biophysical** | **Social** | **Economic** |
| **Low** | ▪ Largely disturbed from natural state,<br>▪ Limited natural fauna and flora remains,<br>▪ Exotic plant species evident,<br>▪ Unplanned development,<br>▪ Water resources disturbed and impaired. | ▪ The local communities are not within sighting distance of the mining operation,<br>▪ Lightly inhabited area (rural). | ▪ The area is insensitive to development,<br>▪ The area is not a major source of income to the local communities. |
| **Medium** | ▪ Mix of natural and exotic fauna and flora,<br>▪ Development is a mix of disturbed and undisturbed areas, within an overall planned framework,<br>▪ Water resources are well controlled. | ▪ The local communities are in the proximity of the mining operation (within sighting distance),<br>▪ Peri-urban area with density aligned with a development framework,<br>▪ Area developed with an established infrastructure. | ▪ The area has a balanced economic development where a degree of income for the local communities is derived from the area,<br>▪ The economic activity could be influenced by indiscriminate development. |
| **High** | ▪ Largely in natural state,<br>▪ Vibrant fauna and flora, with species diversity and abundance matching the nature of the area,<br>▪ Well planned development,<br>▪ Area forms part of an overall ecological regime of conservation value,<br>▪ Water resources emulate their original state. | ▪ The local communities are in close proximity of the mining operation (on the boundary of the mine),<br>▪ Densely inhabited area (urban/dense settlements),<br>▪ Developed and well-established communities. | ▪ The local communities derive the bulk of their income directly from the area,<br>▪ The area is sensitive to development that could compromise the existing economic activity |

**Table 26-5: Weighting Factor 1 – Nature of Terrain**

| | Flat | Undulating | Rugged |
|---|---|---|---|
| Weighting factor 1: Nature of the terrain/ accessibility | 1.00 | 1.10 | 1.20 |

Note:

- Flat - Generally flat over the mine area;
- Undulating - A mix of sloped and undulating areas within the mine area; and
- Rugged - Steep natural ground slopes (greater than 1:6) over the majority of the mine area.

**Table 26-6: Weighting Factor 2 – Proximity to Urban Area**

| | Urban | Peri-urban | Remote |
|---|---|---|---|
| Weighting factor 2: Proximity to urban area where goods and services are to be supplied | 1.00 | 1.05 | 1.10 |

Note:

- Urban - Within a developed urban area;
- Peri-urban - Less than 150 km from a developed urban area; and
- Remote - Greater than 150 km from a developed urban area.

Quantities for certain defined items e.g. plant and related infrastructure, are then inserted and the cost for closure is calculated. Contingencies and VAT are applied to the cost.

The classification of Blyvoor Gold Mine has been summarised in Table 26-7 below.

**Table 26-7: Mine classification**

| Mine | Risk Class | Sensitivity | Terrain | Proximity to Urban Area |
|---|---|---|---|---|
| Blyvoor Gold Mine | A | High | Flat | Peri-Urban |

## 26.2 Item 3(s)(ii): Confirm that this amount can be provided for from operating expenditure

The financial provision has been calculated based on the information available at the time of this report being compiled. The assumptions and limitations applicable to the calculation are detailed in Section 11.2 of the Closure and Rehabilitation Report in Appendix 13. It is also assumed that this cost will be adjusted with the first annual revision of the financial provision, as more detailed information becomes available.

This being said, Blyvoor Gold has inherited the rehabilitation liabilities of a mature mine and finds itself in the invidious position that whilst it is raising capital to bring the mine into production, it must also be in a position to meet the rather onerous obligations for financial provisioning resulting from the past activities of the previous owners of BGMC, including what appears to be a significant under funding of the financial costs for rehabilitation and closure.

Blyvoor Gold was required to provide rehabilitation provisioning up to an amount of R144 million. Blyvoor Gold has further been granted latitude to fund this level of rehabilitation provisioning over a period of 10 years.

Given that the rehabilitation provisioning is significantly in excess of the anticipated R144 million, Blyvoor Gold is encouraged to request the DMR to assist the company in finding ways to mitigate the immediate financial impact on the Project. One solution may be that the DMR allow a phasing in of the financial provisioning, similar to the existing provisioning arrangement.

The possibility exists for the closure costing associated with the Orphans be secured by means of financial provisioning from the current owners of the Orphans. This will require collaboration between the DMR and Blyvoor Gold.

# 27 Item 3(t): Deviations from the Approved Scoping Report and Plan of Study

There have been deviations to Digby Wells' Scope of Work since the submission of the final Scoping Report, which was approved on 27 March 2018. This section provides the changes as well as the motivation for such changes.

## 27.1 Item 3(t)(i): Deviations from the methodology used in determining the significance of potential environmental impacts and risks

Digby Wells provided a proposal to Blyvoor Gold to undertake an amendment process in terms of the NEMA, informed by the Section 93 Directive in terms of the MPRDA, issued to Blyvoor Gold from the DMR in a letter dated 06 April 2017. The Directive noted that Blyvoor Gold must address non-compliances with the MPRDA and the approved converted Mining Right. The Directive focused mostly on additional information required for the SLP, Financial Provisioning for rehabilitation and Black Economic Empowerment documentation.

During proposal compilation, Blyvoor Gold indicated that to facilitate information required to complete the amendment process, historic EMPrs for the mining operation dated 2000, 2007 and 2012 would be provided. In addition, an EMPr was submitted with the Section 11 Mining Right transfer and cession application, which EMPr was assumed to have the most recent data and information for the mining operation, and therefore, Digby Wells provided a proposal to amend the Golder EMP (2017). In addition, the scope of the proposal was further amended to undertake a Scoping and EIA process, as it was established that the metallurgical plants on site did not have an AEL. Blyvoor Gold also indicated that the liquidator would provide all available specialist studies, and the scope was amended to exclude updated specialist studies.

## 27.2 Item 3(t)(ii): Motivation for the deviation

Based on the scope defined in Section 27.1, Digby Wells undertook a Gap Analysis of the information provided by Blyvoor Gold. The Gap Analysis established that no specialist studies formed part of any of the scope for any of the Historic EMPs provided. Further information was searched for in the hard copy files during the project kick-off meeting and site visit. Digby Wells recommended that Blyvoor Gold follow up with DMR for proof of the approval of the Golder EMP (2017). The Application Form was submitted and the Scoping Phase commenced, based on the aforementioned assumptions.

The DMR approved the Scoping Report but informed Digby Wells that the Golder EMP (2017) was not approved as part of the Section 11 transfer and cession of the Mining Right, and also requested the Application Form be amended to change the activity description regarding the requirement of an AEL. A meeting was held between Digby Wells and the DMR on 23 May 2018 to clarify the approach and the requirements of the Scoping and EIA process. In this meeting, the DMR confirmed that the only approved EMP for BGMC was the EMP dated 2000 and approved in 2001. Based on the discussions held at this meeting, the DMR requested Digby Wells to amend the scope to include the following:

- Assess the EMP (2000) to establish what mining activities had been authorised, and align the EIA/EMP report to include the authorised activities, as well as clarify what activities still require authorisation;
- Due to the lack of specialist reports, and the dated baseline contained in the EMP (2000), the DMR also requested the following specialist investigation be included in this application process:
  - Groundwater Impact Assessment;
  - Surface Water Impact Assessment;
  - Biophysical Report containing an updated fauna and flora baseline, as well as a combined Aquatics and Wetlands Impact Assessment;
  - Air Quality Impact Assessment;
  - Radiological Impact Assessment;
  - Community Health Impact Assessment;
  - Updated Heritage Baseline study; and
  - Social Impact Assessment.

To accommodate the additional time required to undertake the Specialist investigations, Digby Wells applied for an extension to the NEMA timeframe in a letter submitted to DMR on 10 July 2018. DMR granted a timeframe extension in a letter dated 24 July 2018, stipulating that the

Final EIA must be submitted on or before 06 December 2018. In the interim, Blyvoor Gold had to raise funds for the additional scope of work, and confirmed the enlarged scope of work with Digby Wells on 09 July 2018.

# 28 Item 3(u): Other Information required by the Competent Authority

Compliance with the provisions of sections 24(4)(a) and (b) read with section 24 (3) (a) and (7) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) the EIA report must include the relevant plans providing details of the environment to be impacted by the proposed, project, ensure that relevant organs of state are informed of the project, and all relevant information pertaining to the project activities, associated impacts, and environmental management plan. All report plans are attached in Appendix 2.

## 28.1 Item 3(u)(i)(1): Impact on the socio-economic conditions of any directly affected person

The socio-economic baseline is contained in Section 8.4.15, the impact assessment in Section 10.7 and the full Addendum Report is available in Appendix 12. The direct impacts of the mine reopening are generally positive, as the negative impacts for directly affected individuals occurred mostly as a result of the liquidation of BGMC and the former mining villages falling into disrepair as a result. This impact and associated issues have been investigated and discussed throughout the report.

## 28.2 Item 3(u)(i)(2): Impact on any national estate referred to in section 3(2) of the National Heritage Resources Act

A Heritage report was compiled and is attached in Appendix 11. The scope included a desktop investigation and a site visit to determine whether any heritage sites are present within the MRA. No heritage resources were identified, and a Notice of Intent to Develop was compiled, and will be submitted on SAHRIS when the Draft EIA/EMP is submitted for public comment.

# 29 Item 3(v): Other matters required in terms of Sections 24(4)(a) and (b) of the Act

The only feasible alternative investigated is the No-Go alternative and the impacts associated with the project not proceeding (Sections 8, 13, 20). Other discussions, also in Section 8, pertaining to potential alternatives considered the location, type of activity to be undertaken, design or layout of the activity, technology to be used, and operational aspects, This has been discussed at length throughout the report in terms of socio-economic impacts and environmental impacts. Refer to Section 23 for the discussion regarding the reasoned opinion whether the proposed activities should be authorised, for further motivation for the existing mining footprint being the preferred alternative.

# Part B: Environmental Management Programme Report

# 1 Item 1(a): Details of the EAP

Digby Wells Environmental has been appointed by Blyvoor Gold to undertake the Environmental-Legal applications for the proposed Project. The details of the EAP for this Project are contained in Table 1-1.

**Table 1-1: Contact details of the EAP**

| | |
|---|---|
| **Name of Practitioner:** | Xanthe Taylor |
| **Telephone:** | 011 789 9495 |
| **Fax:** | 011 069 6801 |
| **Email:** | xanthe.taylor@digbywells.com |

## 1.1 Item 3(a)(ii): Expertise of the EAP

Ms Xanthe Taylor is the appointed Environmental Assessment Practitioner (EAP) representing Digby Wells. Xanthe has been working as an Environmental Consultant since 2012, and joined the Digby Wells' Environmental Legal Services Department in 2015. The EAP's curriculum vitae and degree are attached in Appendix 2.

### 1.1.1 The Qualifications of the EAP

Xanthe Taylor attained her Honours Degree in Environmental Management from the University of South Africa in 2013. Recently, Xanthe attended and completed a SETA-accredited Project Management course for the duration of 2017.

### 1.1.2 Summary of the EAP's Past Experience

Xanthe Taylor has been employed as an Environmental Consultant since 2012, consulting almost exclusively to the mining industry and has experience with various commodities including gold, coal, and platinum. She has worked with South African and international environmental legislation, and has experience in multiple processes including Basic Assessments, Scoping/EIAs, EMPs, Water Use Licencing, amendment applications, exemption applications, appeals processes, public participation, environmental awareness training, environmental auditing, and project management.

# 2 Item 1(b): Description of the aspects of the activity

The environmental baseline is provided in Part A, Section 8.4, Environmental Attributes associated with the Development.

# 3 Item 1(c): Composite Map

The composite map is provided in Figure 3-1 and in Plan 12, Appendix 3.

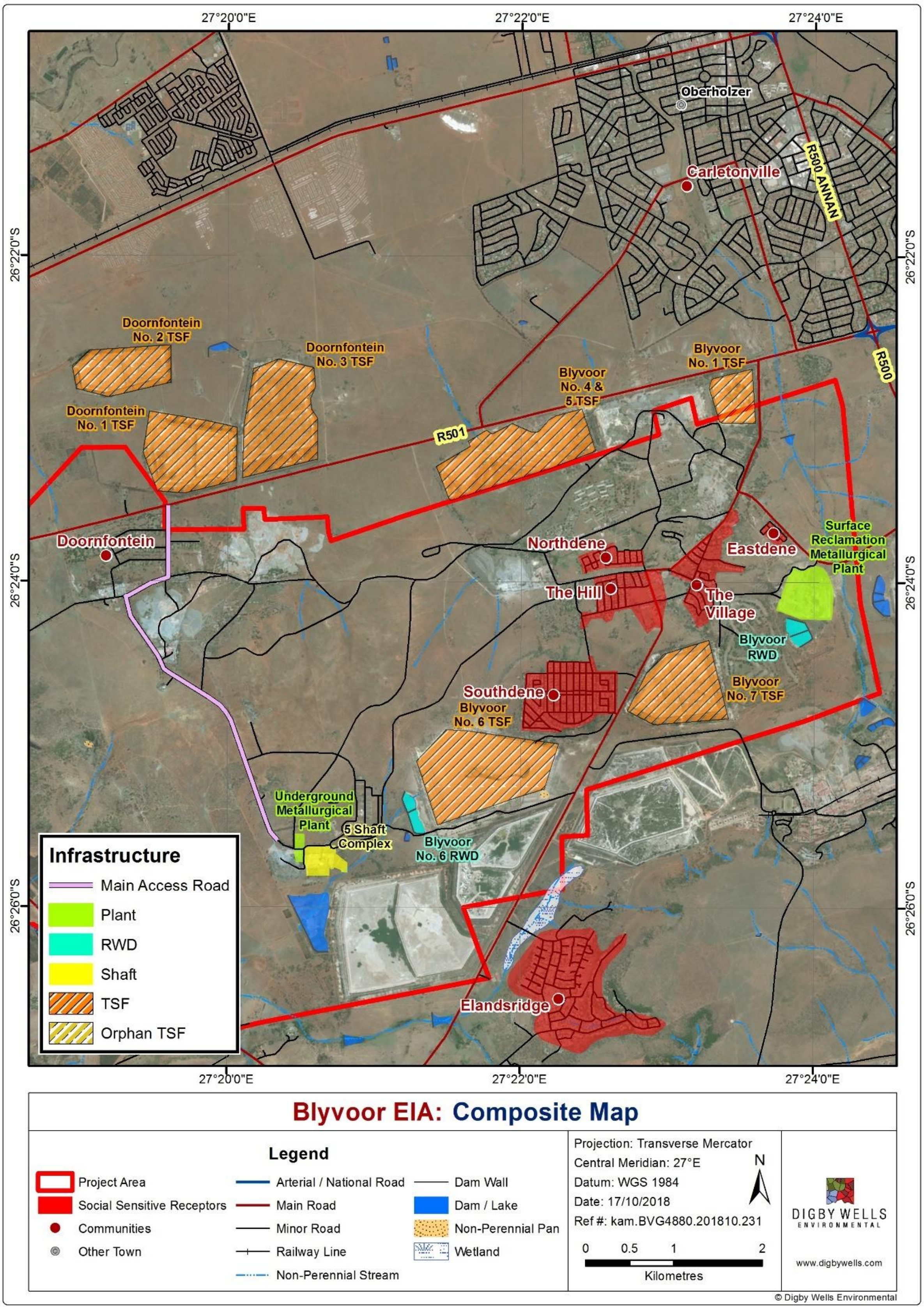



**Figure 3-1: Composite Map**

# 4 Item 1(d): Description of Impact management objectives including management statements

## 4.1 Item 1(d)(i): Determination of closure objectives

Closure and rehabilitation is a continuous series of activities that begin with planning prior to the project's design and construction, and end with achievement of long-term site stability and the establishment of a self-sustaining ecosystem. Not only will the implementation of this concept result in a more satisfactory environmental outcome, but it will also reduce the financial burden of closure and rehabilitation. The following points outline the main objectives for rehabilitation and closure of the Project:

- The overall closure objective is to leave behind an ex-mining area that is safe, stable and non-polluting, aligned to the Merafong Magisterial District spatial development framework, as well as current agricultural, tourism and other economic initiatives of the region, towards leaving behind a positive post mining legacy;
  - The above closure goal is stated qualitatively and will become more specific as the more detailed closure measures are derived during the LOM.
- The main objective is to rehabilitate the TSF, metallurgical plants and shaft infrastructure with the purpose of reintegrating these areas into a post-mining viable economy;
- Blyvoor Gold will ensure that the rehabilitated TSFs, metallurgical plants and shaft infrastructure sites are:
  - Neither a danger to public health and safety nor to animal health and safety;
  - Not a source of pollution;
  - Stable (ecological and geophysical);
  - Rehabilitated to the state that it is suitable for the predetermined and agreed land use;
  - Compatible with the surrounding biophysical environment;
  - A sustainable environment;
  - Aesthetically acceptable; and
  - Not an economic, social or environmental liability to the local community or the state now or in the future.
- Blyvoor Gold will ensure that the interest of all interested and affected parties (I&APs) are considered, and that all relevant legislation regarding mine closure is adhered to, and all relevant application procedures are followed.

## 4.2 Item 1(d)(ii): The process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of undertaking a listed activity

An Environmental Response Plan is a process to respond rapidly and effectively to and manage emergency situations that may arise at the mine. The Environmental Response Plan must have the following objectives:

- Categorisation of emergency situations through hazard identification and to define procedures for responses to the situations;
- Assigning responsibilities for responding to emergency situations;
- Implementation of an effective system to receive, record and communicate reports of environmental incidents and emergencies; and
- Ensuring that all environmental incidents or emergencies are investigated and the necessary procedures are in place to implement corrective and preventative actions to prevent a recurrence of the incident.

The Emergency Preparedness and Response Code of Practice will be compiled in accordance with the following:

- Occupational Health and Safety OHSAS 18001; and
- The Mine Health and Safety Act, 1996 (Act No. 29 of 1996).

In the event of an emergency, the Emergency Response Plan/Procedure will be consulted and the required actions implemented. To facilitate the effective implementation of the procedures, copies of the Emergency Response Plan will be placed in accessible and visible locations around the Project site. Figure 4-1 provides a general overview of the Emergency Response Procedure.

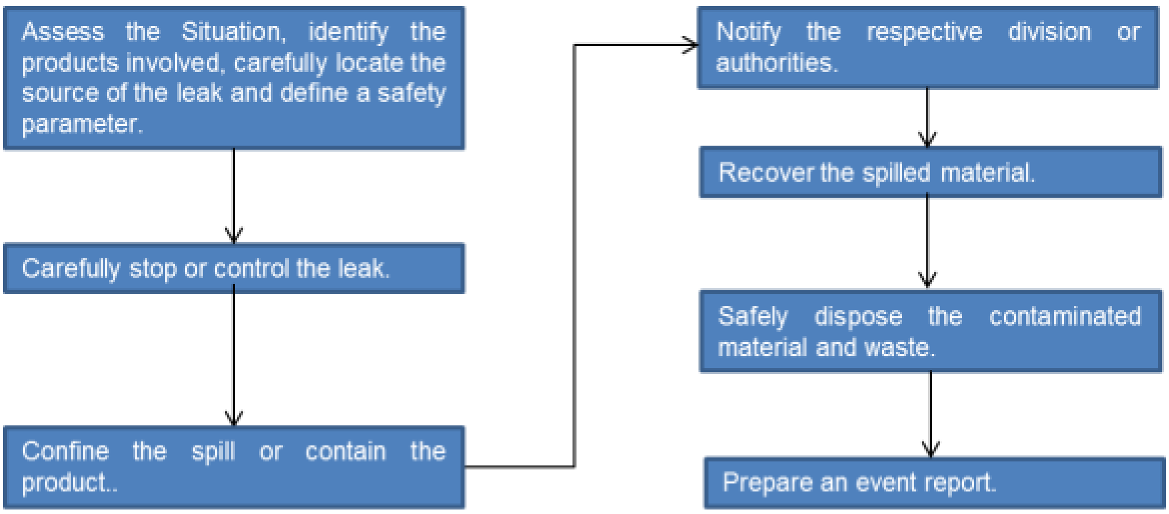



**Figure 4-1: Emergency Response Procedure Overview**

#### 4.2.1 Communication

A list of emergency contact numbers will be displayed at various locations around the Project site. If the emergency has the potential to affect surrounding communities, the communities will be alerted via alarm signals or contacted in person.

#### 4.2.2 Training and Emergency Situation

The efficiency of the Emergency Response Plan must be tested by running training programmes and frequent emergency simulations. This will aid in preparing employees to respond in case of emergencies.

### 4.3 Item 1(d)(iii): Potential risk of Acid Mine Drainage

Eight TSFs were purchased by Blyvoor Gold Operations (Pty) Ltd, and none of these facilities have been lined. The potential for existing Acid Mine Drainage (AMD) may have already been realised through seepage beneath these TSFs.

### 4.4 Item 1(d)(iv): Steps taken to investigate, assess, and evaluate the impact of acid mine drainage

The Geochemical and Waste Analysis provides the results of the TSFs sampled on site. The discussion is included in Section 8.4.11 in Part A, and is also discussed in the Groundwater Report attached in Appendix 5. The results of the samples analysed show that the sampled TSFs were determined to be acid generating, requiring a Class C Liner should the TSF be reclaimed and then reused for the depositing of tailings.

### 4.5 Item i(d)(v): Engineering or mine design solutions to be implemented to avoid or remedy acid mine drainage

Seeing as all the TSFs owned by Blyvoor Gold Operations (Pty) Ltd were deposited prior to the promulgation of NEM:WA, the liner requirements cannot realistically be implemented where large TSFs of 30m in height are still in situ. TSF No. 4 & 5 were partially reclaimed prior to Blyvoor Gold purchasing the various assets associated with the Mining Right. Blyvoor Gold intend to complete the reclamation of TSF No. 4 & 5 and then to re-deposit tailings onto TSF No. 4 & 5. Digby Wells has recommended that the footprint of TSF No. 4 & 5 is lined. Blyvoor Gold had not purchased these assets at the time geochemical samples were being taken on site, but the assumption from the outcome of the waste classification is that this is representative of all the TSFs on site. If the footprint of TSF No. 4 & 5 is lined and has capacity for further deposition of other reclaimed TSFs, the reclaimed TSF footprints can be rehabilitated and ongoing tailings seepage will have been minimised.

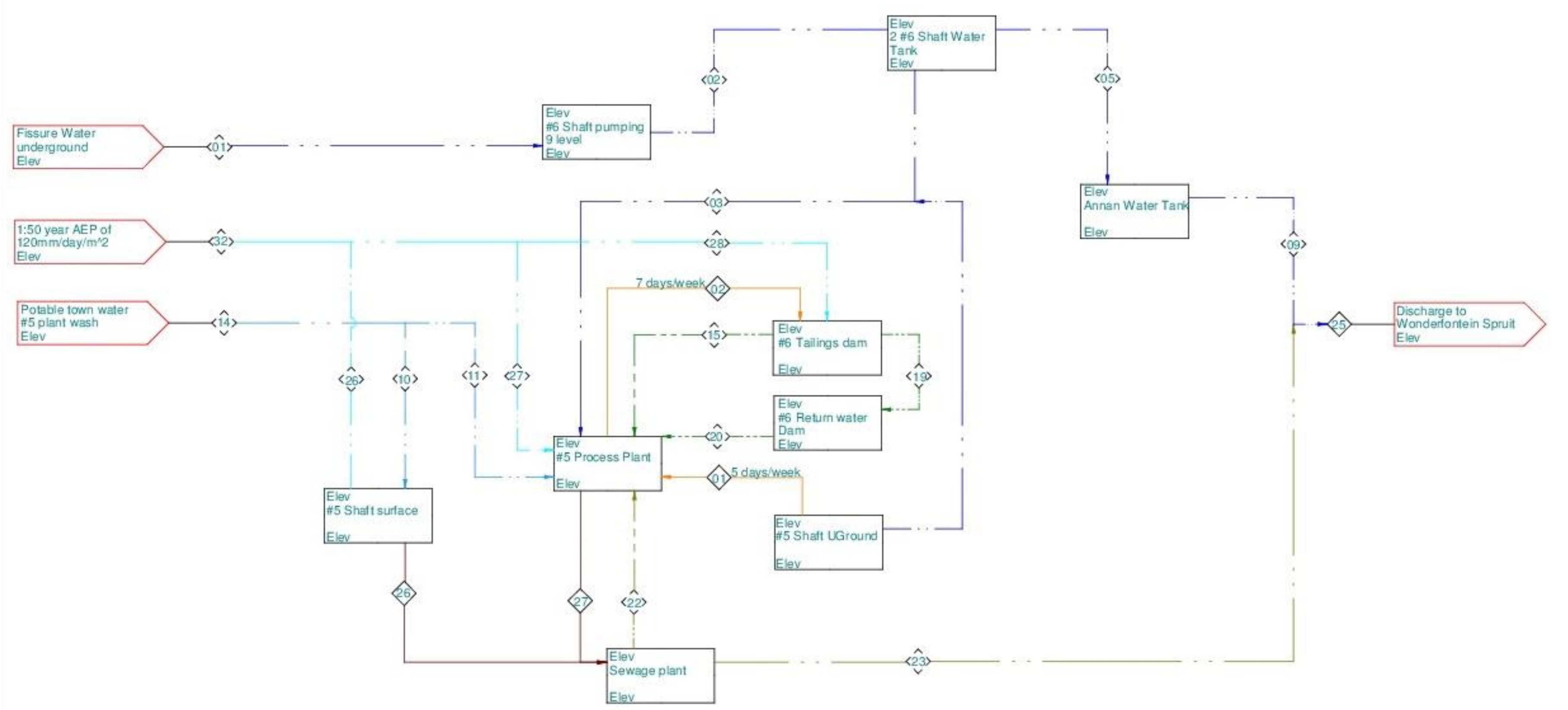
## 4.6 Item 1(d)(vi): Measures that will be put in place to remedy any residual or cumulative impact that may result from acid mine drainage

The Groundwater report has included a monitoring programme which requires Blyvoor Gold to drill additional monitoring boreholes to provide sufficient data to understand the groundwater characteristics on site, and the extent of contamination from the TSFs. As a condition of authorisation, the borehole monitoring network must be implemented with the construction activities and the monitoring programme implemented as soon as possible to provide data for a conceptual groundwater model. It is anticipated that construction and refurbishment activities will take approximately 18 months to complete if Environmental Authorisation is granted. As some of this information was not possible to be obtained for this application, an amendment to the EMPr is recommended. This data is crucial for an informed impact assessment and rehabilitation plan. Blyvoor Gold will also need to procure data regarding the extent of contamination at the base of the TSFs to be able to adequately plan for rehabilitation of these footprints, and feasibly be able to apply for closure.

## 4.7 Item 1(d)(vii): Volumes and rate of water use required for the mining, trenching or bulk sampling operation

Figure 4-2 shows the draft water balance, which Blyvoor Gold is required to update and finalise once sufficient data has been gathered from the operations. The final water balance will be included in the EMPr amendment recommended to address the gaps in information for this application process.

It must be noted that this water balance only became available after the Surface Water report was completed, and has not been reviewed by Digby Wells nor has the balance been included in any of the assessments presented herein.




| No | Equipment & component description | Drwg / Model | pwr (kW) |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |
| 7 | | | |
| 8 | | | |
| 9 | | | |
| 10 | | | |
| 11 | | | |
| 12 | | | |
| 13 | | | |
| 14 | | | |
| 15 | | | |
| 16 | | | |
| 17 | | | |
| 18 | | | |
| 19 | | | |
| 20 | | | |
| 21 | | | |
| 22 | | | |
| 23 | | | |
| 24 | | | |
| 25 | | | |
| 26 | | | |
| 27 | | | |
| 28 | | | |
| 29 | | | |
| 30 | | | |
| 31 | | | |
| 32 | | | |
| 32 | Total number of items and power | | 0 |

| Description | Fissure water | #6 shaft 9 lvl pumped water | #5 plant supply | | #6 shaft tank discharge | | Annan tank overflow | | Disch to Wfein spruit | Pot water to #5 shaft surf | Pot water to #5 plant surf | | | Total potable water | #6 TSF return | | | | Storm water to RW dam | Storm water to plant | | treated WW to #5 plant | treated WW to spruit | | Total disch to Wfein spruit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Raw & GS (m^3/h) | 250.00 | 250.00 | 109.7 | | 140.33 | | 140.33 | | 140.33 | 12.50 | 0.42 | | | 12.92 | 29.25 | | | | 4250 | 303.6 | | 12.27 | 0.00 | | 140 |
| per 24 hours (m^3) | 6000 | 6000 | 1316 | | 46840 | | 4684 | | 4684 | 150 | 5 | | | 155 | 702 | | | | 102000 | 7286 | | 147.25 | 4.75 | | 4689 |
| Density (kg/m^3) | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1001 | | | | 1005 | 1001 | | 1001 | 1001 | | 1001 |
| Press min,max (bar) | 0,0 | 50,1 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 2,3 | 2,3 | 2,3 | 2,3 | 2,3 | 0,1 | | | | 0,0 | 0,3 | | 0,1 | 0,1 | | 0,1 |
| Ph min,max | 6,8 | 6,8 | 6,8 | 6,8 | 6,8 | 6,8 | 6,8 | 6,8 | 6,8 | 6.5,7.5 | 6.5,7.5 | 6.5,7.5 | 6.5,7.5 | 6.5,7.5 | 7,9 | | | | 7,8 | 7,8 | | 6,8 | 6,8 | | 6,8 |
| Temp min,max (°C) | 5,20 | 5,20 | 5,20 | 5,20 | 5,20 | 5,20 | 5,20 | 5,20 | 5,20 | 5,20 | 5,20 | 5,20 | 5,20 | 5,20 | 10,25 | | | | 5,20 | 5,20 | | 5,25 | 5,25 | | 5,25 |
| Stream No | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| Solids flow tph | 94.7 | 65.00 | | | | | | | | | | | | | | | | | | | | | | | |
| Solids SG (t/m^3) | 2.74 | 2.74 | | | | | | | | | | | | | | | | | | | | | | | |
| bulk density (t/m^3) | 1.80 | 1.80 | | | | | | | | | | | | | | | | | | | | | | | |
| Sol bulk flow (m^3/h) | 52.6 | 36.1 | | | | | | | | | | | | | | | | | | | | | | | |
| Solid 100% pass | 300 | 0.150 | | | | | | | | | | | | | | | | | | | | | | | |
| Solid 80% pass (mm) | 70 | 0.750 | | | | | | | | | | | | | | | | | | | | | | | |
| Solid 50% pass (mm) | 30 | 0.050 | | | | | | | | | | | | | | | | | | | | | | | |
| Liquid Density (t/m^3) | 1.00 | 1.0 | | | | | | | | | | | | | | | | | | | | | | | |
| Liquid flow (m^3/h) | 5.0 | 97.5 | | | | | | | | | | | | | | | | | | | | | | | |
| Liquid flow (tph) | 5.0 | 97.5 | | | | | | | | | | | | | | | | | | | | | | | |
| Mixture flow (tph) | 99.7 | 162.5 | | | | | | | | | | | | | | | | | | | | | | | |
| Mixture flow (m^3/h) | 39.6 | 121.2 | | | | | | | | | | | | | | | | | | | | | | | |
| Mixture SG (t/m^3) | 2.52 | 1.34 | | | | | | | | | | | | | | | | | | | | | | | |
| Mixt Solid m/m (%) | 95 | 40.0 | | | | | | | | | | | | | | | | | | | | | | | |
| Press Start min,max | 0,0 | 2,3 | | | | | | | | | | | | | | | | | | | | | | | |
| End min,max (bar) | 0,0 | 0,0 | | | | | | | | | | | | | | | | | | | | | | | |
| Ph min,max | 6,8 | 10,11 | | | | | | | | | | | | | | | | | | | | | | | |
| Temp min,max (°C) | 0,40 | 15,35 | | | | | | | | | | | | | | | | | | | | | | | |
| Description | Ore to plant | Plant tails | | | | | | | | | | | | | | | | | | | | | | | |

| Description | #5 Shaft surf rainfall | #5 plant rainfall | #6 TSF rainfall | | | | | 1:50 AEP (120mm/m^2/24 hr) |
|---|---|---|---|---|---|---|---|---|
| ProcW & other | 529 | 192.50 | 8500 | 0.00 | 0.00 | 0.00 | 0.00 | 9222 |
| per 24 hours | 6353 | 2310 | 102000 | | | | | 110663 |
| Fluid Dens | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| min,max (bar) | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 | 0,0 |
| Ph min,max | 7,7 | 7,7 | 7,7 | 7,7 | 7,7 | 7,7 | 7,7 | 7,7 |
| min,max (°C) | 5,20 | 5,20 | 5,20 | 5,20 | 5,20 | 5,20 | 5,20 | 5,20 |
| Stream No | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 32 |
| Solids flow (tph) | 1.00 | 0.03 | | | | | | |
| Solids SG (t/m^3) | 1.20 | 1.20 | | | | | | |
| bulk dens (t/m^3) | 0.70 | 0.70 | | | | | | |
| bulk flow (m^3/h) | 1.4 | 0.0 | | | | | | |
| Solid 100% pass | 100 | 100 | | | | | | |
| Solid 80% pass | 80 | 80 | | | | | | |
| Solid 50% pass | 50 | 50 | | | | | | |
| Liq Dens (t/m^3) | 1.0 | 1.0 | | | | | | |
| Liq flow (m^3/h) | 12.5 | 0.42 | | | | | | |
| Liq flow (tph) | 12.5 | 0.42 | | | | | | |
| Mixt flow (tph) | 13.5 | 0.45 | | | | | | |
| Mixt flow (m^3/h) | 13.3 | 0.46 | | | | | | |
| Mixt SG (t/m^3) | 1.01 | 0.97 | | | | | | |
| Solids m/m (%) | 7.4 | 7.4 | | | | | | |
| St min,max (bar) | 0,0 | 2,3 | | | | | | |
| End min,max | 0,0 | 0,0 | | | | | | |
| Ph min,max | 11,12 | 11,12 | | | | | | |
| min,max (°C) | 10,30 | 10,50 | | | | | | |
| Description | #5 shaft surf WW sewage | #5 plant WW sewage | | | | | | |

| | | |
|---|---|---|
| Material | | |
| Drawn | D.Tonkin | 2018-10-12 |
| Checked | D. Whittaker | 2018-10-12 |
| Engineer | by | 2017- |
| Manager | by | 2017- |

**Blyvoor Gold (Pty) Ltd**
*No 5 Shaft, Blyvooruitzicht*
*Carletonville, Gauteng, South Africa*
*26°25'38.57"S 27°20'27.46"E*
*email : enquiries@blyvoorgold.com*

BLYVOOR GOLD

| TOL (mm) | 10 | 50 | 100 | 250 | 500 | 1000 | 2000 | 5000 |
|---|---|---|---|---|---|---|---|---|
| CAST ± | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 10 |
| FAB ± | 0.5 | 1 | 1 | 1.5 | 2 | 2.5 | 3 | 5 |
| MACH ± | 0.1 | 0.15 | 0.2 | 0.3 | 0.4 | 0.5 | 0.75 | 1 |

A1 Drwg Title: Overall block flow diagram for the #5 shaft site water balance | Area: na m²

| Site | Type | Area-Eqp' | Comp'Part-Item | Sheet | Scale | Mass |
|---|---|---|---|---|---|---|
| 5Site | Pfd | 00-AU-00' | cu-00'001-00 | 1 of 1 | na | na kg |

**Figure 4-2: Draft Water Balance**

## 4.8 Item 1(d)(viii): Has a water use licence has been applied for

The transfer of the Water Use Licence (WUL) to Blyvoor Gold Capital (Pty) Ltd was successfully completed in 2017. This WUL expires in 2021. The current WUL includes for activities that are not required for the Project and an application for the renewal of the WUL, which will be required to address all aspect of the operation that are either not currently licenced, or licenced but no longer required, will be submitted in due course.

## 4.9 Item 1(d)(ix): Impacts to be mitigated in their respective phases

Table 4-1 provides the activities identified and the mitigation measures to be applied to the identified impacts in the respective phases of the Project.

**Table 4-1: Impacts to be Mitigated in their Respective Phases**

| Activities | Phase | Size and scale of disturbance | Mitigation Measures | Compliance with standards | Time period for implementation |
|---|---|---|---|---|---|
| Site clearing where vegetation has re-established | Construction | Limited to areas where construction activities take place | ▪ The Project infrastructure already exists. Any future infrastructure development which will need excavation and vegetation clearance should only be limited to the proposed development footprint;<br>▪ Any required soil stockpiles should be stabilised, and stockpile slopes should not exceed 1:3 (Vertical: Horizontal) to reduce erosion from the stockpile and subsequent siltation of proximal watercourses;<br>▪ Dust suppression measures must be undertaken on the cleared areas during construction to reduce wind erosion;<br>▪ All fuel and other chemical storage areas should be appropriately bunded and have spill kits in place. Construction workers should be trained in the use of spill kits to contain and immediately clean up any leakages or spills. All used oils should be disposed of by accredited vendors from the mine site. | Chamber of Mines Guidelines<br>NEMA<br>NEM:AQA | Construction Phase |
| Reconstruction of metallurgical plants and other mining infrastructure | Construction | Limited to areas where construction activities take place | ▪ The area of disturbance at all times must be minimised, no unnecessary digging or scraping must occur;<br>▪ The drop heights when loading onto trucks and at tipping points should be minimised. | Compliance with EMP, once approved | Construction Phase |
| Reconstruction of metallurgical plants and other mining infrastructure | Construction | Regional extent | ▪ No hiring at the gate.<br>▪ Maximise the use of local labour to the fullest extent possible, even if this implies increasing the 70% local hire commitment made in the SLP by reducing the 30% provincial hire.<br>▪ Develop and implement a communication plan for the local community (the 'mine village') as part of a wider SEP for the Project, which should include, inter alia, progress on the recommissioning process, employment opportunities available linked to skills required, and when positions will be available. Factual information might not always be received favourably but will assist in managing unrealistic expectations - one of which is currently that the mine will go back to operating on its previous scale and re-hire all retrenched workers. | Compliance with SLP | Construction Phase |
| Reconstruction of metallurgical plants and other mining infrastructure | Construction | Regional extent | ▪ Promote the employment of locals that was affected by the provisional liquidation from Blyvoor Gold first and thereafter from the MCLM wherever possible: the creation of employment opportunities within the WRDM as per the requirements of the mining charter.<br>▪ Promote local procurement of goods and services wherever possible: besides providing employment, expenditure in a local economy is one of the other important ways an operation such as the proposed facility can contribute to a positive economic impact (including direct, indirect and induced impacts). The more money spent locally, the better the local economy. | Compliance with SLP | Construction Phase |

| Activities | Phase | Size and scale of disturbance | Mitigation Measures | Compliance with standards | Time period for implementation |
|---|---|---|---|---|---|
| | | | ▪ Support the diversification of the local economy: given that the MCLM local economy is heavily dependent on the mining sector, focus should be on supporting community projects that can assist in diversifying the local economy of the area beyond the LoM and an appropriate portable skills training.<br>▪ Support LED projects that are feasible, sustainable and promotes job creation: investing in projects that are feasible, sustainable and promotes job creation will mean that once decommissioning of operations is imminent, the supported project can continue without continued support from the plant.<br>▪ Ensure that a process of on-going communication and dialogue should be implemented to ensure that unrealistic expectations are addressed as a matter of course and that the Blyvoor Gold operations allow a mutually beneficial process to be put in place. | | |
| Reconstruction of metallurgical plants and other mining infrastructure | Construction | Regional extent | ▪ Employ a competent and experienced community relations team to manage continued interaction between Blyvoor Gold and its mining impacted communities and hold them to strict performance criteria.<br>▪ Acknowledge and remedy past grievances and act on outstanding commitments.<br>▪ Establish meaningful avenues of two-way communication.<br>▪ Build relationships through goodwill and understanding. Be upfront and straightforward about potential issues and difficulties, including environmental risks and limited job opportunities.<br>▪ Be responsive and adaptive to complaints and other issues.<br>▪ Listen to and act on community concerns.<br>▪ Involve communities in shaping community development projects.<br>▪ Design and implement a grievance mechanism. Monitor grievances to allow for eventual proactive actions instead of reactive addressing of complaints. | Compliance with SLP | Construction Phase |
| Site clearing where vegetation has re-established Reconstruction of metallurgical plants and other mining infrastructure | Construction | HGM Units 2 and 3 (refer to Figure 10-1 in Part A) | The No. 5 Shaft complex, and metallurgical plant are all in proximity to the HGM Units 2 and 3; therefore, the following mitigation and management measures have been prescribed for the construction phase:<br>▪ Ensure soil management programme is implemented and maintained to minimise erosion and sedimentation;<br>▪ During the construction phase, erosion berms should be installed on roadways and downstream of stockpiles to prevent gully formation and siltation of the freshwater resources. The following points should serve to guide the placement of erosion berms:<br>▪ Where the track has a slope of less than 2%, berms every 50m should be installed;<br>▪ Where the track slopes between 2% and 10%, berms every 25m should be installed;<br>▪ Where the track slopes between 10%-15%, berms every 20m should be installed; and | NWA GN 704 requirements regarding stormwater management for mining activities it is noted that all clean and dirty water must be separated.<br>NEM:BA<br>NEMA<br>Mining and Biodiversity Guideline (DEA et al., 2013). | Construction Phase |

| Activities | Phase | Size and scale of disturbance | Mitigation Measures | Compliance with standards | Time period for implementation |
|---|---|---|---|---|---|
| | | | ▪ Where the track has slope greater than 15%, berms every 10m should be installed.<br>▪ Limit the footprint area of the construction activities to what is essential in order to minimise impacts as a result of vegetation clearing and compaction of soils (all areas but critically so in wetland areas);<br>▪ Appropriate storm water measures should be in place. It should be ensured that clean and dirty water separation systems are the first infrastructures to be installed on site and these need to be in working order and regularly maintained;<br>▪ If it is absolutely unavoidable that any of the wetland or instream areas present (not withstanding those already accounted for in the proposed activities) will be affected, disturbance must be minimised and suitably rehabilitated;<br>▪ Ensure that no incision and canalisation of the wetland and instream features present takes place;<br>▪ All erosion noted within the construction footprint should be remedied immediately and included as part of an ongoing rehabilitation plan;<br>▪ Active rehabilitation, re-sloping, and re-vegetation of disturbed areas immediately after construction;<br>▪ All soils compacted as a result of construction activities should be ripped/scarified (<300mm) and profiled;<br>▪ Implement and maintain a suitable AIP control programme to prevent further encroachment as a result of disturbance to the surrounding terrestrial zones;<br>▪ Permit only essential personnel within the 100m zone of regulation for all freshwater features identified;<br>▪ No unnecessary crossing of the wetland features and their associated buffers should take place and the substrate conditions of the wetlands and downstream stream connectivity must be maintained;<br>▪ No material may be dumped or stockpiled within any rivers, tributaries or drainage lines;<br>▪ No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland or instream areas and their associated zones of regulation (notwithstanding those areas to be directly impacted upon as a result of the proposed activities). All vehicles must remain on demarcated roads and within the construction footprint. The No-go zone should be avoided;<br>▪ All vehicles must be regularly inspected for leaks;<br>▪ Re-fuelling must take place at a diesel facility, on a sealed surface area away from wetlands to prevent ingress of hydrocarbons into topsoil;<br>▪ All spills should be immediately cleaned up and treated accordingly;<br>▪ Freshwater systems should be monitored monthly during construction; and | | |

| Activities | Phase | Size and scale of disturbance | Mitigation Measures | Compliance with standards | Time period for implementation |
|---|---|---|---|---|---|
| | | | ▪ Appropriate sanitary facilities must be provided for the duration of the construction activities and all waste must be removed to an appropriate waste facility. | | |
| Temporary storage of hazardous products, including fuel | Construction | Limited to areas where construction and refurbishment will take place | ▪ The Project infrastructure already exists. Any future infrastructure development which will need excavation and vegetation clearance should only be limited to the proposed development footprint;<br>▪ Any required soil stockpiles should be stabilised, and stockpile slopes should not exceed 1:3 (Vertical: Horizontal) to reduce erosion from the stockpile and subsequent siltation of proximal watercourses;<br>▪ Dust suppression measures must be undertaken on the cleared areas during construction to reduce wind erosion;<br>▪ All fuel and other chemical storage areas should be appropriately bunded and have spill kits in place. Construction workers should be trained in the use of spill kits to contain and immediately clean up any leakages or spills. All used oils should be disposed of by accredited vendors from the mine site. | NWA | Construction Phase |
| All construction activities | Construction | Regional | **(From the Golder SIA):**<br>▪ Promote the employment of locals that was affected by the provisional liquidation of BGMC first and thereafter from the MCLM wherever possible: the creation of employment opportunities within the WRDM as per the requirements of the mining charter.<br>▪ Promote local procurement of goods and services wherever possible: besides providing employment, expenditure in a local economy is one of the other important ways an operation such as the proposed facility can contribute to a positive economic impact (including direct, indirect and induced impacts). The more money spent locally, the better the local economy.<br>▪ Support the diversification of the local economy: given that the MCLM local economy is heavily dependent on the mining sector, focus should be on supporting community projects that can assist in diversifying the local economy of the area beyond the LoM and an appropriate portable skills training.<br>▪ Support LED projects that are feasible, sustainable and promotes job creation: investing in projects that are feasible, sustainable and promotes job creation will mean that once decommissioning of operations is imminent, the supported project can continue without continued support from the plant.<br>▪ Ensure that a process of on-going communication and dialogue should be implemented to ensure that unrealistic expectations are addressed as a matter of course and that the Project operations allow a mutually beneficial process to be put in place. | Compliance with SLP | Construction Phase |
| Reconstruction of metallurgical plants and other mining infrastructure | Operational | Regional | ▪ Manage the influx of people;<br>▪ The quality of groundwater and surface water must be monitored to ensure that the Project does not have any detrimental effects on community water sources;<br>▪ Conduct baseline water and sanitation studies on communities based on accepted health indicators; | Compliance with SLP | Operational Phase |

| Activities | Phase | Size and scale of disturbance | Mitigation Measures | Compliance with standards | Time period for implementation |
|---|---|---|---|---|---|
| | | | ▪ Monitor for groundwater organics, bi-annually, including: Total Coliform, E. Coli and Heterotrophic plate count;<br>▪ Ensure proper disposal of human waste that is generated from the Project;<br>▪ Ensure proper waste management from Project generated waste according to waste management principles;<br>▪ Support the local authority in supporting and improving water and sanitation services, including the collection and disposal of waste in the communities;<br>▪ Establish water and sanitation committees in the communities to manage their own water and sanitation services. This will improve sustainability of any outreach support;<br>▪ Support information campaigns in the community on water use, hygiene and general sanitation; and<br>▪ Depending on the results of the baseline data gathering, support the government's school deworming programme in partnership with local authorities. | | |
| Operation of the underground mine, conveyors, processing plants, haulage, etc. | Operational | Limited to within the mine site | ▪ The area of disturbance at all times must be minimised, no unnecessary digging or scraping must occur;<br>▪ The drop heights when loading onto trucks and at tipping points should be minimised | Compliance with EMP, once approved | Operational Phase |
| Operation of the underground mine, conveyors, processing plants, haulage, etc. | Operational | Limited to operational areas and immediate surrounds | ▪ Implement dust management plan;<br>▪ Apply wetting agents, dust suppressant or binders on the exposed area;<br>▪ Vegetate, with grass or a gravel monolayer, the exposed areas;<br>▪ Reduce erosion loss by roughening slope surface - this dissipates energy of water or wind moving over the slope;<br>▪ Assess the angle of the slope, as maximum erosion occurs on slopes with angles between 30° and 35°;<br>▪ Improve upon the surface strength of a slope, which will lower the rate of erosion;<br>▪ Implement PM monitoring and continue with ongoing dust fallout monitoring;<br>▪ Collect data on a longitudinal basis from the local health centres on incidence of increased respiratory disease - especially respiratory tract infections that could be ascribed to dust. While these may not be specifically ascribed to the Project, the prevailing trends are useful to monitor so that any concerns could be addressed. This may require health systems strengthening to support recording; and<br>▪ Establish a monthly and annual reporting structure to appraise performance, compliance and complaints. | NWA GN 704 requirements regarding stormwater management for mining activities it is noted that all clean and dirty water must be separated.<br>NEM:BA<br>NEMA<br>Mining and Biodiversity Guideline (DEA et al., 2013) | Operational Phase |
| Operation of the underground mine, conveyors, processing plants, haulage, etc. | Operational | Regional | ▪ Develop and implement a Stakeholder Engagement Plan (SEP), inclusive of a communications plan for the 'mine village'.<br>▪ Undertake a skills survey in the local community, allowing local residents to register their interest and particular skills for upcoming job opportunities.<br>▪ Reduce the 30% employment target for Gauteng (as per the SLP) based on the outcome of the skills survey, i.e. if required skills are found in the mine village, | Compliance with SLP | Operational Phase |

| Activities | Phase | Size and scale of disturbance | Mitigation Measures | Compliance with standards | Time period for implementation |
|---|---|---|---|---|---|
| | | | rather increase the 70% local employment target to ensure maximum uptake of local residents.<br>▪ Establish a local labour desk where interested work seekers can register and provide proof of qualifications and experience. The labour desk must consider previous employees. The desk should be operated by an independent party to prevent nepotistic requirement and increase local confidence that the mine is following a fair and transparent process.<br>▪ Explore the possibility of expanding job opportunities beyond mining-related work to also include hiring contract workers to assist with LED projects.<br>▪ Comply with minimum wage requirements for unskilled labour and all other requirements of the Employment Equity Act to ensure maximum benefits accrue to workers. | | |
| Operation of the underground mine, conveyors, processing plants, haulage, etc. | Operational | Regional | ▪ Develop a Social Investment Strategy. This is additional voluntary investment that the mine makes in the sustainable development of the local communities and can include supporting development projects on a regional (district or province) level (often this can be done by financing a certain project through a local NGO).<br>▪ Avoid investing in philanthropy projects only (i.e. building or repairing infrastructure, providing food parcels, etc.) – although these projects are 'quick wins' necessary for the mine to win the trust of the local community, it creates the expectation that the mine will continue to, for example, maintain the infrastructure they built, which ceases when the mine suspends operations (as is currently experienced in the mine village).<br>▪ Local developmental NGOs who have the experience to implement sustainable development projects are key stakeholders in determining community development projects that are not mine dependent and can continue past the LoM.<br>▪ Be slow in making promises to the community to first ensure that commitments are well researched and feasible. | Compliance with SLP | Operational Phase |
| Mine water management | Operational | Limited to water management infrastructure to ensure impacts do not exceed the mine boundary. | ▪ Runoff from dirty areas should be directed to the existing storm water management infrastructure (PCDs) and should not be allowed to flow into the stream, unless DWS discharge authorisation has been granted upon compliance with relevant effluent discharge standards as stipulated in the NWA. The PCDs and dirty water channels should be lined either by concrete or High Density Polyethylene (HDPE) to prevent contamination of groundwater through seepage;<br>▪ Water quality monitoring should continue downstream and upstream of the mine site, and within all surface water circuits at the mine to detect any contamination arising from operational activities;<br>▪ Vehicles must only be serviced within designated service bays.<br>▪ The management of general and other forms of waste must ensure collection and disposal into clearly marked skip bins that can be collected by approved contractors for disposal to the appropriate disposal sites; and | NWA GN 704 requirements regarding stormwater management for mining activities it is noted that all clean and dirty water must be separated.<br>NEM:BA<br>NEMA<br>Mining and Biodiversity Guideline (DEA et al., 2013) | Operational Phase |

| Activities | Phase | Size and scale of disturbance | Mitigation Measures | Compliance with standards | Time period for implementation |
|---|---|---|---|---|---|
| | | | ▪ The hydrocarbon and chemical storage areas and facilities must be located on a hard-standing area (paved or concrete surface that is impermeable), roofed and bunded in accordance with SANS1200 specifications. This will prevent mobilisation of leaked hazardous substances. | | |
| Mine water management | Operational | Limited to mine site | ▪ Disturbance of soils during infrastructure demolition should be restricted to relevant footprint areas;<br>▪ Movement of demolition machinery and vehicles should be restricted to designated access roads to minimise the extent of soil disturbance;<br>▪ The best option to limit AMD is early avoidance of sulphide oxidation through use of a combination of several techniques which include the following (Sahoo et al., 2013):<br>  ▪ Electrochemical treatment of the acidified effluent producing re-usable water;<br>  ▪ Physical barriers using wet or dry covers that retard sulphide oxidation;<br>  ▪ Chemical passivation, which involves encapsulation of sulphide surfaces using organic and/or inorganic coatings such as silica, phosphate, lipids and humic acid; and<br>  ▪ Desulphurization which separates sulphide minerals into a low-volume stream, that mainly results in non-acid-generating waste with low sulphur content.<br>  ▪ Use of accredited contractors for removal or demolition of infrastructure is recommended; this will reduce the risk of waste generation and accidental spillages;<br>  ▪ Should decant occur at a later stage, decant water should be treated to acceptable water quality levels prior to discharge into the natural stream | NWA GN 704<br>NEM:AQA<br>NEM:BA<br>NEMA<br>Mining and Biodiversity Guideline (DEA et al., 2013) | Operational Phase |
| Mine water management | Operational | Limited to areas of activity and immediate surrounds | ▪ Ensure proper dust protection mechanisms are in place to reduce sedimentation and contamination of the wetland systems due to the TSFs, with special mention of TSF No. 1, TSF No. 6 and TSF No. 7;<br>▪ Ensure continued testing of the water quality of decant and ensure treatment is of a suitable standard if necessary, before discharging into the Wonderfonteinspruit. Ensure decant is suitably discharged so as not to cause channelization of the wetland;<br>▪ Both RWDs are in close proximity to the freshwater resources present. It should be ensured that there is no leaching of harmful substances into the freshwater resources;<br>▪ Biomonitoring is recommended to be conducted by suitably qualified wetland and aquatic ecologists.<br>▪ Toxicological testing is recommended to take place on the freshwater resources present at least once annually or prior to any planned discharges on at least three trophic levels. This will help to determine any impacts to the aquatic communities present as a result of seepage or spills and in the case of any planned discharges, to determine a safe dilution ratio. | NWA GN 704<br>NEM:AQA<br>NEM:BA<br>NEMA<br>Mining and Biodiversity Guideline (DEA et al., 2013) | Operational Phase |

| Activities | Phase | Size and scale of disturbance | Mitigation Measures | Compliance with standards | Time period for implementation |
|---|---|---|---|---|---|
| | | | ▪ Limit the footprint area of the operational activities to what is absolutely essential in order to minimise impacts as a result of any potential vegetation clearing and compaction of soils (all areas but critically so in freshwater areas);<br>▪ If it is unavoidable that any of the freshwater areas present will be affected, disturbance must be minimised and suitably rehabilitated;<br>▪ Ensure that no incision and canalisation of the freshwater features present takes place as a result of the proposed operational activities;<br>▪ All erosion noted within the operational footprint as a result of any potential surface activities should be remedied immediately and included as part of the ongoing rehabilitation plan;<br>▪ A suitable AIP control programme must be put in place so as to prevent further encroachment as a result of disturbance to the surrounding terrestrial zones;<br>▪ All areas of increased ecological sensitivity should be designated as “No-Go” areas and be off limits to all unauthorised vehicles and personnel;<br>▪ No unnecessary crossing of the wetland features, instream areas and their associated buffers, as well as the constructed berms or canals should take place and the substrate conditions of the wetlands, instream areas and downstream stream connectivity must be maintained;<br>▪ No vehicles or heavy machinery may be allowed to drive indiscriminately within any freshwater areas and their associated zones of regulation. All vehicles must remain on demarcated roads;<br>▪ All vehicles must be regularly inspected for leaks;<br>▪ Re-fuelling must take place on a sealed surface area away from freshwater features to prevent ingress of hydrocarbons into topsoil;<br>▪ All spills should be immediately cleaned up and treated accordingly;<br>▪ Appropriate sanitary facilities must be provided for the duration of the operational activities and all waste must be removed to an appropriate waste facility;<br>▪ Monitor all systems for erosion and incision;<br>▪ All erosion noted within the footprint should be remedied immediately and included as part of an ongoing rehabilitation plan;<br>▪ Ensure soil management programme is implemented and maintained to minimise erosion and sedimentation;<br>▪ All soils compacted as a result of construction activities should be ripped/scarified (<300mm) and profiled (see the Soil Specialist Report for more information);<br>▪ Permit only essential personnel within the 100m zones of regulation for all freshwater features identified; and<br>▪ Ongoing wetland rehabilitation is necessary during the operational phase as stipulated in the monitoring section. | | |
| Mine water management | Operational | Regional | ▪ Manage the influx of people;<br>▪ The quality of groundwater and surface water must be monitored to ensure that the Project does not have any detrimental effects on community water sources; | Compliance with SLP | Operational Phase |

| Activities | Phase | Size and scale of disturbance | Mitigation Measures | Compliance with standards | Time period for implementation |
|---|---|---|---|---|---|
| | | | ▪ Conduct baseline water and sanitation studies on communities based on accepted health indicators;<br>▪ Monitor for groundwater organics, bi-annually, including: Total Coliform, E. Coli and Heterotrophic plate count;<br>▪ Ensure proper disposal of human waste that is generated from the Project;<br>▪ Ensure proper waste management from Project generated waste according to waste management principles;<br>▪ Support the local authority in supporting and improving water and sanitation services, including the collection and disposal of waste in the communities;<br>▪ Establish water and sanitation committees in the communities to manage their own water and sanitation services. This will improve sustainability of any outreach support;<br>▪ Support information campaigns in the community on water use, hygiene and general sanitation; and<br>▪ Depending on the results of the baseline data gathering, support the government's school deworming programme in partnership with local authorities. | | |
| Operation of the underground mine, conveyors, processing plants, haulage, etc. | Operational | Operational areas | ▪ Develop a dust management plan;<br>▪ Application of wetting agents, dust suppressant or binders on the exposed area;<br>▪ Vegetation of exposed area;<br>▪ Use of electrostatic precipitators; and<br>▪ Dust extractor system. | NEM:AQA | Operational Phase |
| Demolition and removal of all infrastructure, including transporting materials off site | Decommissioning | Areas of disturbance on site | ▪ Disturbance of soils during infrastructure demolition should be restricted to relevant footprint areas;<br>▪ Movement of demolition machinery and vehicles should be restricted to designated access roads to minimise the extent of soil disturbance;<br>▪ The best option to limit AMD is early avoidance of sulphide oxidation through use of a combination of several techniques which include the following (Sahoo et al., 2013):<br>  ▪ Electrochemical treatment of the acidified effluent producing re-usable water;<br>  ▪ Physical barriers using wet or dry covers that retard sulphide oxidation;<br>  ▪ Chemical passivation, which involves encapsulation of sulphide surfaces using organic and/or inorganic coatings such as silica, phosphate, lipids and humic acid; and<br>  ▪ Desulphurization which separates sulphide minerals into a low-volume stream, that mainly results in non-acid-generating waste with low sulphur content.<br>  ▪ Use of accredited contractors for removal or demolition of infrastructure is recommended; this will reduce the risk of waste generation and accidental spillages; | NWA GN 704<br>NEM:AQA<br>NEM:BA<br>NEMA<br>Mining and Biodiversity Guideline (DEA et al., 2013) | Decommissioning and Post-Closure |

| Activities | Phase | Size and scale of disturbance | Mitigation Measures | Compliance with standards | Time period for implementation |
|---|---|---|---|---|---|
| | | | ▪ Should decant occur at a later stage, decant water should be treated to acceptable water quality levels prior to discharge into the natural stream | | |
| Demolition and removal of all infrastructure, including transporting materials off site | Decommissioning | Areas of demolition and immediate surrounds | ▪ Ensure maintenance of TSFs to reduce dust pollution;<br>▪ Test the water quality of decant and treat if necessary, before discharging into the Wonderfonteinspruit. Decant should be discharged diffusely so as not to cause channelization of the wetland;<br>▪ Ensure that sound environmental management is in place during the proposed decommissioning phase;<br>▪ Limit the footprint area of the decommissioning and rehabilitation activities to what is absolutely essential in order to minimise impacts as a result of vegetation clearing and compaction of soils (all areas but critically so in wetland areas);<br>▪ All erosion noted within the decommissioning area footprint should be remedied immediately and included as part of the ongoing rehabilitation plan;<br>▪ All soils compacted as a result of decommissioning activities should be ripped/scarified (<300mm) and profiled;<br>▪ Permit only essential personnel within the zones of regulation for all freshwater features identified;<br>▪ Wherever possible, restrict decommissioning activities to the drier winter months to avoid sedimentation of the freshwater resources further downstream;<br>▪ No material may be dumped or stockpiled within any wetland areas (or the buffers) in the vicinity of the proposed decommissioning footprint;<br>▪ Freshwater resources and their associated zones of regulation are to be clearly demarcated and avoided wherever possible;<br>▪ An AIP management plan to be implemented and managed for the life of the proposed decommissioning, rehabilitation, closure and post-closure phases;<br>▪ As much vegetation growth as possible should be promoted within the proposed development area during all phases. In order to protect soils, vegetation clearance should be kept to a minimum;<br>▪ Monitor all freshwater systems for erosion and incision;<br>▪ All areas where active erosion is observed should be ripped, re-profiled and seeded with indigenous grasses;<br>▪ No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas and their associated zones of regulation. All vehicles must remain on demarcated roads and within the project area footprint;<br>▪ Compacted soils should be ripped, re-profiled and re-seeded;<br>▪ All vehicles must be regularly inspected for leaks;<br>▪ Re-fueling must take place at a diesel facility on a sealed and bunded surface area away from wetlands to prevent ingress of hydrocarbons into topsoil;<br>▪ All existing litter, debris should be removed from the freshwater systems and littering should be prohibited on an ongoing basis;<br>▪ All spills from machinery should be immediately cleaned up and treated accordingly; | NWA GN 704<br>NEM:AQA<br>NEM:BA<br>NEMA<br>Mining and Biodiversity Guideline (DEA et al., 2013) | Decommissioning and Post-Closure |

| Activities | Phase | Size and scale of disturbance | Mitigation Measures | Compliance with standards | Time period for implementation |
|---|---|---|---|---|---|
| | | | ▪ Appropriate sanitary facilities must be provided for the duration of the rehabilitation activities and all waste must be removed to an appropriate waste facility; and<br>▪ Monitoring should be carried out as specified in the monitoring programme. | | |
| Rehabilitation, including spreading of soil, re-vegetation and profiling or contouring, and post-closure monitoring | Decommissioning | Mine site and areas outside of the mining boundaries related to monitoring | ▪ Ensure maintenance of TSFs to reduce dust pollution;<br>▪ Test the water quality of decant and treat if necessary, before discharging into the Wonderfonteinspruit. Decant should be discharged diffusely so as not to cause channelization of the wetland;<br>▪ Ensure that sound environmental management is in place during the proposed decommissioning phase;<br>▪ Limit the footprint area of the decommissioning and rehabilitation activities to what is absolutely essential in order to minimise impacts as a result of vegetation clearing and compaction of soils (all areas but critically so in wetland areas);<br>▪ All erosion noted within the decommissioning area footprint should be remedied immediately and included as part of the ongoing rehabilitation plan;<br>▪ All soils compacted as a result of decommissioning activities should be ripped/scarified (<300mm) and profiled;<br>▪ Permit only essential personnel within the zones of regulation for all freshwater features identified;<br>▪ Wherever possible, restrict decommissioning activities to the drier winter months to avoid sedimentation of the freshwater resources further downstream;<br>▪ No material may be dumped or stockpiled within any wetland areas (or the buffers) in the vicinity of the proposed decommissioning footprint;<br>▪ Freshwater resources and their associated zones of regulation are to be clearly demarcated and avoided wherever possible;<br>▪ An AIP management plan to be implemented and managed for the life of the proposed decommissioning, rehabilitation, closure and post-closure phases;<br>▪ As much vegetation growth as possible should be promoted within the proposed development area during all phases. In order to protect soils, vegetation clearance should be kept to a minimum;<br>▪ Monitor all freshwater systems for erosion and incision;<br>▪ All areas where active erosion is observed should be ripped, re-profiled and seeded with indigenous grasses;<br>▪ No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas and their associated zones of regulation. All vehicles must remain on demarcated roads and within the project area footprint;<br>▪ Compacted soils should be ripped, re-profiled and re-seeded;<br>▪ All vehicles must be regularly inspected for leaks;<br>▪ Re-fueling must take place at a diesel facility on a sealed and bunded surface area away from wetlands to prevent ingress of hydrocarbons into topsoil;<br>▪ All existing litter, debris should be removed from the freshwater systems and littering should be prohibited on an ongoing basis; | NWA GN 704<br>NEM:AQA<br>NEM:BA<br>NEMA<br>Mining and Biodiversity Guideline (DEA et al., 2013) | Decommissioning and Post-Closure |

| Activities | Phase | Size and scale of disturbance | Mitigation Measures | Compliance with standards | Time period for implementation |
|---|---|---|---|---|---|
| | | | ▪ All spills from machinery should be immediately cleaned up and treated accordingly;<br>▪ Appropriate sanitary facilities must be provided for the duration of the rehabilitation activities and all waste must be removed to an appropriate waste facility; and<br>▪ Monitoring should be carried out as specified in the monitoring programme. | | |
| | Decommissioning | Mine site and areas outside of the mining boundaries related to monitoring | ▪ Disturbance of soils during infrastructure demolition should be restricted to relevant footprint areas;<br>▪ Movement of demolition machinery and vehicles should be restricted to designated access roads to minimise the extent of soil disturbance;<br>▪ The best option to limit AMD is early avoidance of sulphide oxidation through use of a combination of several techniques which include the following (Sahoo et al., 2013):<br>▪ Electrochemical treatment of the acidified effluent producing re-usable water;<br>▪ Physical barriers using wet or dry covers that retard sulphide oxidation;<br>▪ Chemical passivation, which involves encapsulation of sulphide surfaces using organic and/or inorganic coatings such as silica, phosphate, lipids and humic acid; and<br>▪ Desulphurization which separates sulphide minerals into a low-volume stream, that mainly results in non-acid-generating waste with low sulphur content.<br>▪ Use of accredited contractors for removal or demolition of infrastructure is recommended; this will reduce the risk of waste generation and accidental spillages;<br>▪ Should decant occur at a later stage, decant water should be treated to acceptable water quality levels prior to discharge into the natural stream | NWA GN 704<br>NEM:AQA<br>NEM:BA<br>NEMA<br>Mining and Biodiversity Guideline (DEA et al., 2013) | Decommissioning and Post-Closure |

# 5 Item 1(f): Impact Management Actions

Table 5-1 provides a description of impact management actions for the impacts identified for this Scope of Work, and the manner in which the impact management objectives and outcomes will be achieved.

**Table 5-1: Impact Management Actions**

| Activity | Potential Impact | Aspects Affected | Mitigation Type | Compliance with Standard | Time Period for Implementation |
|---|---|---|---|---|---|
| Site clearing where vegetation has re-established Reconstruction of metallurgical plants and other mining infrastructure | Siltation of the Mooi River Loop, Wonderfonteinspruit and Greenbelt Streams leading to deterioration of water quality | Surface Water | Reduce through limiting vegetation clearance and stockpile maintenance | To prevent surface water contamination | Construction |
| | Compaction of soils, increased potential for erosion and sedimentation loss of natural vegetation, and increased invasive/alien vegetation | Wetlands | Reduce through limiting vegetation access, avoid by preventing alien species establishment | Minimise loss of habitat, compliance with NEM:BA | Construction |
| Reconstruction of metallurgical plants and other mining infrastructure | Refurbishment of the ventilation shaft and Plant will lead to the generation of fugitive dust comprising TSP, $PM_{10}$ and $PM_{2.5}$ | Air Quality | Avoid through responsible construction activity management | NEM:AQA | Construction |
| | Project-induced in-migration can have ripple impacts on social cohesion and place additional strain on limited resources (e.g. housing and basic services) | Socio-economic | Avoid through sufficient and clear communication with the local communities | Compliance with SLP & LED | Construction |
| | Negative perceptions of the mine affecting resident's sense of well-being | Socio-economic | Rectify through frequent and transparent communication with the community | Ensuring Social Licence to Operate | Construction |
| | Conflict as a result of limited opportunities and sudden change can give rise to social mobilisation that can threaten the continued operation of the mine | Socio-economic | Avoid and/or reduce through proper employment advertisement and re-employing as many staff from the previous operation as possible | Compliance with SLP & LED | Construction |
| | Exposure to refuse and raw sewage | Community Health | Reduce – ensure all services are effectively implemented, such as sewerage plant reimplementation | Best environmental practice | Operational |
| Temporary storage of hazardous products, including fuel | Contamination of water in the Mooi River Loop, Wonderfonteinspruit and Greenbelt Streams and subsequent deterioration of water quality for downstream water users. | Surface Water | Avoid through effective surface water management infrastructure monitoring and maintenance | To prevent contamination of surface water resources | Construction |
| All construction activities | Employment and income generation that could assist in uplifting households in the local village | Socio-Economic | Rectify through effective implementation of locally sourced labour | Compliance with SLP & LED | Construction |
| Operation of the underground mine, conveyors, processing plants, haulage, etc. | Dust will be airborne, with particulates such as TSP, PM10, and PM2.5 leading to nuisance effect, reduction in the quality of air, with potential health and environmental implications from exposure | Air Quality | Avoid or reduce through responsible management practices and effective monitoring | NEM:AQA | Operational |

| Activity | Potential Impact | Aspects Affected | Mitigation Type | Compliance with Standard | Time Period for Implementation |
|---|---|---|---|---|---|
| | Reduction in air quality due to the emission of particulates | Air Quality | Avoid through effective dust suppression and TSF management | NEM:AQA | Operational |
| | Reduction in air quality due to the emission of particulates through the ventilation shaft | Air Quality | Reduce through improved ventilation technology to reduce surface emissions without trapping underground | NEM:AQA | Operational |
| | Exposure to potentially hazardous PM in the air | Community Health | Rectify and avoid through implementing mitigation measures and monitoring plans | Compliance with SLP and best practice guidelines | Operational |
| | The Project will generate income in the form of wages, taxes and royalties that all add to economic benefits to the local area | Socio-economic | Enhance through local economy support such as local procurement | Compliance with SLP & LED | Operational |
| | Implementation of LED projects will address some legacy issues | Socio-economic | Enhance through sustainable, long-term LED projects which can operate independently of the mine | Compliance with SLP & LED | Operational |
| Mine water management | In-stream water quality deterioration from runoff contaminated areas and any dirty water discharges such as treated sewage effluent into nearby watercourses | Surface Water | Rectify through implementing monitoring programme and addressing issues as they arise | Monitoring compliance, WUL compliance and preventing contamination on site | Operational |
| | Hydrocarbon and chemical spillages and leakages from haulage trucks and machinery resulting in water quality deterioration | Surface Water | Avoid through vehicle maintenance and proper storage of hazardous materials, such as cyanide | To prevent contaminated runoff from entering surface water resources | Operational |
| | Contamination of water resources resulting in reduced quality | Wetlands and Aquatic Ecology | Rectify through reinstatement of water management infrastructure | Compliance with NWA | Operational |
| | Decant, erosion, sedimentation reducing water quality | Wetlands and Aquatic Ecology | Rectify by reinstating surface water management on site, implementing effective water management around TSFs, implement monitoring programmes and address issues timeously | Compliance with NWA and proposed monitoring programmes | Operational |
| | Consuming contaminated water | Community Health | Avoid by having sufficient water quality data prior to dewatering into Wonderfonteinspruit | Compliance with the Constitution and NWA | Operational |
| | Dewatering; reducing water quality, increasing turbidity, altering ecology | Wetlands and Aquatic Ecology | Avoid and rectify by having sufficient water quality data prior to dewatering into Wonderfonteinspruit | Compliance with NWA, WUL and monitoring requirements | Operational |

| Activity | Potential Impact | Aspects Affected | Mitigation Type | Compliance with Standard | Time Period for Implementation |
|---|---|---|---|---|---|
| Demolition and removal of all infrastructure, including transporting materials off site | In-stream water quantity and quality deterioration | Surface Water | Avoid through effective on-site management and planning prior to any decommissioning activities commence | Compliance with NWA, WUL and monitoring requirements | Decommissioning |
| | Erosion and general scouring from sedimentation, as well as degraded habitat due to water quality deterioration will affect the local watercourse and river reaches directly downstream. | Wetlands | Avoid through effective on-site management and planning prior to any decommissioning activities commence | Compliance with NWA, WUL and monitoring requirements | Decommissioning |
| Rehabilitation, including spreading of soil, re-vegetation and profiling or contouring, and post-closure monitoring | In-stream water quality deterioration | Surface Water | Avoid/rectify through responsible and thorough monitoring programmes | Compliance with NWA, WUL and monitoring requirements | Decommissioning |
| | Decant resulting in degraded water quality | Wetlands | Rectify through decant management for the assumed period when decant is expected to occur | Compliance with NWA, WUL and monitoring requirements | Decommissioning |
| | Erosion and general scouring from sedimentation, as well as degraded habitat due to water quality deterioration will affect the local watercourse and river reaches directly downstream | Wetlands | Avoid/rectify through responsible and thorough monitoring programmes | Compliance with NWA, WUL and monitoring requirements | Decommissioning |
| All activities | Continued lack of environmental mitigation measures has caused fear amongst local residents and impacted on their health | Socio-economic | Rectify legacy issues through continued and transparent communication with the affected community | Compliance with NWA, NEMA, NEMWA, MPRDA and best practice | All phases |

# 6 Financial Provision

## 6.1 Item (i)(1): Determination of the amount of Financial Provision

Regulation 6 of the Financial Provision Regulations (GN R1147 in GG 39425 of 20 November 2015) requires that an applicant for a mining right must determine the financial provision calculation based on the actual costs required for:

- Annual rehabilitation;
- Final rehabilitation, decommissioning and closure; and
- The remediation of latent or residual environmental impacts including but not limited to the pumping and treatment of polluted or extraneous water.

### 6.1.1 Item (i)(1)(a): Describe the closure objectives and the extent to which they have been aligned to the baseline environment described under Regulation 22 (2) (d) as described in 2.4 herein

Closure and rehabilitation is a continuous series of activities that begin with planning prior to the project's design and construction, and end with achievement of long-term site stability and the establishment of a self-sustaining ecosystem. Not only will the implementation of this concept result in a more satisfactory environmental conclusion, but it will also reduce the financial burden of closure and rehabilitation.

The following points outline the main objectives for rehabilitation and closure:

- Achieve a final land use that is sustainable and meets both legislative requirements and stakeholder needs.
- Maintain and monitor all rehabilitated areas following re-vegetation and, if this monitoring shows that the objectives have been met, make an application for closure;
- Comply with local, district and national regulatory requirements; and
- Follow a comprehensive consultation and communication process with all stakeholders.

Rehabilitation and closure objectives have been tailored to the project at hand. This Rehabilitation, Decommissioning and Mine Closure Plan aims to assist Blyvoor Gold in carrying out successful rehabilitation of the Project area.

### 6.1.2 Item (i)(1)(b): Confirm specifically that the environmental objectives in relation to closure have been consulted with landowner and interested and affected parties

The Closure report is attached in Appendix 13 and is subject to public comment. Any comments received during the public review period will be included in the comments and responses report.

### 6.1.3 Item (i)(1)(c): Provide a rehabilitation plan that describes and shows the scale and aerial extent of the main mining activities, including the anticipated mining area at the time of closure

This section provides the rehabilitation strategy for the Project. Refer to Appendix 13 for the complete Rehabilitation and Closure Report.

#### 6.1.3.1 *Soil Management*

Soil management measures typically include the following:

- The rehabilitated area will be profiled to replicate, as far as possible, the natural landform;
- When there is insufficient soil material for use, select suitable sub surface materials (i.e. those that are neither saline nor sodic) as a substitute for soil when covering rehabilitated areas; and
- Ensuring organic content is sufficient to sustain microbial activity, encourage infiltration, limit runoff and improve soil stability. As far is practicable, mulch with grass clippings (cut when seed content is at its highest) as an attempt to provide a seed bank.

#### 6.1.3.2 *Shaping and Levelling*

Disturbed areas should, where possible, be shaped and levelled back to original pre-construction ground level and should be free draining.

#### 6.1.3.3 *Soil Compaction Alleviation*

To alleviate or reduce soil compaction the following will take place:

- Rip all disturbed footprints and heavily compacted areas (hard pans, access roads) to a depth of 0.3 m;
- Soil will be ripped when moist to allow for maximum alleviation of compaction; and
- Soils must be de-compacted and/or replaced when they are dry to minimise compaction.

#### 6.1.3.4 *Soil Amelioration*

Soil amelioration should be done as follows:

- Following de-compaction, an acceptable seed-bed should be produced through surface tillage;
- Soil must be sampled and analysed for pH, exchangeable cations, phosphorus, soil texture, soil organic carbon and heavy metals once placed on rehabilitated areas; and

- Fertiliser (mainly Nitrogen, Phosphorus and Potassium) based on soil condition, must be applied, where required, to raise the soil nutrient content to the desired levels and maintenance should continue.

#### 6.1.3.5 *Erosion Control*

The following should be done as part of erosion control on rehabilitated land:

- Unnecessary disturbance and vegetation removal should be avoided and prevented;
- If any erosion occurs, corrective actions must be taken to minimise any further erosion from taking place;
- Restriction of vehicle movement over sensitive and rehabilitated areas to reduce compaction
- Pre-development drainage patterns should be reinstated as far possible; and
- Rehabilitated areas must be monitored monthly for erosion.

#### 6.1.3.6 *Vegetation Establishment*

The establishment of natural vegetation is a necessary component of the decommissioning and rehabilitation phase. The overall objectives for the establishment of natural vegetation of reshaped areas are to:

- Prevent erosion;
- Avoid soil loss;
- Restore the land to the agreed land capability;
- Reduce sedimentation into aquatic ecosystems such as rivers and streams;
- Re-establish eco-system processes (succession) to ensure that a sustainable land use can be established without requiring excessive fertiliser additions; and
- Restore the biodiversity of the area as far as possible.

To ensure vegetation establishment, the following should be done:

- Rehabilitated areas should be properly prepared;
- Shaped areas must be covered with suitable growth medium; and
- Growth properties should be improved by the addition of organic matter and fertilizer, where required.

To ensure successful rehabilitation of the Project area, it is important to note vegetation types such as the Carletonville Dolomite Grassland and Gauteng Shale Mountain Bushveld so that these can be replaced to some extent once operations have been completed.

#### 6.1.3.7 *Alien Invasive Species Management*

Alien invasive species tend to out-compete the indigenous vegetation; this is due to the fact that they are vigorous growers that are adaptable and able to invade a wide range of ecological niches (Bromilow, 2010). They are tough, can withstand unfavourable conditions and are easily spread which is detrimental to rehabilitation of vegetation.

Alien Invasive Plants (AIPs) directly compete with rehabilitating vegetation and could result in increasing costs of revegetation in the long term. In addition, various invasive species are required by law to be removed. Methods should be used that are appropriate for the species concerned, as well as for the ecosystem in which they occur.

When performing the controlling methodology for weeds and invaders, damage to the environment must be limited to a minimum. One of the most cost-effective and sustainable options is to utilise biocontrol. Biocontrol makes use of a natural enemy of the AIP in its native country to help reduce the population in the country it invades (see the Agricultural Research Council website for more information on Biocontrol). If mechanical and chemical means need to be used, AIPs must be continually removed after rehabilitation has occurred for at least three growing seasons to ensure the seed bank is depleted. Continual monitoring will be needed for seeds that are likely to be blown in from adjacent areas.

Blyvoor Gold must note the following to manage AIP:

- There must be no planting of alien plants (e.g. *Nicotiana glauca* (Wldetabak); *Asclepias fruticose* (Melkbos, Wildekapok); *Pennisetum setaceum* (Fountain grass) and *Sutherlandia frutescens* (Kankerbossie).) anywhere within the project area;
- The transportation of soils or other substrates infested with alien species should be strictly controlled; and
- It is essential that appropriate veld management (particularly appropriate grazing levels and burning frequencies) should be applied to areas of secondary indigenous vegetation (e.g. secondary grassland of historically cultivated areas), and especially the grassland and wetland vegetation of untransformed habitats. Appropriate grazing levels and burning frequencies will not only ensure that good vegetation condition and biodiversity levels are maintained, but will also serve to control the spread and increase in cover of palatable alien species such as *Paspalum dilatatum*.

To manage alien invasive species the following is recommended:

- Mechanical methods including tree felling, hand pulling and ring barking must be implemented;
- Chemical control methods including selective/ non-selective, contact/ systemic herbicides as per regulations must be implemented;
- Category 1(a), and 1(b) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) listed species must be targeted for eradication;

- Preventative measures should be undertaken within the mine site area where natural vegetation occurs to combat bush encroachment and invasion of alien species which may result in the deterioration of natural resources; and
- Regular vegetation monitoring of the site must take place.

### 6.1.4 Item (i)(1)(d): Explain why it can be confirmed that the rehabilitation plan is compatible with the closure objectives

The Rehabilitation Plan has been compiled in support of the primary closure objectives which are to remove unwanted infrastructure and rehabilitate the land to a suitable mixed end land use which provides a safe and stable environment for surrounding receptors.

### 6.1.5 Item (i)(1)(e): Calculate and state the quantum of the financial provision required to manage and rehabilitate the environment in accordance with the applicable guideline

Digby Wells calculated the financial provision for the Project according to the Department of Mineral Resources (DMR) guidelines set out by the 2005 *"Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provision Provided by a Mine"*. The guidelines outline the methods for infrastructure removal and rehabilitation required for closure.

#### 6.1.5.1 *Financial Provision Estimate*

The estimated overall financial provision required for the rehabilitation and closure of all three entities of Blyvoor Gold is **R 383 738 316.00** (Excl. VAT). A summary of the financial provision estimate is presented in Table 6-1 below.

**Table 6-1: Summary of the overall financial provision for the three entities of Blyvoor Gold**

| DIGBY WELLS ENVIRONMENTAL | **Digby Wells Environmental**<br>**Blyvoor Gold Capital (Pty) Ltd – MR143GP, BVG4880**<br>**Revision 0** |
|---|---|
| **Description** | **DMR Financial Provision Assessment** |
| Blyvoor Gold Capital | R 47 858 994 |
| Blyvoor Gold Operations | R 221 443 958 |
| "The Orphans" | R 114 435 363 |
| **GRAND TOTAL** | **R 383 738 316** |

### 6.1.6 Item (i)(1)(f): Confirm that the financial provision will be provided as determined

Blyvoor Gold is the holder of the Mining Right and is therefore liable for the financial provisioning. A liability assessment will also need to be undertaken annually to ensure the financial provision is in line with the closure cost.

# 7 Items 1(g) – (k): Monitoring, Frequency, Reporting, Responsible Persons, Timeframes and Mechanisms for Monitoring Compliance of Impact Management Actions

Blyvoor Gold will be responsible for the implementation of all monitoring, mitigation and management measures, as well as compliance with the EMP. The recommended monitoring programme for the mine is detailed below. The applicant will keep a record of all environmental monitoring taken on site. This section must be read in conjunction with Table 7-5.

## 7.1 Groundwater

Groundwater monitoring should be undertaken to establish the following:

- Groundwater level trends, through sampling; and
- Groundwater quality trends, through sampling. Constituents to be monitored include: .

Groundwater quality should be monitored to allow for early detection and mitigation implementation. Groundwater levels should be monitored to detect any changes or trends in groundwater elevation and flow direction.

A total of nine monitoring locations are proposed, located upstream and downstream of the project area, in proximity to the TSFs are located. TSF6 and alternatively TSF4 and 5 are planned to be operational during the life of mine, however groundwater monitoring is established to monitor any potential contamination that may emanate from all the existing TSFs. Liner installation cannot be accommodated for the existing facilities however due to the absence of a liner at all facilities a concern regarding their impact to the groundwater arises. It is therefore important to monitor the potential impact from the facilities observing groundwater quality and level trends, during and post operation.

Due to the absence of groundwater level data, certainty regarding the groundwater flow direction will be established once boreholes are drilled upon project initiation. The monitoring network will then be refined accordingly. Table 7-1 lists the location of the proposed monitoring boreholes locations, as shown in Figure 7-1.

**Table 7-1: Proposed monitoring boreholes**

| Site ID | Latitude | Longitude |
|---|---|---|
| BVG1 | -26.373097 | 27.319115 |
| BVG2 | -26.378243 | 27.364068 |
| BVG3 | -26.373279 | 27.390034 |

| Site ID | Latitude | Longitude |
|---|---|---|
| BVG4 | -26.40753 | 27.3509 |
| BVG5 | -26.40472 | 27.375687 |
| BVG6 | -26.402087 | 27.405221 |
| BVG7 | -26.429268 | 27.393803 |
| BVG8 | -26.448836 | 27.353546 |
| BVG9 | -26.423 | 27.322303 |

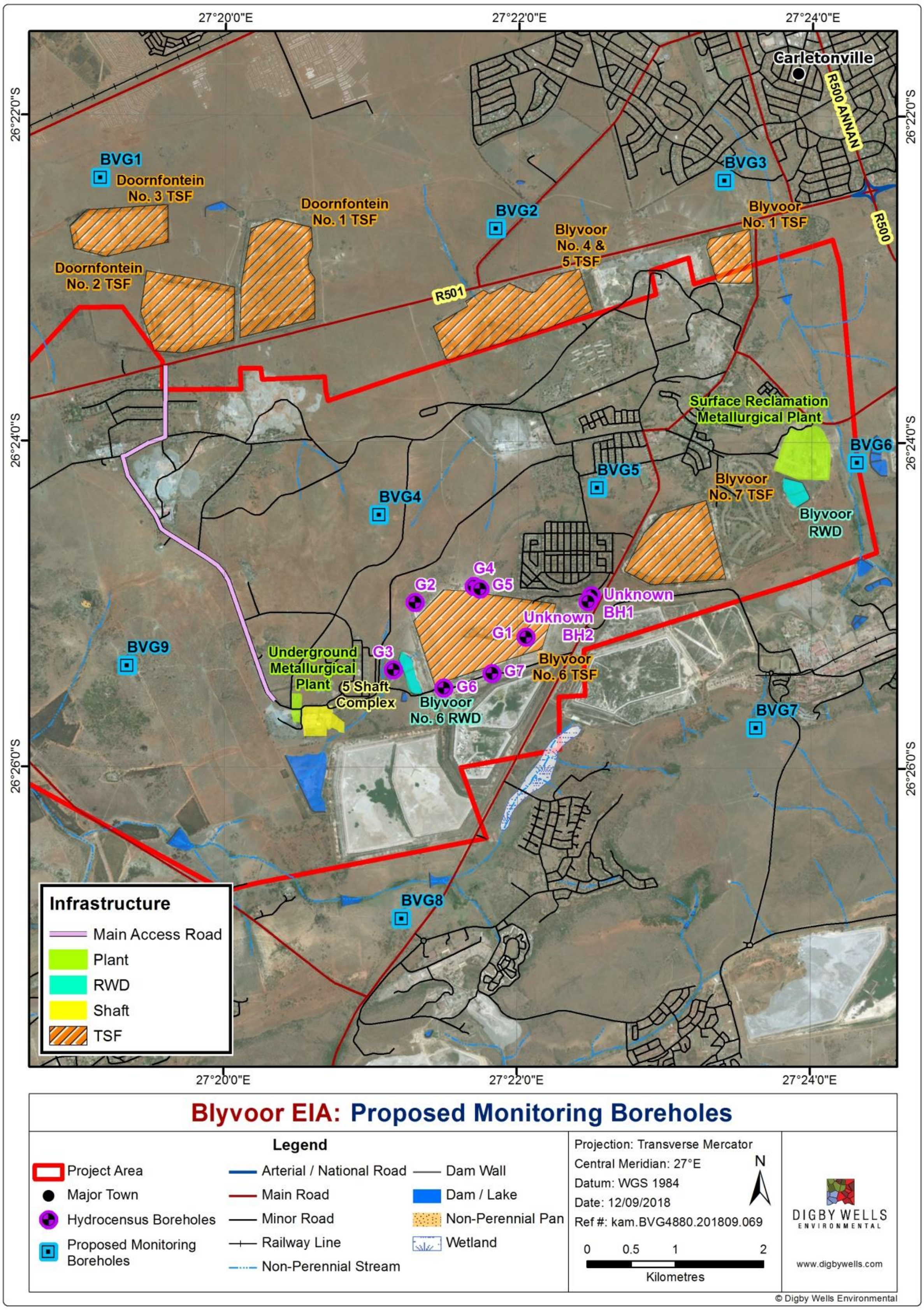



**Figure 7-1: Proposed monitoring network**

### 7.1.1 Water Sampling and Preservation

When sampling the following procedures are proposed:

- One-litre plastic bottles with a cap are required for the sampling exercises;
- Glass bottles are required if organic constituents are to be tested;
- Collected samples must be stored in a cooler box or fridge while on site; and
- Sample bottles should be marked clearly with the borehole name, date of sampling, sampling depth and the sampler's name and submitted to an accredited laboratory.

### 7.1.2 Sampling Frequency

Monitoring of inorganic constituents should be conducted quarterly to reflect influences of wet and dry seasons and monitoring of organic constituent should be conducted biannually. The sampling frequency could be adjusted following the groundwater quality trend analysis.

It is suggested that quarterly samples be collected, extending up to two years post closure and based on the trends it can be adjusted until a sustainable situation is reached and after it has been signed off by the authorities.

### 7.1.3 Parameters to be Monitored

Parameters to be monitored are the following:

- Inorganics:
  - TDS, EC, pH, Alkalinity;
  - Major ions i.e. Ca, Mg, Na, K, $SO_4$, $NO_3$, F, Cl; and
  - Minor and trace metals, including As, Al, Co, Cr, Zn, Cd, Cu, Fe, Ni, Pb, V, Mn, U.
- Organics:
  - Total Coliforms, E. coli, F. coli and Heterotrophic plate count.

## 7.2 Surface Water

Blyvoor Gold should undertake surface water quality monitoring before recommencement of mining activities to provide baseline water quality. Monitoring should continue after resumption for the whole of the Project LOM as per the monitoring programme recommended in Table 7-5. The proposed monitoring points are presented in Table 7-2 and in Figure 8-5.

**Table 7-2: Proposed monitoring points at the Project**

| Monitoring Localities | Description | Coordinates | |
|---|---|---|---|
| | | Latitude | Longitude |
| SW1 | Unknown stream upstream of the Project | -26.438707° | 27.314957° |
| SW2 | Unknown stream downstream of the Projectr | -26.397488° | 27.275844° |
| SW3 | Mooirivierloop adjacent to the Project | -26.372194° | 27.239131° |
| Wonderfonteinspruit | Upstream | -26.316700° | 27.392500° |
| | Downstream | -26.434700° | 27.151900° |
| Blyvooruitzicht 116 IQ | Western Deep Spruit | -26.38833° | 27.39861° |

The constituents to be tested for include but not limited to; pH, Electrical Conductivity, Cyanide, Aluminium, hydrocarbons, Sulphates, Phosphates, Iron, Manganese, Calcium, Magnesium, Nitrate, Ammonia, Fluoride, Chloride, Total dissolved solids, Suspended Solids; Sodium, Potassium.

It is also recommended to monitor water quality within the mine water dams or water containment facilities to determine the concentration levels in case of an overflow or need for discharge.

## 7.3 Wetlands and Aquatic Biomonitoring

Monitoring is required upstream and downstream of the proposed activities and should include as a minimum: water quality, macro-invertebrate integrity, toxicological testing and habitat suitability assessments.

It is highly recommended that ongoing monitoring of the instream integrity in the vicinity of the Project continue so as to identify any emerging trends in terms of improvements or degradations in the ecological integrity and functioning of these systems, with special relevance to maintenance of biodiversity. It is advisable that the same assessor be utilised for ongoing monitoring purposes to minimise fluctuations and irregularities in the results as a result of variations in sampling times and efficiency.

### 7.3.1 Wetland Monitoring

Monitoring to be conducted at the monitoring location point provided, by an independent suitably qualified wetland specialist. The recommended timing of such monitoring audits should be as follows:

- Monthly during the construction phase;
- Biannually during the operational phase;
- Monthly during the rehabilitation phase; and
- Annually for a minimum of three years after the rehabilitation phase.

- PES and EIS would need to be determined for any wetland within 500m of any proposed activity, in line with the timing schedule noted above.
- Wet-Health (Macfarlane *et al.* 2009) should be used to determine the PES of the wetlands. The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present State score, ranging from A (natural) to F (critically modified).
- The EIS tool, as outlined by DWAF (1999) and updated in Rountree et al. (2012), should be used to determine the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred. Ecological Importance and Sensitivity, Hydro-functional Importance and Importance in terms of Basic Human Benefits are the three determinants that are assessed for the wetlands on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance.
- The consistent use of these tools in monitoring will allow comparable results between monitoring periods. Should any of these tools be updated, the latest version should be utilized during monitoring.

### 7.3.2 Aquatic Biomonitoring

Monitoring to be conducted by an independent suitably qualified aquatic specialist. The recommended timing of such monitoring audits should be as follows:

- Quarterly during the construction phase;
- Biannually during the operational phase; and
- Annually for a minimum of three years after the rehabilitation phase.

## 7.4 Air Quality Dust Monitoring Programme

The monitoring of dust deposition rates in and around the Project area has been on-going for many years and should be maintained. Analysed dust deposition records have shown that the area experience high deposition rates. The aforementioned can be attributed to the several mining companies that are operational in the area with adverse implications on the ambient air quality. Despite the latter, it is recommended that Blyvoor Gold continue monitoring and ensure measured data are used to inform and revise management mitigation plans.

### 7.4.1 $PM_{10}$ Monitoring Programme

With the dust deposition measurement already in place, it is recommended that a real-time particulate monitor be set up to measure fine particulate matter in the project area in order to fulfil regulatory requirements on monitoring and reporting in accordance with the National Atmospheric Emissions Reporting Regulation, GG No.38633 – GNR 283 (2015).

## 7.5 Radiological

The NNR regulatory process requires Certificate of Registration (CoR) holders to submit a public Radiation Protection Programme (RPP) for approval by the NNR. The basis for the definition of the public RPP is the outcome of the comprehensive radiological public safety assessment and includes a monitoring programme, a surveillance programme and a control programme

The objective of the baseline characterisation is two-fold. Firstly, to establish the radiological condition of the site and associated infrastructure to develop an appropriate radiation management plan, and secondly to establish the radiological characteristics of radioactive material associated with the TSFs and other stockpile facilities that might be identified. For this purpose, the following activities are proposed:

- Gamma radiation, dose rate and surface contamination surveys (of the site and associated surface infrastructure) to establish the level of surface contamination associated with the mining operation and to identify radioactive material that requires management. Depending on the outcome of these surveys, some areas might require rehabilitation and clean-up before operations commence.
- Develop a sampling programme for each TSF (and other stockpile facilities that might be identified) to produce statistically representative samples of each facility for full spectrum analysis. It is proposed that the representative sample be divided into fractions below 10 micron and above 10 micron. The reason being that the activity concentration is the smaller (inhalable) fraction tends to be higher.
- Determine the radon exhalation rate for each TSF. This involves the sampling of tailings material from different sections of the TSF, which is then used to determine the radon exhalation rate from the samples as a function of the Ra-226 content. This is a laboratory procedure.
- Perform a land use, human behaviour and interaction with the environmental study that can be used for a more comprehensive definition of the public exposure conditions.

The aforementioned activities are not included in the monitoring programme as these activities may only be required once or, depending on operational requirements, perhaps every three-to-five years. The full spectrum analysis is required for the NNR CoR application and associated radiological public safety assessment.

Table 7-3 summarises the proposed radiological monitoring programme aimed at public radiation protection. The responsibility for the implementation and execution of the monitoring programme lies with the Radiation Protection Function (RP Function) that include legally appointed persons consisting of a Radiation Protection Monitor(s) (RPM), a Radiation Protection Officer (RPO), and a Radiation Protection Specialist (RPS).

**Table 7-3: Summary of the Environmental Monitoring Programme for Public Radiation Protection**

| Monitoring Element | Comment | Frequency |
|---|---|---|
| Surface water | Full spectrum analysis (U-238, U-235, Th-232 and progeny) | Biannually |
| | Total Uranium and Thorium | Quarterly |
| Sediments | Full spectrum analysis (U-238, U-235, Th-232 and progeny) | Annually |
| | Total Uranium and Thorium | Biannually |
| Groundwater | Full spectrum analysis (U-238, U-235, Th-232 and progeny) | Once every two years |
| | Total Uranium and Thorium | Biannually |
| Radon gas | Environmental radon using Radon Gas Monitors (RGMs) | Quarterly for a period of 2 to 3 month |
| | Radon exhalation from the ventilation shaft using RGMs | Continuously for a period of 2 to 3 month |
| Dust fallout | Total Uranium and Thorium | Quarterly |

Full spectrum analysis is suitable for detailed dose analysis but is an expensive procedure with long lead times to perform the analysis, which is why less frequent intervals are proposed. The total uranium and thorium analysis are relatively inexpensive with fast turnaround times. These results will monitor variations in activity concentration over the monitoring period.

Large variations in the activity concentration over a short period is not expected in groundwater, oppose to surface water, for example. Therefore, a less frequent sampling schedule is proposed for groundwater. The same principle applies for the sediment samples at the same locations as the surface water sample.

The RGMs to monitor the variation in radon gas works in monitoring periods of 2 to 3 month, after which the RGMs is replaced with new RGMs for the next monitoring period. The monitoring frequency for the ventilation shaft is continuous, since the exhalation of radon gas from the shaft is continuous.

### 7.5.1 Proposed Monitoring Points

Most of the monitoring points proposed to be part of the monitoring programme coincide with the monitoring programme for the environmental pathways. The following can be noted:

- The surface water monitoring locations should coincide with the monitoring points proposed by the Surface Water monitoring programme, i.e., upstream and downstream of the operation as well as discharge points;
- The sediment monitoring locations should coincide with the surface water monitoring points, applying the same principles.

- The groundwater monitoring points should coincide with those recommended in the groundwater monitoring programme, upstream and downstream, as well as upstream and downstream of specific surface facilities. The exact location will be determined by the availability of water bearing boreholes in the specific area.
- The environmental radon monitoring locations do not have to coincide with specific locations. These points should be widespread over the MRA, in the dominant wind direction where receptors are located, complemented with monitoring locations in what can be considered as background. The exact location is often influence by whether a secured location is available to improve the recovery rate of the RGMs.
- The dust fallout monitoring locations should coincide with the monitoring points (dust buckets) currently included in the Blyvoor Gold dust monitoring programme.

## 7.6 Rehabilitation Post-Closure Monitoring

The monitoring measures for the post-closure phase of the Project are provided in Table 7-4 and primarily consist of environmental monitoring. Monitoring provides information on whether rehabilitation methods employed are functioning correctly or not. Monitoring should provide an early indication of problems arising so that corrective management actions can be taken.

The post closure monitoring period will begin once scheduled decommissioning and rehabilitation activities for the site have been completed. The duration of post closure monitoring will be determined based on environmental performance and until it can be demonstrated that the rehabilitation work has achieved the agreed objectives. At present, it has been assumed that post closure monitoring will not continue for more than five years. It is important that the data obtained during monitoring is used to gauge the success of rehabilitation. Negative monitoring findings should be clearly linked to specific corrective actions.

The purpose of monitoring is to ensure that the objectives of rehabilitation are met, and that the rehabilitation process is followed. The physical aspects of rehabilitation should be carefully monitored during the operational phase as well as during the progress of establishment of the desired final land use.

Table 7-4 sets out the proposed monitoring plan and audit requirements for the Project.

## Table 7-4: Post Closure Monitoring Programme

| Component / Aspect | Monitoring – Methodology | Monitoring – Frequency / duration | Performance / success criteria | Corrective action |
|---|---|---|---|---|
| **Soil Management** | | | | |
| Soil fertility | ▪ Undertake a visual assessment and delineate areas where poor vegetation growth has occurred;<br>▪ Submit soil samples to an accredit soil laboratory to conduct soil fertility analysis. | As and where required until soil fertility supports the final land use or for at least 3 years post-closure | ▪ Soil analysis results comply with remediation targets at a 95 percentile level; and<br>▪ Self-sustaining vegetation establishment. | ▪ Apply amelioration where required as informed by sampling undertaken. |
| Erosion | ▪ Conduct a visual assessment to determine areas of potential erosion; and<br>▪ Undertake field investigations, fixed point photography to document the significance of the erosion occurring on site | Twice yearly for at least 3 years post-closure. | ▪ No evidence of significant erosion; and<br>▪ Good vegetation cover and species composition. | As required:<br>▪ Re-shape areas to ensure that they are free-draining;<br>▪ Establish vegetation on bare patches; and<br>▪ Repair and stabilisation of erosion gullies and sheet erosion. |
| Post-mining end land use | ▪ Assess activities completed, as well as legal and related documentation completed and signed-off; and<br>▪ Ensure rehabilitation measures are aligned to the end land use. | Continuously during decommission and closure phase. | ▪ Area has been rehabilitated to an aesthetic quality not to compromise potential tourism; | ▪ Refer back to end land use approach and refine measures to be implemented in achieving the desired final land use. |

| Component / Aspect | Monitoring | | Performance / success criteria | Corrective action |
|---|---|---|---|---|
| | Methodology | Frequency / duration | | |
| | | | ▪ Transfer to third party operator has taken place once the area has been proven to be safe for redevelopment;<br>▪ Legal and zoning issues have been addressed; and<br>▪ Vegetation re-establishment, cover and composition are sustainable. | |
| Topography | ▪ Conduct a visual assessment to determine areas of potential erosion; and<br>▪ Undertake regular digital surveys of rehabilitated areas to confirm that final topography is aligned with landform designs. | During rehabilitation phase | ▪ No evidence of significant erosion.<br>▪ No evidence of water pooling on rehabilitated areas.<br>▪ The final profile achieved should be acceptable in terms of surface water drainage requirements | As required:<br>▪ Re-shape areas to ensure that they are free-draining; and<br>▪ Refer back to end land use approach and refine measures to be implemented in achieving the desired final land use. |

| Component / Aspect | Monitoring | | Performance / success criteria | Corrective action |
|---|---|---|---|---|
| | Methodology | Frequency / duration | | |
| | | | and the end land use objectives. | |
| Vegetation establishment | ▪ Determine whether re-established vegetation communities are on a trajectory of achieving a stable self-sustaining community dominated by species typical of the climax-species present in the adjacent areas:<br>▪ Inspect rehabilitated areas to assess vegetation establishment and provide for early detection of erosion in recently planted/seeded areas (monthly);<br>▪ Undertake fixed point photography at specific points at the rehabilitated sites to obtain a long term directly comparable method of determining changes in the landscape; and<br>▪ Conduct evaluation of rehabilitated areas by | Quarterly for at least 3 years post-closure. | ▪ Limited to no erosion; and<br>▪ Self-sustaining vegetation ecosystem. | As required:<br>▪ Re-vegetate poorly established rehabilitated areas;<br>▪ Re-seed bare patches; and<br>▪ Apply additional fertiliser and/or organic matter, depending on the condition of the vegetation and the initial organic material application. |

| Component / Aspect | Monitoring | | Performance / success criteria | Corrective action |
|---|---|---|---|---|
| | Methodology | Frequency / duration | | |
| | means of field inspections. During these assessments measurement of growth performance and species abundance will be carried out to determine:<br>i. Plant basal cover and species abundance in the grassed areas. Estimates of vegetation canopy and ground cover as well as height;<br>ii. Distribution, growth and survival of woody species;<br>iii. Dominant plant species (woody and herbaceous);<br>iv. Presence of exotic invasive species, and degree of encroachment;<br>v. Browsing or grazing intensity;<br>vi. Notes regarding erosion, such as, type, severity, degree of sediment build-up; and | | | |

<table>
<tr><th rowspan="2">Component / Aspect</th><th colspan="2">Monitoring</th><th rowspan="2">Performance / success criteria</th><th rowspan="2">Corrective action</th></tr>
<tr><th>Methodology</th><th>Frequency / duration</th></tr>
<tr><td></td><td>vii. Species composition and richness.</td><td></td><td></td><td></td></tr>
<tr><td>Invasive alien species</td><td>▪ Visually inspect areas where invasive species have been previously eradicated and areas prone to invasive species (e.g. eroded/degraded areas, along drainage lines, etc.); and<br>▪ Undertake surveys on relevant sites where bush encroachment has previously been identified to determine the status quo of invasive vegetation.</td><td>Yearly for at least 3 years post-closure.</td><td>▪ Limit and/or prevent declared Category 1, 2 and 3 invader species establishing;<br>▪ Minimise extended threat to ecosystems, habitats or other species;<br>▪ Increase the potential for natural systems to deliver goods and services; and<br>▪ Minimise economic or environmental harm or harm to human health.</td><td>▪ Revisit mitigation measures; and<br>▪ Continue control and management.</td></tr>
<tr><td>General site status</td><td>▪ Conduct a visual assessment with respect to compliance of the afore-mentioned closure measures and to ensure that the site is aesthetically neat and tidy, and that no health or safety risks exist on site.</td><td>Once-off following implementation of rehabilitation measures.</td><td>▪ Waste/rubble free sites.</td><td>As required:<br>▪ Clear remnant rubble and dispose of in open pit as backfill material.</td></tr>
</table>

| Component / Aspect | Monitoring | | Performance / success criteria | Corrective action |
|---|---|---|---|---|
| | Methodology | Frequency / duration | | |
| Surface Water Quantity | ▪ Visually assess the functionality of the surface water drainage systems feeding surface water runoff from rehabilitated areas.<br>▪ Undertake field investigations, fixed point photography to document the significance of the erosion occurring on site. | After the first major rains of the season and after any major storm. | ▪ No evidence of significant erosion; and<br>▪ No evidence of water pooling on rehabilitated areas. | As required:<br>▪ Re-shape areas to ensure that they are free-draining; and<br>▪ Refer back to end land use approach and refine measures to be implemented in achieving the desired final land use. |
| Surface Water and Groundwater Quality | ▪ Sample and monitor surface and groundwater quality. | Quarterly for at least 5 years post-closure. | ▪ Water quality results within ranges of the WUL and/or DWS standards. | As required:<br>▪ Increase monitoring frequency and detect point sources.<br>▪ Optimise monitoring plan if needed. |

**Table 7-5: Mechanisms for Monitoring Compliance**

| Activities | Impacts requiring monitoring programmes | Functional requirements for monitoring | Roles and responsibilities (For the execution of the monitoring programmes) | Monitoring and reporting frequency and time periods for implementing impact management actions |
|---|---|---|---|---|
| Groundwater | Groundwater quality and Quantity | ▪ Data storage must be manged no a centralised database;<br>▪ When sampling the following procedures are proposed:<br>  ▪ One-litre plastic bottles with a cap are required for the sampling exercises;<br>  ▪ Glass bottles are required if organic constituents are to be tested;<br>  ▪ Collected samples must be stored in cooler box or fridge while on site; and<br>  ▪ Sample bottles should be marked clearly with the borehole name, date of sampling, sampling depth and the sampler's name and submitted to an accredited laboratory.<br>▪ Inorganic parameters to be monitored:<br>  ▪ TDS, EC, pH, Alkalinity;<br>  ▪ Major ions i.e. Ca, Mg, Na, K, $SO_4$, $NO_3$, F, Cl; and<br>  ▪ Minor and trace metals, including As, Al, Co, Cr, Zn, Cd, Cu, Fe, Ni, Pb, V, Mn, U.<br>▪ Organic parameters to be monitored:<br>  ▪ Total Coliforms, E. coli, F. coli and Heterotrophic plate count. | Environmental Officer or subcontracted specialist | Monitoring of inorganic constituents should be conducted quarterly to reflect influences of wet and dry seasons and monitoring of organic constituent should be conducted biannually. The sampling frequency could be adjusted following the groundwater quality trend analysis.<br>It is suggested that quarterly samples be collected, extending up to two years post closure and based on the trends it can be adjusted until a sustainable situation is reached and after it has been signed off by the authorities. |
| Surface Water | Surface Water quality | ▪ Ensure water quality monitoring as per existing monitoring programme. Parameters should include but not limited to; pH, Electrical Conductivity, Cyanide, Aluminium, hydrocarbons, Sulphates, Phosphates, Iron, Manganese, Calcium, Magnesium, Nitrate, Ammonia, Fluoride, Chloride, Total dissolved solids, Suspended Solids; Sodium, Potassium.<br>▪ It is also recommended to monitor water quality within the mine water dams or water containment facilities to determine the concentration levels in case of an overflow or need for discharge. | Environmental Officer | ▪ Monthly prior to resumption of operations to obtain the baseline water quality;<br>▪ Monthly during construction and operation (hydrocarbons can be done on a quarterly basis). Monitoring needs to carry on three years after the project has ceased, as is standard practice to detect residual impacts. |
| | Surface Water quantity | ▪ Flow monitoring should be carried out downstream of discharge point to ensure a controlled discharge and effectiveness of discharge point energy dissipaters.<br>▪ The discharge pipeline should be equipped with instantaneous or automatic flow meters to ensure real time measurements of discharge water. | Environmental Officer | In operational areas where automatic flow meters are in place, daily records need to be kept |

| Activities | Impacts requiring monitoring programmes | Functional requirements for monitoring | Roles and responsibilities (For the execution of the monitoring programmes) | Monitoring and reporting frequency and time periods for implementing impact management actions |
|---|---|---|---|---|
| | Physical structures and Storm Water Management Plan (SWMP) performance | ▪ Personnel should have a walk around facilities to determine the facilities conditions and pick out any anomalies such as leaks or overflows and system malfunctions.<br>▪ Storm water channels, and existing mine dams are inspected for silting and blockages of inflows, pipelines for hydraulic integrity; monitor the overall SWMP performance. | Environmental Officer | Continuous process and yearly formal report |
| | Collection of meteorological data | ▪ Measure rainfall | Environmental Officer | Real time system if in place |
| Soil | TSF reclamation | ▪ Design and implement soil monitoring programme in areas susceptible to erosion,<br>▪ Monitor around TSFs to gauge level of contamination | Qualified soil specialist | ▪ Develop during construction phase |
| Wetlands | Wetland system health and integrity (ongoing rehabilitation) | ▪ All soils compacted as a result of construction activities should be ripped/scarified (<300mm) and profiled;<br>▪ the substrate conditions of the wetlands and downstream stream connectivity must be maintained | Qualified wetland ecologist | ▪ Monthly during the construction phase;<br>▪ Biannually during the operational phase;<br>▪ Monthly during the rehabilitation phase; and<br>▪ Annually for a minimum of three years after the rehabilitation phase |
| Aquatics | Impacts which can result in siltation | ▪ Sample sites BVG1, BVG2, BVG3, BVG4<br>▪ Monitoring is required upstream and downstream of the proposed activities and should include as a minimum: water quality, macro-invertebrate integrity, toxicological testing and habitat suitability assessments.<br>▪ It is highly recommended that ongoing monitoring of the instream integrity in the vicinity of the Project continue so as to identify any emerging trends in terms of improvements or degradations in the ecological integrity and functioning of these systems, with special relevance to maintenance of biodiversity. It is advisable that the same assessor be utilised for ongoing monitoring purposes so as to minimise fluctuations and irregularities in the results as a result of variations in sampling times and efficiency | Qualified aquatic ecologist | ▪ Quarterly during the construction phase;<br>▪ Biannually during the operational phase; and<br>▪ Annually for a minimum of three years after the rehabilitation phase |
| Flora | Clearing of vegetation | ▪ Develop an Alien Invasive Species monitoring programme | Qualified ecologist | During the construction phase for implementation prior to the operational phase commencing |
| Air Quality | All activities which could result in PM emissions or distribution | ▪ Install real time particulate monitor | Qualified air quality specialist | For the LOM to generate accurate data and monitor decommissioning PM releases |
| Radiological | Surface water | Full spectrum analysis (U-238, U-235, Th-232 and progeny) | | Biannually |
| | | Total Uranium and Thorium | | Quarterly |

| Activities | Impacts requiring monitoring programmes | Functional requirements for monitoring | Roles and responsibilities (For the execution of the monitoring programmes) | Monitoring and reporting frequency and time periods for implementing impact management actions |
|---|---|---|---|---|
| | Sediments | Full spectrum analysis (U-238, U-235, Th-232 and progeny) | Radiation Protection Monitor(s), a Radiation Protection Officer, and a Radiation Protection Specialist | Annually |
| | | Total Uranium and Thorium | | Biannually |
| | Groundwater | Full spectrum analysis (U-238, U-235, Th-232 and progeny) | | Once every two years |
| | | Total Uranium and Thorium | | Biannually |
| | Radon gas | Environmental radon using Radon Gas Monitors (RGMs) | | Quarterly for a period of 2 to 3 month |
| | | Radon exhalation from the ventilation shaft using RGMs | | Continuously for a period of 2 to 3 month |
| | Dust fallout | Total Uranium and Thorium | | Quarterly |

# 8 Item 1(l): Indicate the frequency of the submission of the performance assessment report.

Blyvoor Gold must appoint an external auditor to undertake an annual performance assessment of the conditions contained in the EMPr, in terms of Regulation 34 of the EIA Regulations, dated 2014 (as amended) under the NEMA. Once the report is finalised, Blyvoor Gold is responsible for making the performance assessment report available to the public for review, in terms of Regulation 34(6) of the NEMA EIA Regulations, 2014 (as amended).

Based on the assumption that the Construction Phase will be completed within 18 months from Authorisation, it is recommended that bi-annual audits of this EMPr are undertaken for the first two years; during construction and the first year of operation. Blyvoor Gold should conduct an annual internal audit during this initial two year period and appoint an external auditor to undertake an independent annual audit for the second year. Thereafter, Blyvoor Gold must continue with annual internal audits, and appoint an external auditor to conduct a performance assessment every second year.

Blyvoor Gold must also establish a grievance register for the public to report any issues or perceived non-compliances. All issues or concerns raised by the public must be captured in a grievance database. The timeframe to address these grievances, as well as the steps taken by Blyvoor Gold to address these issues must be recorded against each grievance captured. Blyvoor Gold must determine a realistic timeframe in which to address the recorded grievance and this database must be included in the internal and external audits.

# 9 Item 1(m): Environmental Awareness Plan

This section requires information pertaining the Applicant's implementation of an environmental awareness plan and how this plan will be communicated internally to all staff.

## 9.1 Item 1(m)(1): Manner in which the applicant intends to inform his or her employees of any environmental risk which may result from their work

The purpose of an Environmental Awareness Plan is to outline the methodology that will be used to inform the mine's employees of any environmental risks which may result from their work and the manner in which the risks must be dealt with to avoid contamination or the degradation of the environment. The environmental awareness plan is primarily a tool to introduce and describe the requirements of the range of environmental and social plans for the proposed project during the life of the Project.

The environmental awareness plan ensures that training needs are identified and appropriate training is provided. The environmental awareness plan should communicate:

- Importance of conformance with the environmental policy, procedures and other requirements of good environmental management;

- The significant environmental impacts and risks of an individual's work activities and the environmental benefits of improved performance;
- Individual's roles and responsibilities in achieving the aims and objectives of the environmental policy; and
- The potential consequences of not complying with environmental procedures.

The objective of this Environmental Awareness Plan is to:

- Inform employees and contractors of any environmental risks which may result from their work; and
- Inform employees and contractors of the manner in which the identified possible risks must be dealt with to prevent degradation of the environment.

In general, the purpose of implementing an Environmental Awareness Plan is to optimise the awareness of those partaking in the mining and related activities which have the potential to impact negatively on the environment and in doing so, promote the global goal of sustainable development.

The awareness training of employees, supervisors, sub-contractors, contractors and visitors will ensure that co-operation in terms of environmental management will occur. This will contribute to the successful implementation of the conditions set out in the EMPR and Environmental Authorisation, and thus to the environmental sustainability of the project. In addition, it will ensure the success of the proposed project regarding compliance with legislation, and avoid possible future liabilities and legal action due to a lack of environmental awareness.

## 9.2 Item 1(m)(2): Manner in which risks will be dealt with in order to avoid pollution or the degradation of the environment

Management will establish and maintain procedures for the internal communication between the various levels and functions of the organisation, and receiving, documenting and responding to relevant communication from external I&APs. The organisation shall consider processes for external communication on its significant environmental aspects and record its decision.

Communication is a management responsibility. All line supervisors are responsible for effective communication within their own sections. Environmental risks will be dealt with through training and communication to ensure minimal degradation of the environment.

# 10 Item 1(n): Specific information required by the Competent Authority

The financial provision for the environmental rehabilitation and closure requirements of mining operations is governed by NEMA, as amended, which provides in Section 24P that the holder of a mining right must make financial provision for rehabilitation of negative environmental impacts. The financial provision will be reviewed and refined annually, as mining progresses and further information is made available.

# 11 Item 2: Undertaking

The EAP herewith confirms:-

(a) the correctness of the information provided in the reports

(b) the inclusion of comments and inputs from stakeholders and I&APs ;

(c) the inclusion of inputs and recommendations from the specialist reports where relevant; and

(d) the acceptability of the project in relation to the finding of the assessment and level of mitigation proposed.

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# Appendix 1: Mining Right and Water Use Licence

# Appendix 2: EAP CV and Qualifications

# Appendix 3: Plans

# Appendix 4: Public Participation

# Appendix 5: Groundwater Report

# Appendix 6: Surface Water Report

# Appendix 7: Biodiversity Report

# Appendix 8: Air Quality Report

# Appendix 9: Radiological Report

# Appendix 10: Community Health Report

# Appendix 11: Heritage Report

# Appendix 12: Social Impact Assessment Addendum Report

# Appendix 13: Closure and Rehabilitation Report