mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

BASIC ASSESSMENT REPORT

and

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

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: Sishen Iron Ore Company (Pty) Ltd (SIOC)

TEL NO: 053 739 2800

FAX NO: 053 739 2179

POSTAL ADDRESS: Private Bag X506, Kathu

PHYSICAL ADDRESS: Hendrik van Eck Street, Kathu, 8446

FILE REFERENCE NUMBER SAMRAD: NC 30/5/1/2/3/2/1/(259) MR

EXM Advisory Services

ENVIRONMENTAL • MINERAL RIGHTS • SOCIAL & SD

SISHEN MINE

Sishen Iron Ore Company (Pty) Ltd

Basic Assessment Report and Environmental Management Programme Report:

Development of an Overflow Dam at the Aldag PCD and the Lylyveld South PCD

2018-02-19

FINAL

DMR Ref: NC 30/5/1/2/3/2/1/ (259) MR

AngloAmerican

SOLUTIONS | PROGRESS | PARTNERS

Tel: 010 007 3617 **Fax:** 086 616 0443

Address: Office 1013, Ground Floor Block 1, Bryanston Gate Office Park, Corner Main Road &d Homestead Avenue, Bryanston, Johannesburg 2191

Directors: DT van der Merwe & KC Fairley **Associate Director:** RC Letter

Company Reg: 2014/189068/07

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

PART A

SCOPE OF ASSESSMENT AND BASIC ASSESSMENT REPORT

1. CONTACT PERSON AND CORRESPONDENCE ADDRESS

1.1 DETAILS AND EXPERTISE OF THE EAP

Name of The Practitioner: Roelof Letter

Tel No.: 010 007 3617

Fax No.: 086 616 0443

E-mail address: roelof@exm.co.za

TABLE 1: EXPERTISE OF THE EAP.

EAP	Qualification	Years' experience
Mr. Roelof Letter	BSc Geography and Environmental Management (UJ) BSc (hons) Environmental Management (UNISA) LLM Environmental Law (UCT)	8 Years
Mrs Lynné Viljoen	LLM Environmental Law (NWU)	2 Years

CV's with experience is attached as APPENDIX A: CV'S OF THE EAP TEAM.

2. LOCATION OF THE OVERALL ACTIVITY.

A description of the property on which the proposed project is located is provided in Table 2 and shown in Figure 1.

Table 2: Locality of the Activity

Farm Name:	Remaining extent of the farm Lylyveld 545 Remaining extent of the farm Sishen 543
Application area (Ha)	The Sishen Mining Right area covers approximately 26 000 ha of which the new and expansion of the Pollution Control Dam's (PCD's) of approximately 9 ha will be included in the project.
Magisterial district:	Hay
Distance and direction from nearest town	The Town of Kathu is located approximately 14 kilometres south of the remaining extent of the farm Lylyveld 545 and approximately 7 kilometres south west of the farm Sishen 543
21-digit Surveyor General Code for each farm portion	1. Remaining extent of the farm Lylyveld 545: C04100000000054500000 2. Remaining extent of the farm Sishen 543: C04100000000054300000

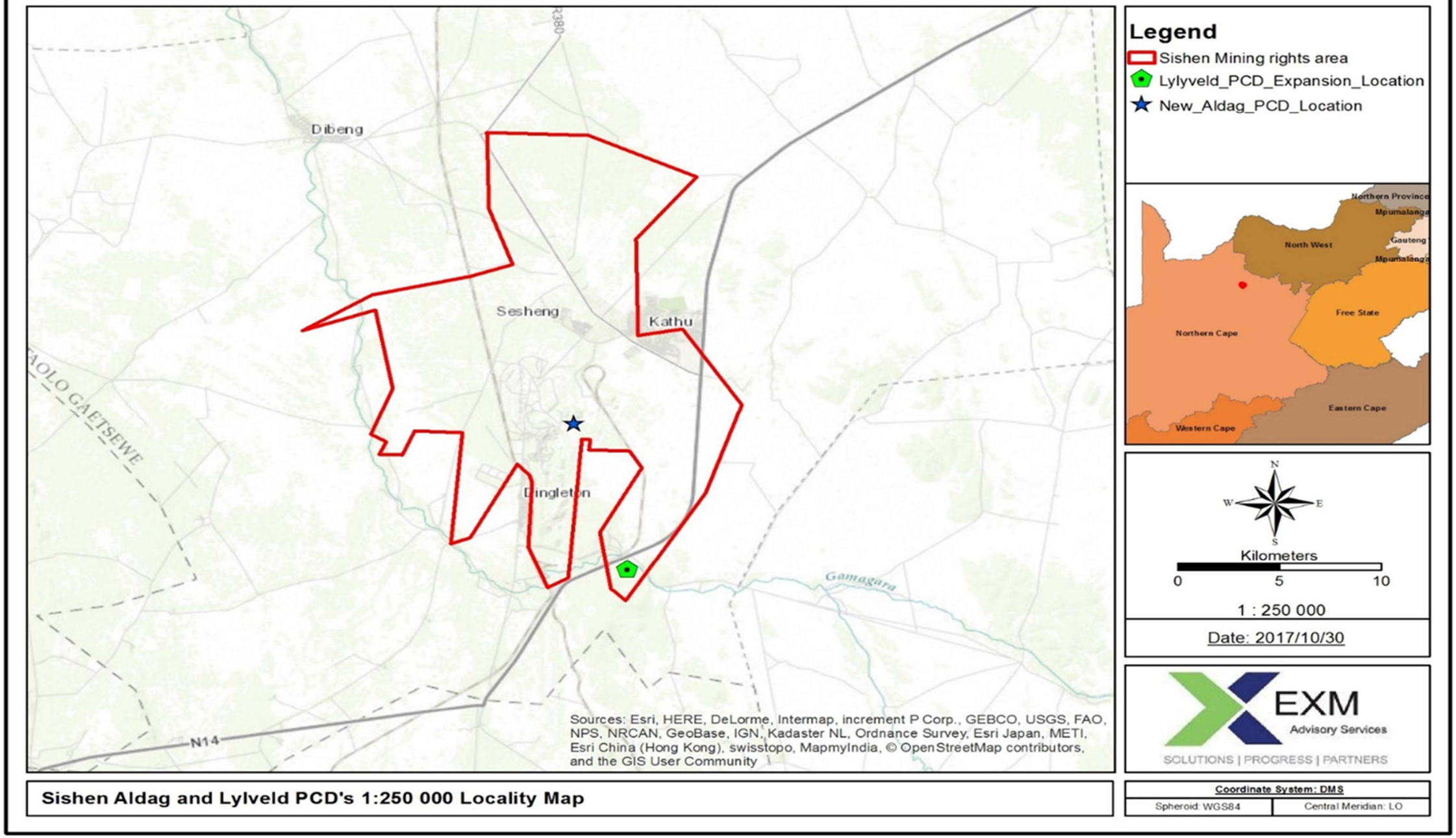


FIGURE 1: 1:250 000 LOCALITY MAP OF THE PROPOSED OVERFLOW DAM AT ALDAG AND LYLYVELD PCD

3. DESCRIPTION OF THE SCOPE OF THE PROPOSED OVERALL ACTIVITY

3.1 Plan Showing Location of Listed Activities and Associated Infrastructure

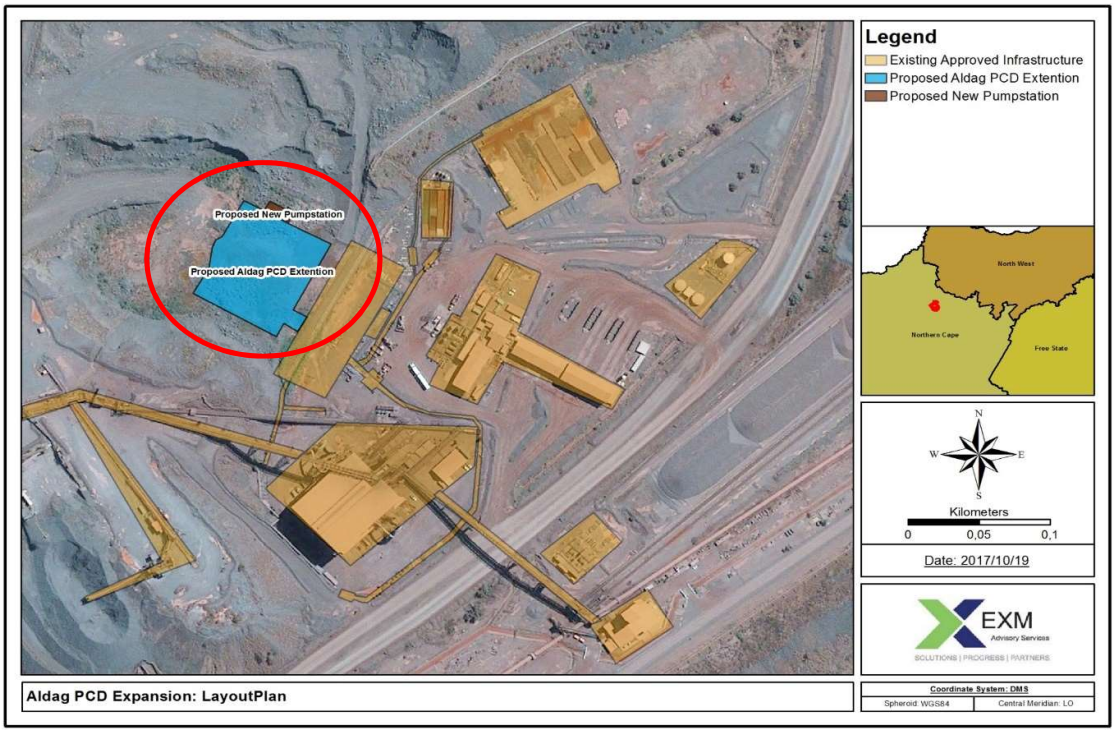


FIGURE 2: NEW OVERFLOW PCD AT THE ALDAG REFUELLING STATION AT SISHEN MINE

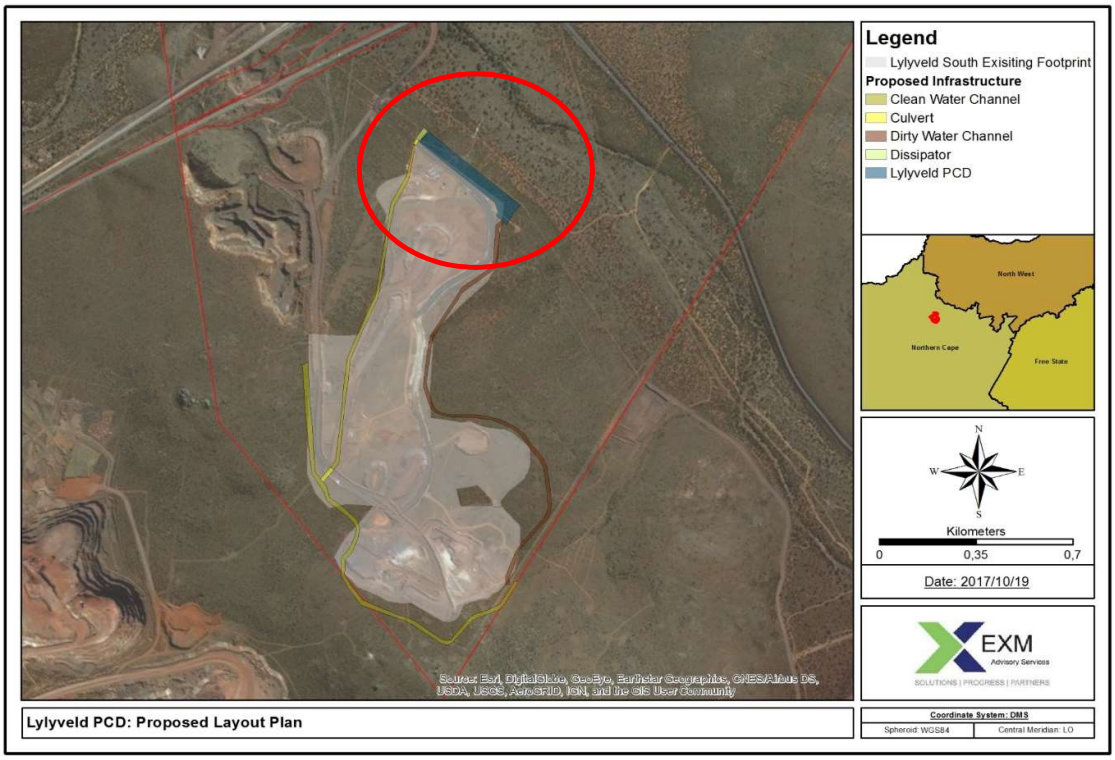


FIGURE 3: PROPOSED PCD AT THE LYLYVELD SOUTH MINING AREA AT SISHEN MINE

3.2 Listed and specified activities

Table 3: Listed and specified Activities

NAME OF ACTIVITY	AERIAL EXTENT OF THE ACTIVITY HA OR M²	LISTED ACTIVITY	APPLICABLE LISTING NOTICE
Lylyveld PCD: Construction of clean and dirty water diversion channels. The channels will have an internal diameter of more than 0.36 metres, however have a peak throughput of less than 120 litres per second.	**6.1 ha. Two diversion berms of: 3.6 km by 1 m deep and 5.96 km by 1 m deep**	**X**	**GNR 983** **Listing Notice 1:** **Activity 9:** The development of infrastructure exceeding 1 000 metres in length for the bulk transportation of water or storm water— (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more; excluding where— (a) such infrastructure is for bulk transportation of water or storm water or storm water drainage inside a road reserve or railway line reserve; or (b) where such development will occur within an urban area.
Lylyveld PCD: The clearance of an area greater than 1 ha and less than 20 ha of indigenous vegetation is required at the Lylyveld South Mining Area for the construction of the Lylyveld PCD.	**4 ha**	**X**	**GNR 983** **Listing Notice 1:** **Activity 27:** The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for- (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan
Aldag and Lylveld PCD: An amendment to the current Integrated Water Use Licence is required for the PCD's from the Department of Water and Sanitation (DWS).	**3 ha**	**X**	**GNR 983** **Listing Notice 1:** **Activity 34** The expansion of existing facilities or infrastructure for any process or activity where such expansion will result in the need for a permit or licence or an amended permit or licence in terms of

			national or provincial legislation governing the release of emissions, effluent or pollution, excluding— (i) where the facility, infrastructure, process or activity is included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies; (ii) the expansion of existing facilities or infrastructure for the treatment of effluent, wastewater, polluted water or sewage where the capacity will be increased by less than 15 000 cubic metres per day; or (iii) the expansion is directly related to aquaculture facilities or infrastructure where the wastewater discharge capacity will be increased by 50 cubic meters or less per day.

3.3 Description of activities to be undertaken

Sishen Mine, part of the Sishen Iron Ore Mining Company (Pty) Ltd, located near Kathu, has been in operation since the 1950's and operates under an existing mining right (DMR Ref: NC 259 MR) and an approved EMPr (2002, as amended). The Department of Water and Sanitation (DWS) require mining operations to separate clean and dirty stormwater under Regulation GNR. 704, 1999 (Regulations on use of water for Mining and Related Activities aimed at the Protection of Water Resources) in terms of the National Water Act, 1998 (NWA). To ensure compliance with this requirement, Sishen Mine is currently in the process of improving the management of the dirty and clean water systems to ensure alignment with the provisions GNR. 704. The infrastructure proposed includes:

- A Pollution Control Dam (PCD) located near the existing Aldag Filling Station within the mine (Overflow PCD at Aldag); and
- A PCD at the existing Lylyveld South Mining Areas (Lylyveld South PCD).

The development of these dams is motivated by the requirement to contain dirty water run-off from the catchment during a 1 in 50-year storm event in accordance with GNR. 704.

3.3.1 Proposed overflow PCD at Aldag

The Aldag PCD is being developed to contain dirty water run-off from the Aldag filling station and also the primary and secondary crusher area of the JIG plant within Sishen Mine. The existing approved Aldag PCD is undersized at 4 000 m^3. A second 6000 m^3 overflow dam is thus required, which will be directly connected to the current planned dam providing an overall storage volume of 10 000 m^3. The overflow dam will cover and area of 3 ha and will be developed adjacent to Aldag PCD in an already transformed area within the mine (see Plate 1). The recovered water from the dams will be recycled and used at the JIG plant as process water.

PLATE 1: PHOTOS OF THE PROPOSED AREA FOR THE NEW OVERFLOW AT ALDAG

The Aldag PCD together with the proposed overflow dam have been sized as follows:

- The two dams with a volume of 10 000 m^3 can retain a 1:50 year 24-hour storm event based on potential water levels in the dam (normal operating level based on stochastic modelling over the wet seasons) before the design storm, with a probability of exceedance beyond the 75% percentile.
- The storage volume will be able to contain a 1:50 year, 24-hour flood volume of 8 185m^3 assuming the dam is empty before the storm, and with a 10% allowance for climate change impacts.
- The dams will be able to contain a 1:100 year 24-hour flood volume of 8 483m^3 assuming the dam is empty before the storm.
- The proposed overflow dam will have the same liner as the existing approved PCD. The liner will be constructed to comply with a Class C liner (Refer to Figure 4; according to national norms and standards for the disposal of waste to landfill (GN R. 636 of 2013).

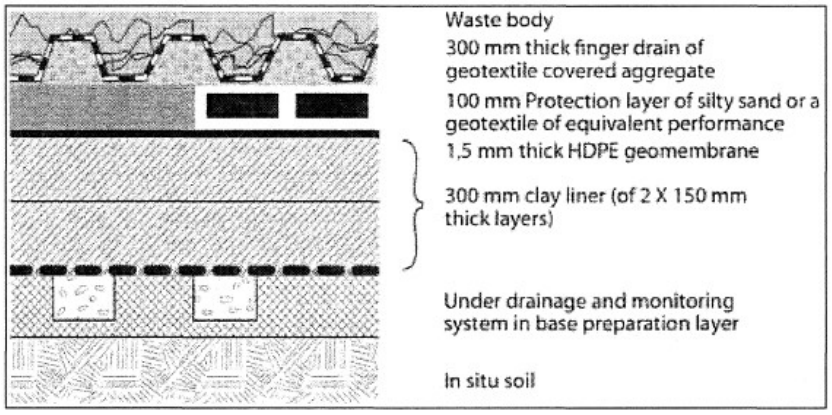


FIGURE 4: EXAMPLE OF A CLASS C LINER

- It is critical for the PCD's to be pumped empty as soon as possible after a rainfall event and should be designated as a priority source of water for the JIG plant.

A layout plan has been provided in Figure 2. The design report and associated preliminary designs of the proposed overflow PCD at Aldag is provided in Appendix B.

3.3.2 Lylyveld South PCD

A PCD with a capacity of 13 000 m^3 has been approved for the Lylyveld South mining operations. The dam has however been constructed. A larger PCD of 38 800 m^3 is however required to ensure that all dirty water run-off from the Lylyveld South area is contained during a 1:50 year 24-hour storm, as required by GNR. 704. The proposed larger PCD will be constructed in an undisturbed area within the Lylyveld South mining area covering an area of ~4 ha (see Plate 2).

PLATE 2: PHOTOS OF THE LYLYVELD SOUTH MINING AREA

The Lylyveld PCD will collect stormwater run-off stormwater from the Lylyveld South mining area as well as the waste rock dumps and prevent stormwater from mining area (dirty water run-off) from entering the Gamagara River, thus preventing siltation of the river. The PCD will be constructed approximately 250 meters from the Gamagara River, thus being outside the 1:100 flood area. It should however be noted that the Lylyveld South mining operation does not comprise any activities that present a significant pollution potential. No maintenance workshops, ore processing facilities, wash bays etc. is located in the area.

The Lylyveld PCD has been designed to have two separated compartments. The water inflows to the dam will first pass through a silt trap/compartment with a capacity of 13 000 m^3. The silt trap/compartment will be lined, and the design will allow light machine access for desilting. It is however not large enough to accommodate a 1:50 year flood. The water will then overflow into the second compartment with a capacity of 25 800 m^3.

The capacity of the PCD was calculated based on the summation of the 1:50 year design rainfall (24 hour) event for the Lylyveld South catchment area and excluded the additional volumes of water that originate from preceding rainfall events. Space constraints due to topography prohibit the development of a larger dam. The PCD has been designed to operate empty, however to ensure the PCD is operated empty water from the dam will be abstracted for mainly dust suppression purposes.

Note that clean and dirty water trenches and berms will be constructed to ensure that dirty water run-off enters the Lylyveld South PCD. Three diversion berms of ~5 km by 1 m deep will be constructed to prevent runoff from mixing with runoff from dirty water areas. These diversions are comprised of a channel and berm component. The purpose of the diversions is to divert upstream/upslope clean water which would otherwise flow into the dirty area. Dirty water channel will ensure dirty water generated on the site does not spill into the environment more frequently than permissible.

The proposed Lylyveld South PCD will be constructed with an appropriate liner, as indicated in Table 4, to ensure prospection of groundwater.

A layout plan has been provided in Figure 3 above. The design report and associated preliminary designs of the proposed Lylyveld South PCD and associated trenches and berms is provided in Appendix B.

Table 4: Liner Design

SILT TRAP			
BASE		CUT / EMBANKMENT SLOPES	
1	75 MM HYSON CELLS FILLED WITH CONCRETE (CLASS 15/19) OR SOILCRETE	1	75 MM HYSON CELLS FILLED WITH CONCRETE (CLASS 15/19) OR SOILCRETE
2	BIDIM A6 AND OR SIMILAR APPROVED	2	BIDIM A6 AND OR SIMILAR APPROVED
3	1500 MICRON HDPE LINER	3	1500 MICRON HDPE LINER
4	150 MM 5% LIME STABILISED CLAY LAYER COMPACTED TO 95% STANDARD PROCTOR DENSITY	4	150 MM 5% LIME STABILISED CLAY LAYER COMPACTED TO 95% STANDARD PROCTOR DENSITY
4	DIMPLE DRAIN 500 AND OR SIMILAR APPROVED	4	DIMPLE DRAIN 500 AND OR SIMILAR APPROVED
5	300 MM CORRECTION LAYER (IN SITU MATERIAL RIP AND RE-COMPACT TO 93% MOD AASHTO DENSITY) - IF REQUIRED	5	300 MM CORRECTION LAYER (IN SITU MATERIAL RIP AND RE-COMPACT TO 93% MOD AASHTO IN CUT, PLACE, COMPACT AND TRIM TO 93% MOD AASHTO DENSITY) - IF REQUIRED
POLLUTION CONTROL - CELL 2			
BASE		CUT / EMBANKMENT SLOPES	
1	1500 MICRON HDPE - SACRIFICIAL LAYER	1	1500 MICRON HDPE - SACRIFICIAL LAYER
2	1500 MICRON HDPE LINER	2	1500 MICRON HDPE LINER
3	150 MM 5% LIME STABILISED CLAY LAYER COMPACTED TO 95% STANDARD PROCTOR DENSITY	3	150 MM 5% LIME STABILISED CLAY LAYER COMPACTED TO 95% STANDARD PROCTOR DENSITY
4	DIMPLE DRAIN 500 AND OR SIMILAR APPROVED	4	DIMPLE DRAIN 500 AND OR SIMILAR APPROVED
5	300 MM CORRECTION LAYER (IN SITU MATERIAL RIP AND RE-COMPACT TO 93% MOD AASHTO DENSITY) - IF REQUIRED	5	300 MM CORRECTION LAYER (IN SITU MATERIAL RIP AND RE-COMPACT TO 93% MOD AASHTO IN CUT, PLACE, COMPACT AND TRIM TO 93% MOD AASHTO DENSITY) - IF REQUIRED

4. POLICY AND LEGISLATIVE CONTEXT

Table 5: Policy and legislative context of the proposed project.

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED	HOW DOES THIS DEVELOPMENT COMPLY WITH AND RESPOND TO THE LEGISLATION AND POLICY CONTEXT?
Mineral and Petroleum Resources Development Act 28 of 2002 (MPRDA)	NC 30/5/1/2/3/2/1/(259) MR	In terms of **Section 102 of the MPRDA**, an amendment of the Sishen Mine Environmental Management Programme (EMPr) as amended to include the construction of the overflow dam at Aldag and Lylyveld PCD at Sishen Mine has been applied for.
National Environmental Management Act 107 of 1998 (NEMA)	NC 30/5/1/2/3/2/1/(259) MR	In terms of Regulation 31 of Part 2 of Chapter 5 of the EIA Regulations under **NEMA**, an amendment of the Sishen Mine EMPr as amended, has been applied for
Environmental Impact Assessment Regulations, 2014 (EIA Regulations) (GNR 982 in GG 38282 of 4 December 2014)		
EIA Regulations: Listing Notice 1 of 2014 (GNR 983 in GG 38282 of 4 December 2014)	NC 30/5/1/2/3/2/1/(259) MR	In terms of **NEMA** environmental authorization for Listed activities 9, 27, and 34 triggered in listing Notice 1 has been applied for
National Water Act 36 of 1998 (NWA)	Applied – Awaiting acceptance from DWS.	In terms of the **NWA** an amendment of the Sishen Mine Integrated Water Use License, has been applied for.
National Environmental Management: Biodiversity Act 10 of 2004 (NEMBA)		Section 57 of NEMBA restricts certain activities involving threatened and protected species (as listed in Regulation

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED	HOW DOES THIS DEVELOPMENT COMPLY WITH AND RESPOND TO THE LEGISLATION AND POLICY CONTEXT?
		GN. 151 and 152, February 2007) without a permit. Restricted activities applicable to the project are limited to the removal of Threatened or Protected Species (TOPS) plants during the clearance of vegetation. The construction of the overflow dam at Aldag PCD is a brownfields project and no clearance of vegetation will be undertaken and no permit is therefore required. The Lylyveld PCD is a Greenfields project and will be constructed in an area which includes areas which have not been previously disturbed. Vegetation clearance will take place and therefore a permit may be required.
National Heritage Resources Act 1999 (NHRA)	N/A	The NHRA provides for the protection of all archaeological and paleontological sites and meteorites. In terms of Section 34 of the Act, no person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant heritage resources authority. A Heritage Impact Assessment of the areas for site clearance for the development of the Lylyveld Stormwater Dam were undertaken in order to determine if there are any heritage resources and buildings older than 60 years. within the mine area
Conservation of Agricultural Resources Act 43 of 1983 (CARA)		Removal of the alien and weed species encountered in the area must take place in accordance with CARA and GNR1048 in GG 9238 of 25 May 1984. Removal of species should take place throughout the construction and operation, phases.
Northern Cape Nature Conservation Act 9 of 2009 (NCNCA)		In terms of Section 50 of NCNA a permit is required for the removal of TOPS.
National Forest Act 1998 (NFA)		One tree species, *Vachellia erioloba*, which is listed as Protected in Section 15 (1) of

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED	HOW DOES THIS DEVELOPMENT COMPLY WITH AND RESPOND TO THE LEGISLATION AND POLICY CONTEXT?
		the NFA was observed within the study area. All relevant permits pertaining to these species are to be acquired prior to onsite activities.

5. NEED AND DESIRABILITY OF THE PROPOSED ACTIVITIES

Sishen Mine is in the process of upgrading the water management system. The overflow dam at Aldag and Lylyveld PCD form an integral and important part of the water management system at the mine. The construction of the PCDs are required to improve the management of dirty and clean water at the mine and to ensure alignment with the provisions GNR. 704 of 1999 in terms of the NWA. The PCDs have been designed to contain dirty water run-off from a 1:50 year storm event. The PCD's will contain the dirty water thus preventing discharge of potentially polluted water (in the case of the overflow dam at Aldag PCD) or sediment (in the case of Lylyveld South PCD) into the natural environment. In addition, the recycling of water from the overflow dam at Aldag PCD into the process will increase the water use inefficiency at Sishen Mine.

6. MOTIVATION FOR THE OVERALL PREFERRED SITE, ACTIVITIES AND TECHNOLOGY ALTERNATIVE.

The overflow at the Aldag PCD is limited to its location, as it would need to remain in close proximity to the existing approved Aldag PCD. The current location is ideally located for the new PCD and it will also be built over already transformed area. No natural vegetation needs to be removed. The location is also suitable for pumping recovered water from the dam to the JIG plant as process water. The area is therefore considered to be ideal for the proposed purpose.

The Lylyveld South PCD is limited to its position mainly because it is required at the lowest elevation to ensure runoff and containment of dirty water. No other area down gradient of the mining operations is feasible due to the adverse effects to the environment. This mainly as the PCD will then be located too close to the Gamagara River bed. The area is therefore considered the most feasible location to manage dirty water runoff from the Lylyveld South catchment area.

The overflow dam at Aldag PCD will be lined with a 150mm HDPE liner; as the area will contain dirty water contaminated with hydrocarbon based material from the Aldag refuelling station. The liner for the Lylyveld South PCD will mainly act as an evaporation system and therefore not require an equivalent liner to a Class C; as indicated in Figure 4. Dirty water generated at the Lylyveld South mining operation will not be significantly polluted by hydrocarbon based materials and therefore the risk for groundwater pollution is low. The proposed liner for the Lylyveld PCD is described in Table 4.

7. DESCRIPTION OF THE PROCESS FOLLOWED TO REACH THE PROPOSED PREFERRED ALTERNATIVES

7.1 Details of the development footprint alternatives considered.

7.1.1 The property on which or location where it is proposed to undertake the activity;

No site alternatives were proposed for this project. The location of the PCDs are limited to the lowest points in order to capture stormwater flow from the catchment areas. The development site for the overflow dam at the Aldag PCD is limited to the location of the existing approved PCD. It will therefore be beneficial to have them in close proximity in order to enable the overflow and to ensure proper functioning. Furthermore, the area footprint will be kept to a minimum and will enable proper maintenance and management of the facility. The location of the Lylyveld PCD is limited to its position mainly because it is required at the lowest elevation to ensure runoff and containment of dirty water. No other area down gradient is feasible due to the adverse effects to the environment. This mainly as a result in the PCD being located to close to the Gamagara River bed. Both PCD's are located within the Sishen Mine approved mining right and property owned by SIOC.

7.1.2 The Type of activity to be undertaken

The activity is the development of dams in order to sufficiently capture the dirty water to ensure dirty water generated on the site does not spill into the environment more frequently than permissible. These systems will also consist of berms and channels routing water to a containment facility (PCD and silt trap). No other development would be able to serve the same purpose as the proposed PCD's. A possible alternative that was considered was to construct evaporation ponds; however due the space requirement for such systems. The options were not considered feasible.

7.1.3 The design or layout of the activity

The project forms part of an existing mining operation. The Sishen Mining Right area covers approximately 26 000 ha of which the new and expansion of the PCD's of approximately 9 ha will be included in the project. The development will thus take place within disturbed areas within the mining right area. All property is owned by SIOC. No areas outside of the mining right area or any alternative properties were considered.

Liner alternatives for the Lylyveld South PCD was also considered. The liner requirement for the Lylyveld PCD does not have to be equivalent to a Class C liner. The main reason being that the PCD is mainly required to capture sediments from the Lylyveld South mining operations prior to entering the Gamagara River.

7.1.4 The technology to be used in the activity

Few technology options exist for the establishment of PCDs. The options that are available are usually differentiated by the type of lining and terracing, the gradient of the land, geology, hydrology and climate. The construction, operation and decommission of the facility will also be the same irrespective of the technology chosen. The purpose of the PCD's will be the management of stormwater to capture dirty water. Technology alternatives is not relevant mainly because this is best practice to contain contaminated storm water. Therefore, no technological alternatives were assessed and considered in this regard.

7.1.5 The operational aspects of the activity

The two dams proposed are expected to carry water only after heavy rains. In dry periods these dams are supposed to be empty. The main function is to control pollution by storing surface run-off rain water during 1:50yrs rain events period.

No operational alternatives were assessed and considered as no feasible reasonable operational alternatives were identified for the proposed development.

7.1.6 The option of not implementing the activity

PCDs form an integral and important part of the water management systems on a mine. The purpose of PCDs for the mine and in the water management circuits are to: minimise the impact of polluted water on the water resource as well as to minimise the area that is polluted as far as possible, by separating out clean and dirty catchments. PCD's will capture and retain the dirty water contribution to the PCDs that cannot be discharged to the water resource, due to water quality constraints, and manage this dirty water through recycling, reuse, evaporation and/or treatment and authorised discharge.

The option of not building the PCDs as proposed will mean that infrastructure would not have sufficient capacity to contain dirty water during a 1:50 years flood event and this may lead to pollution of land and surface water and underground water sources.

7.2 Details of the Public Participation Process Followed

The public participation process was conducted in-line with the requirements of Chapter 6 of the NEMA Environmental Impact Assessment Regulations, Regulation 982 and included the following processes:

- Identification of Interested and Affected Parties (IAPs);
- Notification of IAPs regarding the proposed project;
- Gathering comments, issues and concerns from IAPs;
- Responding to IAP comments, issues and concerns;
- Providing IAPs with the opportunity to review and comment on the BAR.

Each of the processes is described in detail in the sections 7.2.1-7.2.5 below.

7.2.1 Identification of Interested and Affected Parties

Existing databases held by Sishen Mine were updated for the purposes of this project. Potential Interested and Affected Parties (IAPs) were identified based on the definition of IAPs in the EIA regulations. This includes:

- Landowners or tenants adjacent to or within 100 m from the proposed study area. Since the project occurs within the Sishen Mine fenced-off area, this definition was expanded to include neighbours to the mine. The members of the Sishen Environmental Forum include neighbouring landowners and all members were included in the IAP database.
- Representatives of the local municipality/ward councillor with jurisdiction in the area. This definition was expanded for the purposes of the assessment to include the mayor, councillors of the local council as well as members of the district municipality. This included representative of:
    - Gamagara Municipality (including councillors)
    - John Taolo Gaestsewe District Municipality
    - Representatives of ratepayer's associations
    - Authority or organ of state having jurisdiction in respect of any aspect of the activity. The following organs of state have been notified:
    - Department of Agriculture, Land Reform and Rural Development

  - Department of Education
  - Department of Home Affairs
  - Department of Justice
  - South African Heritage Resources Agency
  - Northern Cape Provincial Government
- Representatives of environmental regulatory authorities including:
  - Department of Water & Sanitation, Northern Cape
  - Department of Environment and Nature Conservation, Northern Cape
  - Department of Agriculture, Forestry and Fisheries, Northern Cape
  - Department of Mineral Resources, Northern Cape.
- Persons who responded to the Background Information Document (BID), press advertisements and site posters

The details of all IAPs were compiled into a IAP's database that is included as Appendix C.

7.2.2 Notification of Interested and Affected Parties

In accordance with the Section 41(2)(b) of Chapter 6 of the EIA Regulations (GN. 982 of 4 December 2014, as amended), written notifications (including BID document by email and SMS) has been given to:

- Surrounding landowners;
- Representatives of local government and the local municipalities;
- Ratepayer's association;
- Organs of state.

Written notifications (including BID document) was delivered by hand to the Municipal mayor of the Gamagara Municipality and by registered post to the Municipal Mayor of the John Taolo Gaestsewe District Municipality. Copies of the notification letter are provided in Appendix C.

Other forms of notification included the placement of Site Notices (as per the Regulation required size) at various locations. Five site notices were placed at strategic public locations within Kathu at the:

- Sishen Mine entrance;

- Spar;
- Foodzone;
- Gamagara Municipality
- Checkers

The site notices were available for a period of three (3) weeks whereby IAPs can register to be provided with more information on the project. Photos of the site notices are provided in Appendix C.

Press advertisements were placed in the following newspapers:

- The Volksblad on the 27th of November 2017 in Afrikaans; and
- The Kathu Gazette on the 25th of November 2017 in English.

A copy and proof of the newspaper adverts is provided in Appendix C.

7.2.3 Gathering Comments, Issues and Concerns from IAPs

IAPs were provided with the opportunity to register as IAPs and raise issues and concerns.

7.2.4 Responding to Comments, Issues and Concerns from IAPs

No comments, issues and concerns have been received to date.

7.2.5 Review and Commenting on the BAR

All IAPs were notified of the completion of the BAR and access to the report was made by:

- Electronically via CDs
- Hard copy reports
- Summaries

The BAR was available for review and comment from the 19th January 2018 to the 19th February 2018. Notification was by email. Please find attached as Appendix C a copy of the notification and report review. Additional time will be provided for IAPs that request the BAR after submission and any comments will be submitted to DMR.

7.3 Summary of issues raised by IAPs

Please refer to Appendix C, for the full comments and correspondence with IAPs and authorities.

PLEASE NOTE THAT THE PUBLIC INTEREST IN THE PROJECT HAS BEEN LIMITED AND NO COMMENT HAVE BEEN RECEIVED TO DATE.

7.4 The environmental attributes associated with the sites

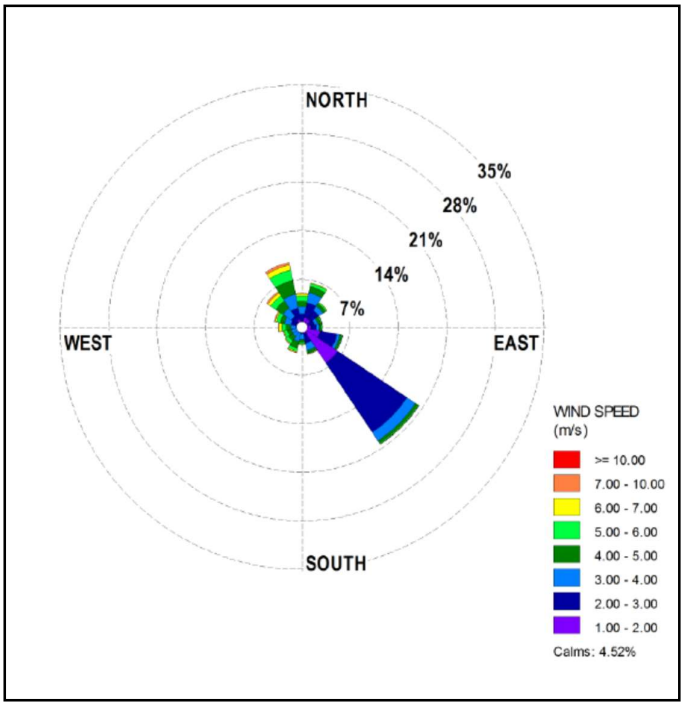
7.4.1 Baseline environment

7.4.1.1 Type of environment affected by the proposed project

The overflow dam at the Aldag PCD will be developed on previously transformed area and the Lylyveld PCD will be constructed in an area which includes areas which have not been previously disturbed. The following section describe the baseline environmental status quo:

Air Quality

The regional wind direction and speeds are of importance as they provide an indication of the receptors areas that will experience the greatest impacts resulting from atmospheric emissions and dust. The wind rose at Sishen Mine for the period of July 2015 to June 2016 (as provided by Airshed, 2017) is provided in Figure5. The wind field is dominated by winds from the north-west and south east with calm conditions occurring only 5% of the time.



Source: Air Quality Impact Assessment (Airshed, 2017)

FIGURE 5: PERIOD AVERAGE WIND ROSE FOR SISHEN MINE JULY 2015 TO JUNE 2016

It is expected that the air quality impacts resulting from activities at Sishen Mine will be most significant to the North-West and the South-East of the operations, particularly to the communities residing in Dingleton and Sesheng (Airshed, 2017). See Figure 6 for the location of receptors and monitoring stations.

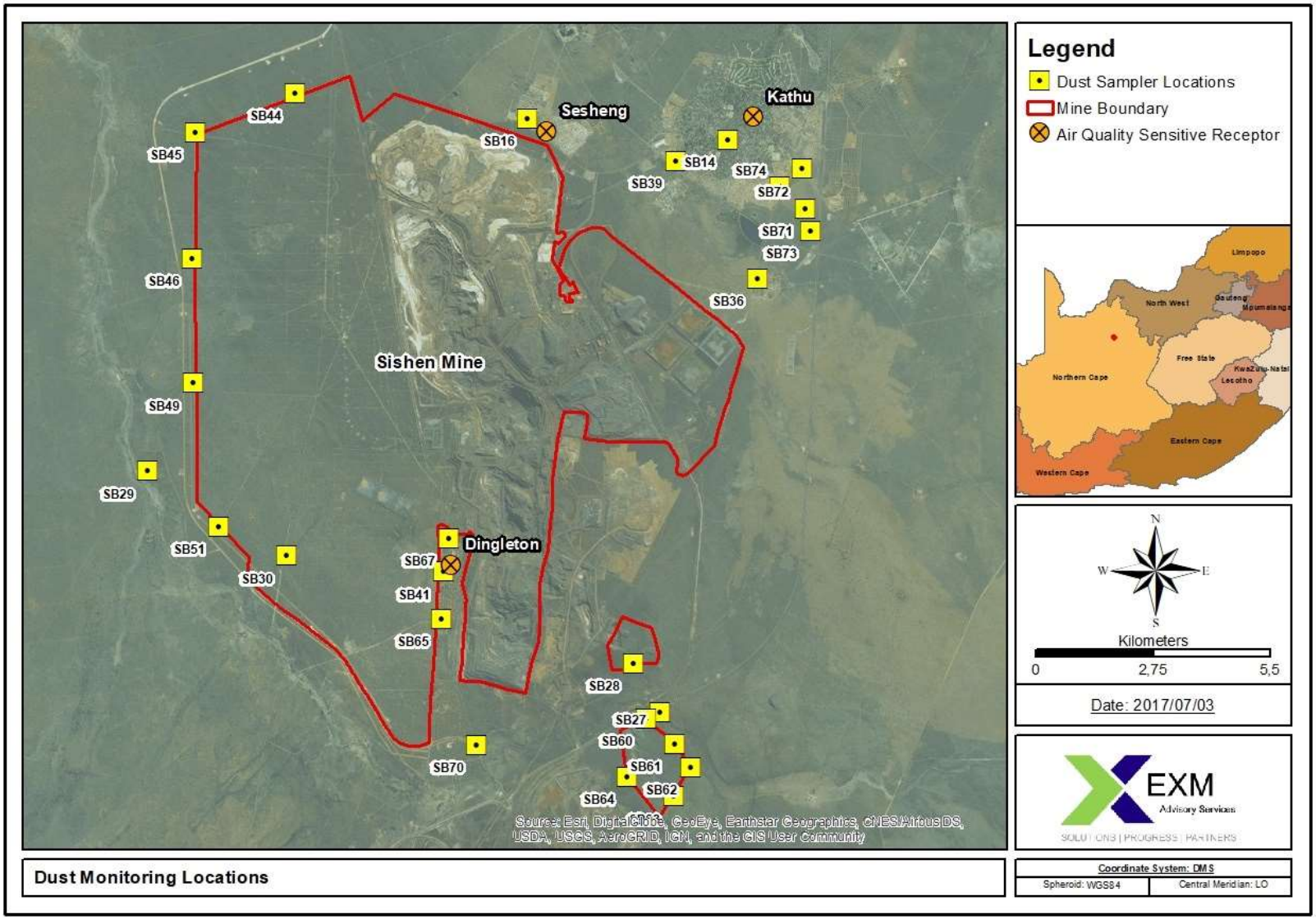


FIGURE 6: LOCATION OF DUST MONITORING STATIONS AND KEY RECEPTORS AT SISHEN MINE

The most recent air quality impact assessment for Sishen Mine was completed for the period July 2015 to June 2016 (Airshed, 2017). Over this period ambient air quality monitoring shows some non-compliance with the National Ambient Air Quality Standards (NAAQS, GN. 1210 of 24 December 2009) for PM_{10} at Sesheng and Dingleton (Table 6).

Table 6: Policy summary of pm10 and pm2.5 results for July 2015-June 2016 monitoring period

Receptor	PM_{10}		$PM_{2.5}$	
	Annual Average Conc. (µg/m3)	**Days of Exceedance of NAAQS (75 µg/m³)**	**Annual Average Conc. (µg/m³)**	**Days of Exceedance of NAAQS (40 µg/m³)**
Dingleton	39	**30**	8.3	0
Sesheng	47	**35**	13.4	1
Kathu	28	2	7.9	1
NAAQS	**40**	**4**	**20**	**4**

Source: Air Quality Impact Assessment (Airshed, 2017)

Dust fall also shows non-compliance with the national dust fallout limits. Non-compliances with the National Dust Control Regulations (NDCR, GN. 827 of 1 November 2013) during the 2015-2016 monitoring campaign are given in Table 7.

Table 7: Summary of months during which dustfall exceed acceptable levels as specified in the NDCR (JULY 2015-JUNE 2016)

Residential Areas (limit = 600 mg/m²/day)	**Months of Non-Compliance**
SB14 – Kathu	October 2015
SB16 – Sesheng	October 2015
SB31 - Tannic Kale Farm	October and December 2015
SB36 – Frum Sub Station	**September, October and November 2015[1]**
SB39 – Voëltjieklub	October 2015
SB41 – Dingleton	October and December 2015

SB71 – New Dingleton PPK Church	February 2016
Non-residential Areas (limit = 1 200 mg/m²/day)	
SB15 – Wincanton	October 2015 and January 2016
SB27 – Demaneng	**October 2015, January and March 2016[1]**
SB28 – Lylyveld North	October 2015 and January 2016
SB29 – Tamaga	October 2015
SB30 – Fritz	October 2015
SB34 – Vliegveld	October 2015
SB44 – Pipeline manhole	October 2015
SB45 – Pipeline T-joints	**September and October 2015[1]**

[1]Non-compliance with the NDCR permitted frequency of 2 exceedances per year, not in sequential months

According to Airshed (2017), the main sources of dust emanating from Sishen's operations are: vehicle entrained dust from unpaved haul roads, crushing and windblown dust with the contributions differing for the different classes of dust pollutants. The Sishen mine has developed and currently implementing a dust management plan to minimise dust generation from its operations.

Noise

A noise survey was undertaken for Sishen Mine in November 2016 (dbAcoutics, 2016). This survey included various monitoring points around the mine (see Figure 7). The monitoring results revealed that the mine activity is audible at most monitoring points and thus as receptors within Dingleton, Sesheng and at a farmhouse located West of the mine. The average noise levels do not exceed the SANS standards. The noise levels were not considered to be intrusive and or to create noise disturbance (dbAcoustics, 2016). The noise levels at Sishen Mine are considered to be normal and in line with the recommended noise levels as prescribed in SANS 10103 of 2008, as well as international best practice (described by the IFC). Although no noise monitoring point was surveyed during the assessment for the Lylyveld South Mining Operation. The Lylyveld South Mining Operation is mainly surrounded by existing mines and no sensitive receptor in close proximity could be identified.

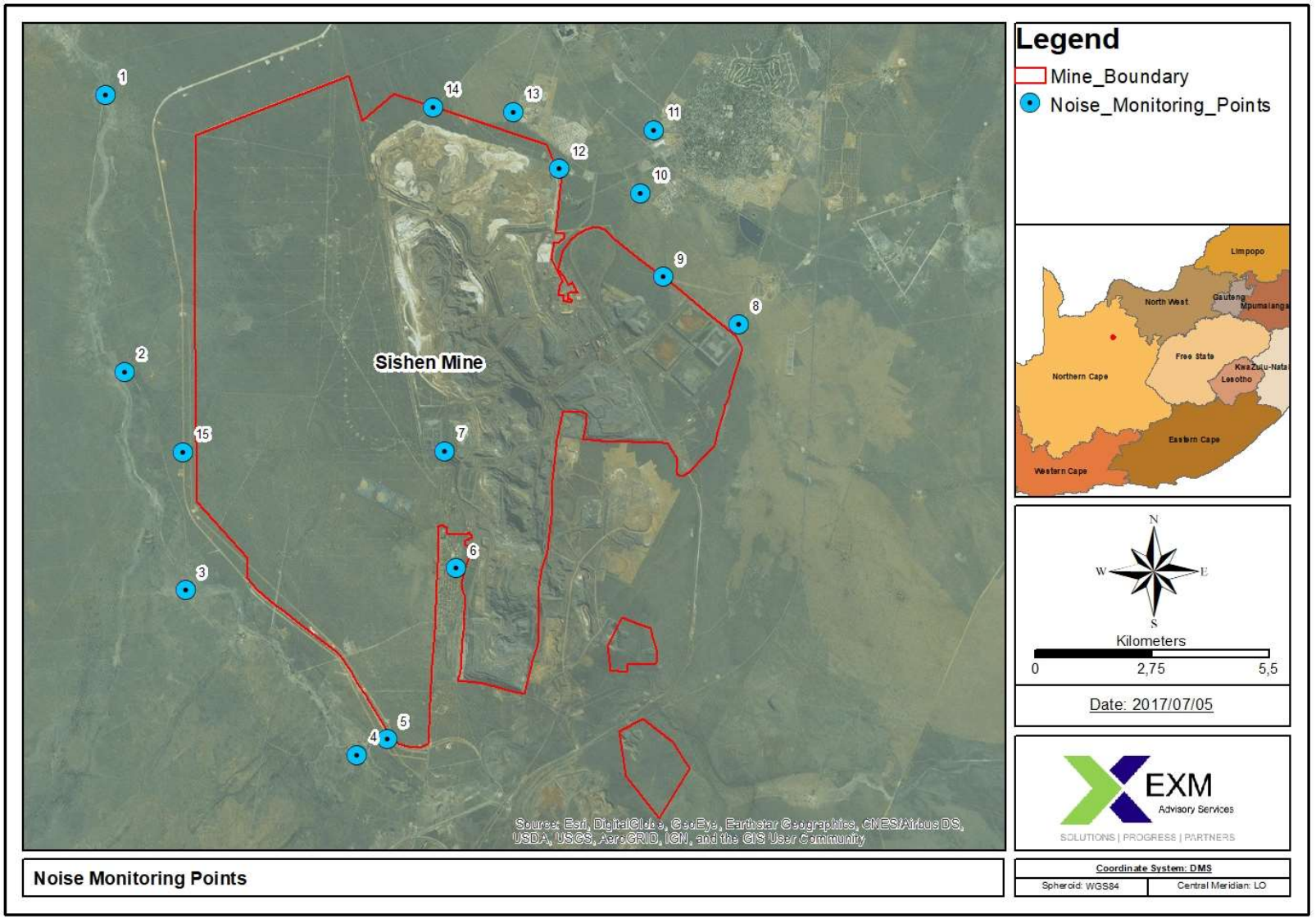


FIGURE 7: NOISE MONITORING POINTS SURROUNDING SISHEN MINE

Biodiversity

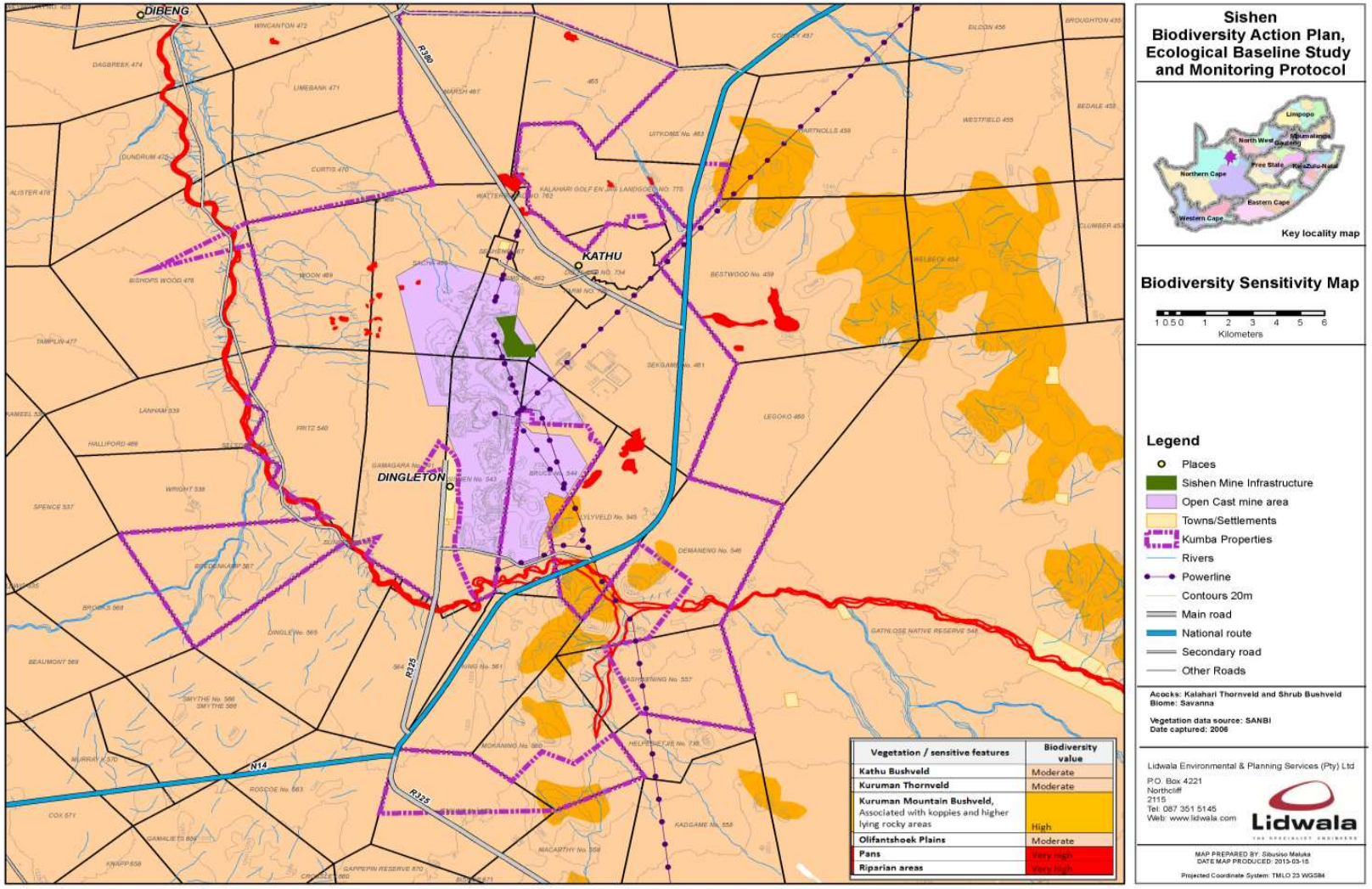
Sishen Mine is located in the Kathu Bushveld/Kuruman Thornveld (Munica & Rutherford, 2006). The Sishen Mine infrastructure and mine pit areas has been described by Lidwala (2013) as having no biodiversity value (see Figure 8). The expansion of the PCDs will all take place within this area. A Terrestrial Ecological Habitat Integrity Investigation was conducted as part of the Environmental Authorisation process for the proposed extension of the two PCD's. The report is attached hereto as Appendix D.

The Aldag and Lylyveld habitat unit is characteristic of the Degraded Kuruman Mountain Bushveld vegetation type as described by Mucina & Rutherford (2006). The habitat unit is considered to be degraded, with impacts resulting from land use and mining activities evident. The Degraded Kuruman Mountain Bushveld habitat unit is considered to be of moderately low sensitivity and development of the PCD will not lead to a loss of sensitive habitat.

The Lylyveld PCD Infrastructure Area is undulating with rocky soils throughout. One tree species, *Vachellia erioloba*, which is listed as Protected in Section 15 (1) of the National Forest Act (1998, as amended in September 2011) was observed within the study area. The study area was predominantly inhabited by faunal species common to the region, that are widely distributed throughout the surrounding habitat. Two faunal species, namely *Neotis ludwigii* (Ludwig's Bustard) and *Ardeotis kori* (Kori Bustard) as listed in the TOPS lists may infrequently visit the area surrounding the PCD. Only one alien invasive plant species was observed within the Lylyveld PCD Infrastructure Area at the time of assessment: *Prosopis glandulosa var. torreyana*.

The woody component of the Lylyveld PCD Infrastructure Area is dominated by species such as *Vachellia erioloba*, *Grewia flava* and *Senegalia mellifera subsp. detinens*, with the herbaceous layer dominated by species such as *Fingerhuthia afriacana, Stipagrostis amabilis* and *Eragrostis lehmanniana* amongst others. However, earthworks and edge effects associated with mining have degraded the habitat as was evident through the absence of larger woody species

The PCD Infrastructure Areas fall within an area that is currently not protected and that is least threatened. Neither of the PCD Infrastructure Areas fall within an area considered to be of biodiversity importance according to the Mining and Biodiversity Guidelines (2013). The PCD Infrastructure Areas is situated within the Griqualand West Centre of Endemism. The PCD Infrastructure Areas also falls within the Gamagara corridor. The Gamagara Corridor comprises the mining belt of the John Taolo Gaetsewe and Siyanda districts and runs from Lime Acres and Danielskuil to Hotazel in the north. The corridor focuses on the mining of iron and manganese.



Source: Biodiversity Action Plan (Lidwala, 2013)

FIGURE 8: SISHEN MINE BIODIVERSITY SENSITIVITY MAP (2013)

Surface Water Resources

Sishen Mine is located within the Lower Vaal Water Management Area (WMA), in the D41J Quaternary Catchment drained by the endorheic Gamagara River. The regional drainage pattern of the area is primarily to the Northwest in the direction of the endorheic Gamagara River, but most of the drainage lines in the mining area have historically been impacted on by mining activities. No surface water resources are located in close proximity to the proposed Aldag overflow dam. The proposed Lylyveld South PCD is approximately 250 metres from the Gamagara River. Currently all dirty water runoff from the Lylyveld South Mining Operations ends up with the Gamagara River causing sedimentation of the river. See Figure 10 showing the rivers and drainage lines surrounding the Lylyveld area.

Stormwater Management

The mean annual precipitation of 349 mm is an average based on rainfall records extending a period of 40 years for the Sishen Weather Station (Station No. 0356857AX,). Records show that the majority of rain falls in the late summer months of January, February and March, whilst the lowest rainfall records are recorded for the months of June, July and August. Table 8 details mean annual rainfall figures for the Sishen area.

Table 8: Mean monthly rainfall Sishen (1961 to 2001)

	Total	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	July	Aug	Sept
Average (mm)	349	23	31	55	70	56	62	33	12	6	2	3	8
Minimum (mm)	105	0	0	0	0	0	0	0	0	0	0	0	0
Maximum (mm)	1086	91	123	276	418	291	275	130	101	79	18	51	51

Source: Sishen IWWMP (MSA, 2014)

Table 9 indicates the highest recorded precipitation in 60 minutes and 24 hours, and the expected maximum precipitation event over 24 hours for the return periods of 25; 50 and 100 years.

Table 9: Storm events of different recurrence intervals

	Maximum recorded in		Expected maximum in 24 hours for		
Recurrence Interval	60 min	24 hrs.'	25 yr	50 yr	100 yr
Maximum Rainfall intensity (mm)	35,9	101,0	92,1	108,5	124,7

Source: Sishen IWWMP (MSA, 2014)

The average annual evaporation rate in the region is 2 026 mm a year, which is more than 5 times greater than the mean annual precipitation (i.e. 349 mm/year).

The stormwater at Sishen Mine is managed by means of two main stormwater drainage canals, namely the Eastern Stormwater Drainage Canal and the Western Stormwater Drainage Canal, which follow the natural (very flat) drainage gradients, before both discharge into the environment along the northern boundary of the mining area, as in Figure 9. The Lylyveld Mining are currently having no suitable stormwater management infrastructure in place. The proposed Lylyveld South PCD will therefore ensure that dirty water generated within the area is captured before it enters the Gamagara River.

The Western Stormwater Drainage Channel is approximately 7,1 km in length, having two other channels linked into it. These drain the areas to the South and West of the beneficiation plant site. They are referred to as the Bruce waste dump canal and the Mikrogolf waste dump canal. The Bruce waste dump canal drains the northern half of the Bruce waste dump, a portion of the non-refined ore stockpiles (stockpile 11B) and a small area to the north of this canal.

The Eastern drainage channel is about 6,4 km in length and drains primarily the eastern portions of the same mine residue dumps as the western drainage channel. The channel is located between the discard dumps and the beneficiation plant site. The eastern drainage channel also receives excess stormwater draining from the beneficiation plant area as well as the workshops, stores and administration areas. Stormwater from the pit area is pumped into the old slimes dams south of the mine adjacent to Protea waste rock dump at Sishen Mine.

Sishen Mine is in the process of upgrading the stormwater management system at the mine by improving the management of dirty and clean water systems to ensure alignment with GNR. 704 and to meet the requirements of the DWS. The proposed overflow PCD at Aldag is therefore proposed to support the current approved Aldag PCD and also align with Sishen Mine stormwater management plan to contain all dirty water to comply with GN 704.

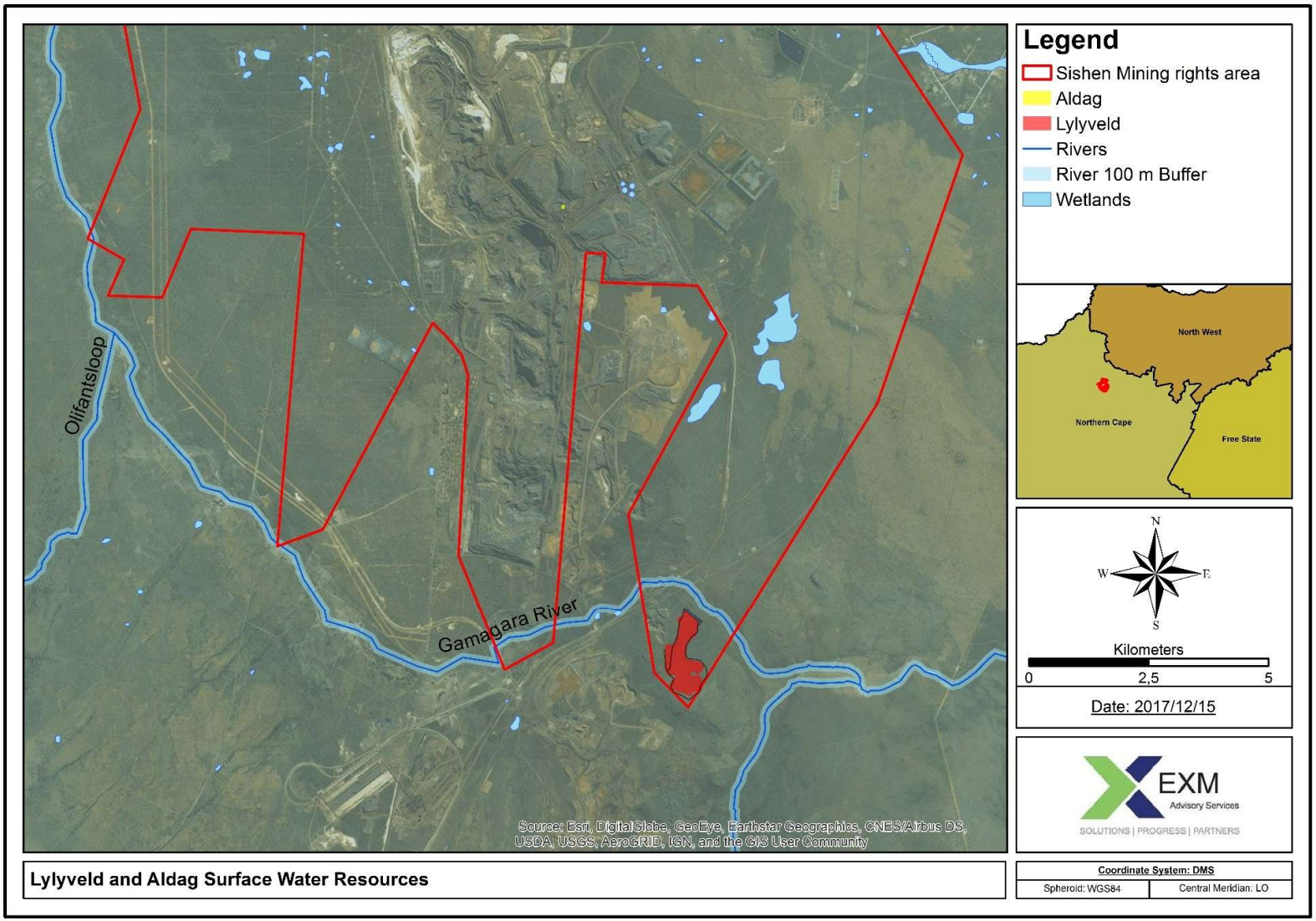


FIGURE 9: RIVERS AND DRAINAGE LINES SURROUNDING THE LYLYVELD AREA

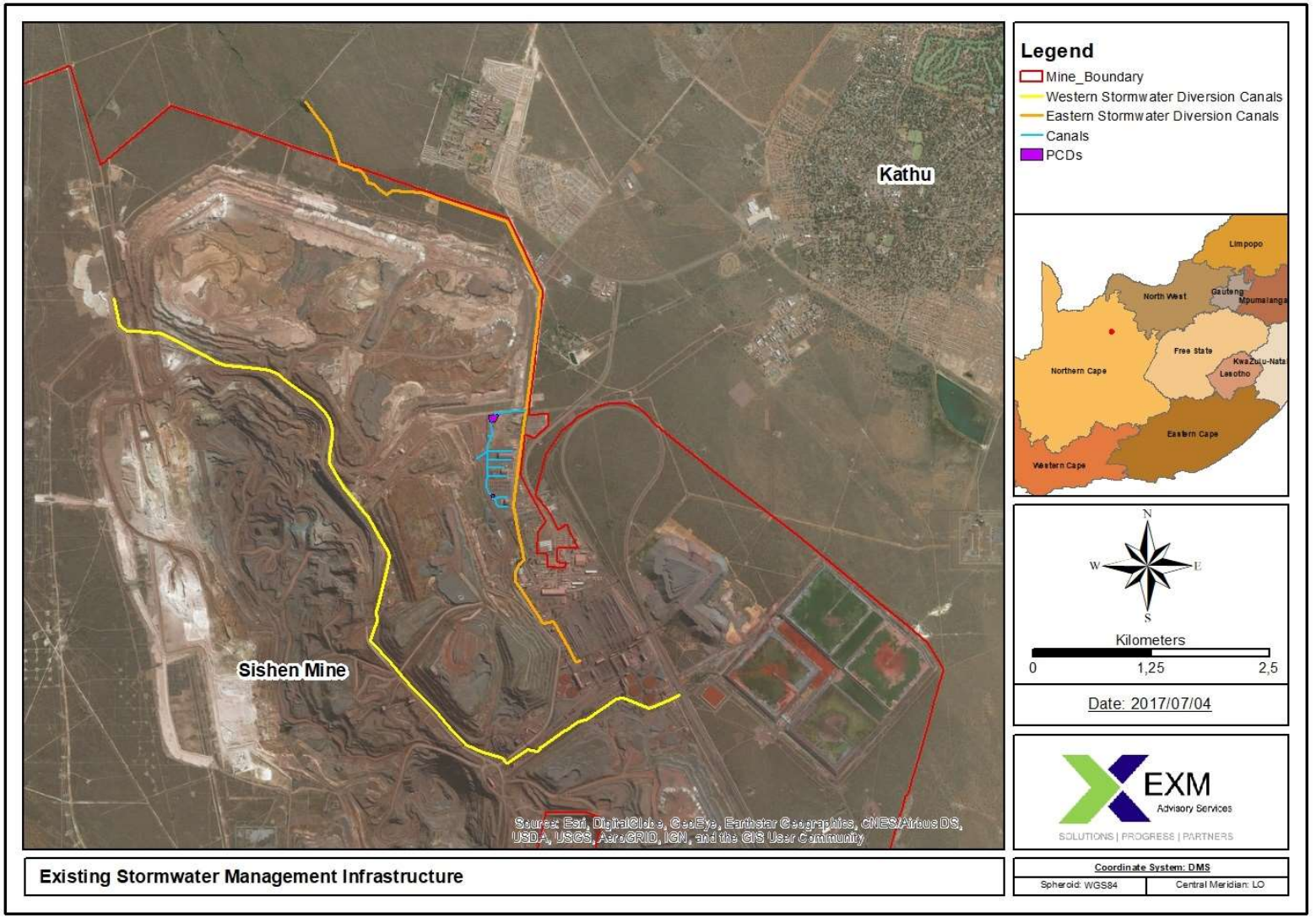


FIGURE 10: EXISTING STORMWATER MANAGEMENT AT SISHEN MINE

Surface Water Quality

According to the IWWMP (MSA, 2014), process water circulated within Sishen Mine can be described as neutral to slightly alkaline (pH levels between 7.21 and 8.54 with an overall average of 7.30), non-saline to extremely saline (TDS between 329 and 5 787 mg/l with an overall average of 908 mg/l) and very hard (Total Hardness between 316 mg/l and 566 mg/l with an overall average of 381 mg/l). There is also evidence of nitrate contamination at some of the monitoring points including the SEP Process Water Dam, inflow into the DMS thickeners and the tailings return water dam where levels average above 60 mg/l. This exceeds licence conditions. High levels of organic compounds (hydrocarbons) have also been detected in process water.

The proposed Lylyveld South PCD main purpose is to capture sediment before it enters the Gamagara River. The operations at Lylyveld South does not present a high probability of adversely affecting the surface water quality. The main reason being that the nature of mining activities at Lylyveld South does not present major sources of pollution; particularly hydrocarbon based materials. This also being the reason for the less stringent liner requirements. The proposed overflow dam at Aldag however has been proposed to ensure that dirty water generated within the delineated dirty catchment area does not overflow into the surrounding environment. The dam is required due to the under sizing of the original approved PCD no being able to contain a 1:50 year flood. The Aldag refuelling Station present a major source of hydrocarbon pollution potential. This mainly being the reason for the more stringent Class C liner requirement. As the source water will be contaminated with hydrocarbon based material. The overflow dam will also be equipped with an oil separator.

Groundwater Quality

There is an extensive groundwater monitoring network at Sishen Mine (see Figure 11). The quality of primary and shallow groundwater at Sishen Mine has been impacted on by historic pollution, with hydrocarbons being the most important contaminants resulting in pollution at the mine. The areas where pollution has occurred are the Aldag Service Station, the existing Diesel Workshop, the Total Depot, the Load-out Station workshop area, the current hazardous waste storage yard and the Primary Crusher Tunnel. Remediation of these contaminated areas is underway. Non-compliances of groundwater quality with South African national standards for drinking water (SANS, 2015) are shown in Table 10. Exceedances include nitrate, ammonia, lead and manganese.

The PCD expansion project will prevent groundwater contamination as result of the seepage of pollutants to groundwater by lining the dams with HDPE liners. Application have been made for an amendment to the existing Sishen Mine Integrated Water Use Licence (IWUL) to include the construction of a new PCD at the Aldag Filling Station and the expansion of the existing approved PCD at the Lylyveld South Mining Areas according to section 21(g).

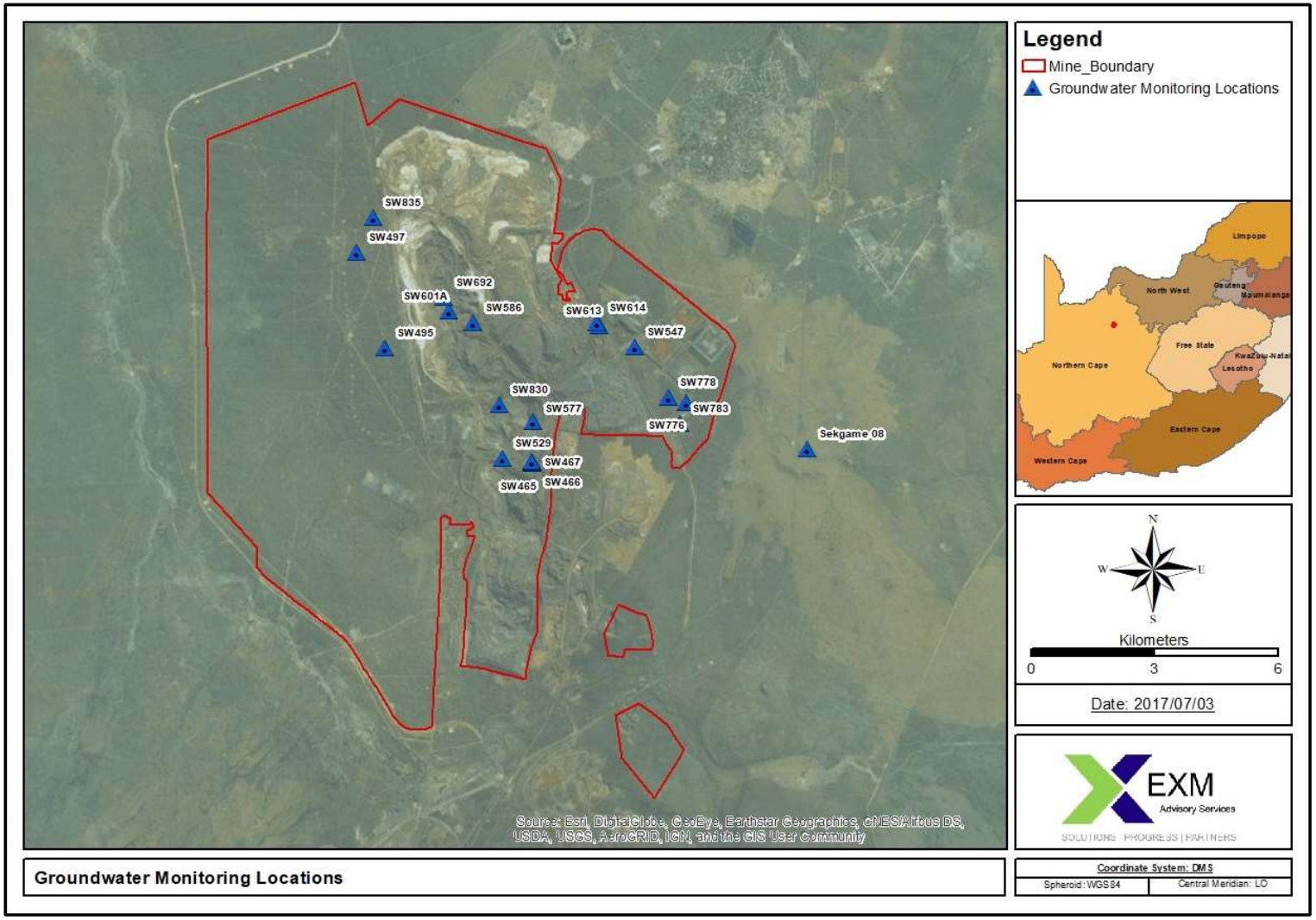


FIGURE 11: EXISTING GROUNDWATER MONITORING POINTS AT SISHEN MINE

Table 10: Non-compliances sans drinking water standards detected in groundwater at Sishen mine (based on 95th percentile from 2003-2014)

Parameter	Symbol	Unit	Value	Risk	SW495	SW497	W467	W547	SW577
Total dissolved solids	TDS	mg/ℓ	1200	Aesthetic	430	386	415	956	414
pH	pH	pH units	5-9.7	Operational	7.6	7.5	7.4	7.7	7.5
Chemical determinants – Macro									
Nitrate	NO_3	mg/ℓ	50	Acute health-1	16	4	18	304	20
Sulphate	SO_4	mg/ℓ	500	Acute health-1	33	32	17	93	17
			250	Aesthetic	33	32	17	93	17
Fluoride	F	mg/ℓ	1.5	Chronic health	0.6	0.3	0.8	0.4	
Ammonia	NH_4	mg/ℓ	1.9	Aesthetic	0.1	0.2	0.2	2.5	0.2
Chloride	Cl	mg/ℓ	300	Aesthetic	39	37	30	100	32
Sodium	Na	mg/ℓ	200	Aesthetic	22	23	18	69	19
Zinc	Zn	mg/ℓ	5	Aesthetic	0	1	0	0	0
Chemical determinants – Micro									
Antimony	Sb	µg/ℓ	20	Chronic health	n.a.	n.a.	n.a.	n.a.	n.a.
Arsenic	As	µg/ℓ	10	Chronic health	b.d.	b.d.	b.d.	b.d.	b.d.
Cadmium	Cd	µg/ℓ	3	Chronic health	b.d.	b.d.	b.d.	b.d.	b.d.
Total Chromium	Cr	µg/ℓ	50	Chronic health	b.d.	2	b.d.	b.d.	b.d.
Cobalt	Co	µg/ℓ	500	Chronic health	2	3	b.d.	b.d.	b.d.
Copper	Cu	µg/ℓ	2000	Chronic health	37	35	31	51	33
Cyanide (recoverable)	CN	µg/ℓ	70	Acute health – 1	n.a.	n.a.	n.a.	n.a.	n.a.
Iron	Fe	µg/ℓ	2000	Chronic health	13	13	9	215	12
		µg/ℓ	300	Chronic health	13	13	9	215	12
Lead	Pb	µg/ℓ	10	Chronic health	0	19	16	1	14
Manganese	Mn	µg/ℓ	500	Chronic health	294	298	8	33	8
		µg/ℓ	100	Aesthetic	294	298	8	33	8
Mercury	Hg	µg/ℓ	6	Chronic health	b.d.	b.d.	b.d.	b.d.	b.d.
Nickel	Ni	µg/ℓ	70	Chronic health	12	11	9	b.d.	10
Selenium	Se	µg/ℓ	10	Chronic health	b.d.	b.d.	b.d.	b.d.	b.d.
Uranium	U	µg/ℓ	15	Chronic health	b.d.	b.d.	b.d.	b.d.	b.d.
Vanadium	V	µg/ℓ	200	Chronic health	54	45	48	b.d.	47
Aluminium	Al	µg/ℓ	300	Operational	b.d.	b.d.	b.d.	52	b.d.

Source: Mine Residue Leachate Assessment (Exigo, 2014)

Land Tenure

The proposed PCDs will both be located within the existing Sishen mining right area. The Sishen Mine surface rights and operating assets are owned by the SIOC. The properties on which the project will be located are provided in Table 11.

Table 11: Project Property Surface Right Ownership

Infrastructure	Location	Property Ownership*
Lylyveld PCD	Remaining extent of the farm Lylyveld 545: C04100000000054500000	Sishen Iron Ore Company (Pty) Ltd
Overflow dam at the Aldag PCD	Remaining extent of the farm Sishen 543: C04100000000054300000	Sishen Iron Ore Company (Pty) Ltd

*the ownership information is extracted from the Vryburg deeds Office, June 2016

Cultural Heritage

The proposed overflow PCD at Aldag will take place within disturbed areas of Sishen Mine. The main concern regarding Heritage Impact is focused on the proposed Lylyveld South PCD which is proposed on a previously undisturbed area. A Heritage Impact Assessment (HIA) of the areas was conducted for site clearance for the development of the Lylyveld South PCD. The report is attached hereto as Appendix E.

The landscape where the Lylyveld South PCD is to be located has a rich and diverse history. No heritage sites were however identified with the site boundaries during the fieldwork. Despite the fact that subterranean Stone Age material is known from the surroundings of the study area. There is thus a high probability that such material could occur at the site. As per the palaeontological desktop assessment the proposed development is unlikely to pose a substantial threat to local fossil heritage.

Socio-Economic Environment

Sishen Mine is located in the Gamagara Local Municipality within the John Taolo Gaetsewe District Municipality and which includes the towns of Kathu, Dibeng, Sesheng and Olifantshoek. Sending municipalities include Joe Morolong Local Municipality and Ga-Estonians Local Municipality.

Sishen Mine has played a significant role in the establishment and development of the town of Kathu and surrounds since 1953. The district is largely reliant on mining with mining contributing 55.5% to the district and 77.5% to the local municipal economy (Demacon, 2016). The mining sector is also the largest employer in the local economy. According to Demacon (2016) there are approximately 50 000 people living in the Gamagara municipal area of which 65% are economically active and 82.3% are formally employed. The sending municipalities show lower economically active segments with approximately 51% and 26% of persons being economically active in Gamagara Local Municipality and Joe Morolong Local Municipality, respectively. Unemployment in these municipalities is also high at 33% and 39%. Similarly, the living standards in the sending municipalities are far lower than in Gamagara.

Sishen Mine plays a crucial role in both the local and provincial economy. For every employee working at the mine, approximately 5 other people are affected (Demacon, 2016). The PCD expansion project will result in both direct and contract opportunities during the construction phase although very limited. No new employment opportunities will be created during operation of the PCD's.

7.4.2 Description of current land uses

The overflow dam to the Aldag PCD will be developed on previously transformed area and the Lylyveld South PCD will be constructed in an area which includes areas which have not been previously disturbed. Only the Lylyveld site will have an adverse effect on the terrestrial environment, which would need to be cleared to construct the PCD. The whole area has however been rezoned for mining.

7.4.3 Description of specific environmental features and infrastructure on the site

The overflow dam at the Aldag PCD is located on completely transformed areas due to historic and current mining activities. No sensitive environmental features existing within or surrounding the overflow dam.

The Lylyveld PCD is located within the degraded Kuruman Mountain Bushveld. One tree species, *Vachellia erioloba*, which is listed as Protected in Section 15 (1) of the National Forest Act (1998, as amended in September 2011) was observed within the study area. Two faunal species, namely *Neotis ludwigii* (Ludwig's Bustard) and *Ardeotis kori* (Kori Bustard) as listed in the TOPS lists may infrequently visit the area surrounding the PCD.

7.4.4 Environmental and current land-use map

Please refer to Land Use maps in Figure 12 & 13

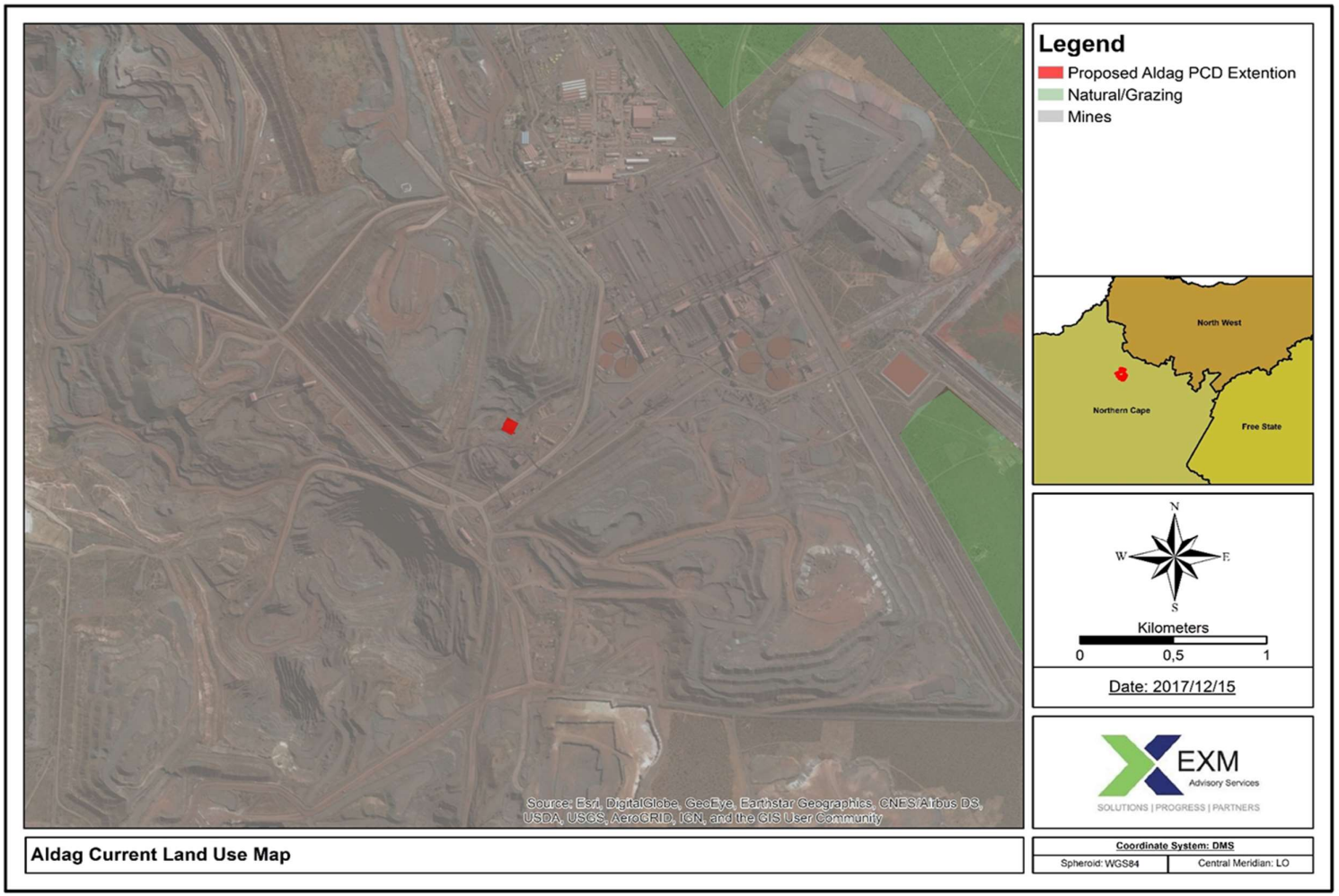


FIGURE 12: OVERFLOW DAM AT THE ALDAG PCD ENVIRONMENTAL AND CURRENT LAND USE MAP

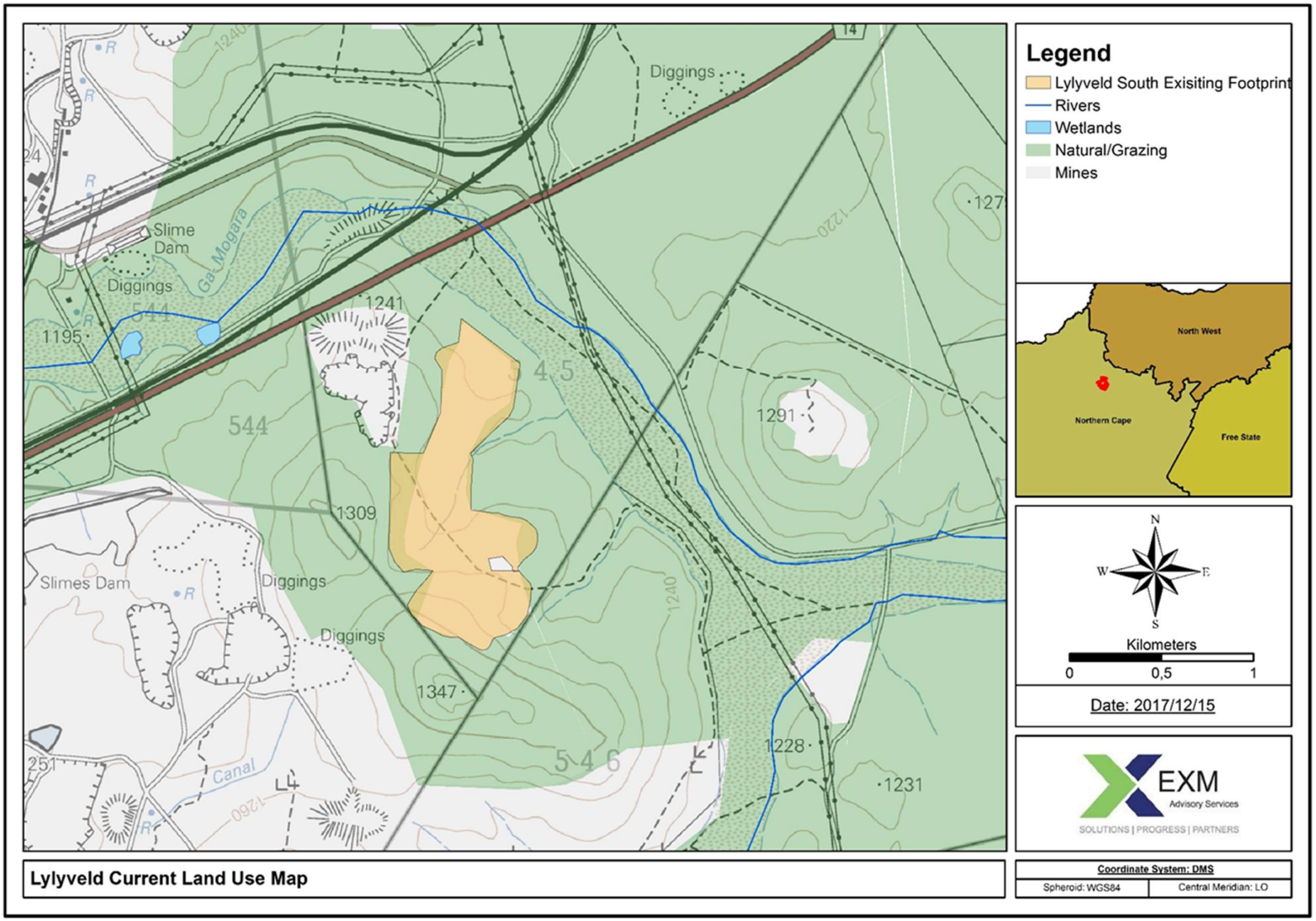


FIGURE 13: LYLYVELD PCD ENVIRONMENTAL AND CURRENT LAND USE MAP

7.5 Impacts identified

The list of the potential impacts of the activities that will be undertaken, as described in the initial site layout are included below. This list of impacts has been informed by both the typical known impacts of such activities and as informed by the consultation with IAPs.

7.5.1 Methodology used in determining the significance of environmental impacts

Impact Ranking Criteria

The impact assessment method used in this assessment takes into account the current environment, the details of the proposed amendment activities and the findings of the specialist studies. Cognisance has been given to both positive and negative impacts that may result from the developments. The significance of the impact is dependent on the consequence and the probability that the impact will occur.

impact significance = (consequence x probability)

Where:

consequence = (severity + extent)/2

and

severity = [intensity + duration]/2

Each criterion is given a score from 1 to 5 based on the definitions given below. Although the criteria used for the assessment of impacts attempts to quantify the significance, it is important to note that the assessment is generally a qualitative process and therefore the application of this criteria is open to interpretation. The process adopted will therefore include the application of scientific measurements and professional judgement to determine the significance of environmental impacts associated with the project. The assessment thus largely relies on experience of the environmental assessment practitioner (EAP) and the information provided by the specialists appointed to undertake studies for the basic assessment.

Where the consequence of an event is not known or cannot be determined, the "precautionary principle" has been applied and the worst-case scenario assumed. Where possible, mitigation measures to reduce the significance of negative impacts and enhance positive impacts will be recommended. The significance of the impact in light of the mitigation measures has also been rated based on a confidence rating of the mitigation measures.

Consideration will be given to the phase of the project during which the impact occurs. The phase of the development during which the impact will occur will be noted to assist with the scheduling and implementation of management measures.

Criteria for Assessing the Impact Significance

Severity Criteria

INTENSITY = MAGNITUDE OF IMPACT	**RATING**
Insignificant: impact is of a very low magnitude	**1**
Low: impact is of low magnitude	**2**
Medium: impact is of medium magnitude	**3**
High: impact is of high magnitude	**4**
Very high: impact is of highest order possible	**5**

DURATION = HOW LONG THE IMPACT LASTS	**RATING**
Very short-term: impact lasts for a very short time (less than a month)	1
Short-term: impact lasts for a short time (months but less than a year)	2
Medium-term: impact lasts for the for more than a year but less than the life of operation.	3
Long-term: impact occurs over the operational life of the proposed mine.	4
Residual: impact is permanent (remains after mine closure)	5

EXTENT = SPATIAL SCOPE OF IMPACT/ FOOTPRINT AREA / NUMBER OF	**RATING**
Limited: impact affects the mine site	1
Small: impact extends to the whole farm portion	2
Medium: impact extends to neighbouring properties	3
Large: impact affects the surrounding community	4
Very Large: The impact affects an area larger the municipal area	5

Probability

PROBABILITY = LIKELIHOOD THAT THE IMPACT WILL OCCUR	**RATING**
Highly unlikely: the impact is highly unlikely to occur	0.2
Unlikely: the impact is unlikely to occur	0.4
Possible: the impact could possibly occur	0.6
Probable: the impact will probably occur	0.8
Definite: the impact will occur	1

Impact Significance

NEGATIVE IMPACTS

≤1	Very low	Impact is negligible. No mitigation required.
>1≤2	Low	Impact is of a low order. Mitigation could be considered to reduce impacts. But does not affect environmental acceptability.
>2≤3	Moderate	Impact is real but not substantial in relation to other impacts. Mitigation should be implemented to reduce impacts.
>3≤4	High	Impact is substantial. Mitigation is required to lower impacts to acceptable levels.
>4≤5	Very High	Impact is of the highest order possible. Mitigation is required to lower impacts to acceptable levels. Potential Fatal Flaw.

POSITIVE IMPACTS

≤1	Very low	Impact is negligible.
>1≤2	Low	Impact is of a low order.
>2≤3	Moderate	Impact is real but not substantial in relation to other impacts.
>3≤4	High	Impact is substantial.
>4≤5	Very High	Impact is of the highest order possible.

DEVELOPMENT PHASE

C	Impact is applicable to the CONSTRUCTION PHASE ONLY
O	Impact is applicable to the OPERATIONAL PHASE ONLY
C&O	Impact is applicable to the CONSTRUCTION AND OPERATIONAL PHASE

7.6 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.

NOTE: A COMPREHENSIVE ASSESSMENT OF ALL IMPACTS IS GIVEN IN SECTION 9. A SHORT DESCRIPTION OF KEY IMPACTS AS DESCRIBED IN THE SPECIALIST STUDIES IS PROVIDED 9.1 AND 9.2. THE SPECIALISTS' IMPACT ASSESSMENTS WERE CONDUCTED ON THE PREFERRED LAYOUT PLAN 1 (FIGURE 2 AND 3).

7.7 The possible mitigation measures that could be applied and the level of l risk.

The mitigation measures for each of the identified impacts are included in 12-14 of Section 9. Mitigation of key impacts and risks are also discussed in detail in Section 9.

The significance of the impact with mitigation has been weighted by multiplying the significance rating without significance by the following depending on the confidence placed in the successful implementation of the mitigation measures or the effectiveness of those measures in reducing the impact.

1	Very low	Measures are very difficult or expensive to implement or are not expected to be effective in reducing the impact (No Confidence)
0.8	Low	Measures are difficult or expensive to implement or are expected to have limited effectiveness in reducing the impact (20% Confidence)
0.5	Moderate	Measures can be implemented with some effort and cost and/or the measures can be effective in mitigating the impact if implemented (50% Confidence)
0.2	High	There is high confidence that mitigation measures can be implemented and can be effective in mitigating the impact (80% Confidence)

7.8 Motivation where no alternative sites were considered.

No alternative sites were considered as result of the overflow dam at the Aldag PCD being limited to the location of the existing approved PCD. Furthermore, the Lylyveld PCD is limited to its position mainly because it is required at the lowest elevation to ensure runoff and containment of dirty water. No other area down gradient is feasible due to the adverse effects to the environment (Refer to section 7.1.

7.9 Statement motivating the alternative development location within the overall site.

The areas included in the infrastructure were identified through methods listed in Section 3-7.

8. 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.

Please refer to Section 7.5.1 for the methodology used in the ranking of impacts. Please also refer to Section 7.7 for the methodology used for the application of a mitigation confidence ranking to the impact ranking. A comprehensive assessment of all impacts is given in section 9.

9. ASSESSMENT OF EACH IDENTIFIED POTENTIALLY SIGNIFICANT IMPACT AND RISK

The impact assessment for each phase of the proposed project is provided below for the construction phase (Table 12), operational phase (Table 13) and decommissioning and closure phase (Table 14). The assessment of the impact and recommended mitigation measures have been identified though the utilisation of the baseline environmental, including the impact assessment methodology provided in section 7.5.1 and the methodology used for the application of a mitigation confidence ranking provided in section 7.7. The supporting impact assessment for construction, operation and decommissioning conducted by the EAP is attached as Appendix F

Table 12: Construction phase impacts for the proposed overflow dam at the Aldag PCD and Lylyveld South PCD

ASPECT	ACTIVITIES	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
Air Quality	Operation of construction vehicles and machinery resulting in entrainment of dust.	Increase in fugitive dust emissions particularly due to an increase in particulate dust levels (PM10 and PM 2.5)	**Moderate**	•Implementation of Sishen Mine Dust Management Plan utilising a combination of watering and chemical stabilization to reduce road dust. •Dust suppression must be performed via a dust suppression watering truck, on the site roads, construction camps and other construction areas. •Vehicles to be used during the construction phase are to be kept in good working condition and should not be the source of excessive fumes. •Air filters on all mechanized equipment must be properly designed and maintained. •Proper rehabilitation of disturbed areas is required in order to minimize the occurrence of bare patches of exposed soil.	Low

ASPECT	ACTIVITIES	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
Visual Environment	Operation of vehicles and machinery Clearance of natural vegetation	Visual impacts as a result of construction activities is only applicable to Lylylvedl South PCD. No visual Impact is expected as result of the construction of the overflow dam at Aldag PDC.. This will primarily involve the deterioration of the local scenic quality and an alteration to the area's sense of place. An expected increase in visibility and visual exposure of the PCD operations. Dust will have a particular impact on visual aesthetic.	**Moderate**	• Implementation of Sishen Mine Dust Management Plan utilising a combination of watering and chemical stabilization to reduce road dust. •Minimize clearance of vegetation. Retain natural trees, shrubbery and grass species wherever possible. •Ensure the amount of bare soil exposed is minimized by staging earthworks in phases and leaving as much ground cover intact as possible during construction.	**Moderate**

ASPECT	ACTIVITIES	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
Soil, Land Use and Land Capability	Vehicular movement on site during the transportation of construction material, vegetation clearance, haulage of stripped topsoil and any other construction activity that requires heavy vehicle movement on site.	Soil compaction will lead to the deterioration of soil fertility and soil potential. Additionally, soil compaction will limit the permeability of the soil in terms of root penetration.	**Moderate**	•Clearly demarcate all construction areas and restrict the activities of contractors and employees to these areas. •Restrict all vehicle movement to the absolute minimum and use dedicated roads. •Existing roads should be used as far as possible. •Heavy vehicles, such as excavators, may only leave roads or parking areas when specific work needs to be undertaken and the go ahead has been given for work to be carried out. •Compliance in terms of contractor activities and vehicular movement must be monitored and reported on weekly. •Minimize clearance of vegetation. •Topsoil stockpiles should be kept as small as possible to prevent compaction of the soils at the bottom of the stockpile. •Vegetation clearance and soil stripping should not be undertaken during wet conditions to prevent soil compaction. •During stripping of soils, contractors should be supervised regarding their activities. •Soil Ripping should be undertaken in areas that will not form part of the infrastructure planed, but have been affected by construction activities. These areas should be revegetated and maintained.	**Low**

ASPECT	ACTIVITIES	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
	Clearance of vegetation, stripping of soils and stockpiling of soils during construction.	Soil erosion and sedimentation. Effective management measures must be implemented to ensure that wind and water erosion are limited at soil stockpile areas and rehabilitation areas. Soil erosion will lead to the physical degradation of the soil. Soil erosion will lead to changes in the ecological characteristics of any disturbed area i.e. establishment of alien invasive species resulting in the loss of natural habitat for indigenous fauna and flora. Soil erosion will lead to a shortage of soil/material for the successful rehabilitation of disturbed areas.	**Moderate**	•During vegetation clearance and soil stripping, contractors and operators should be supervised regarding their activities. •Construction during wet conditions should be restricted or closely monitored to prevent soil erosion. •Soil that is stripped during construction activities should be stockpiled and stockpiles should be protected by an upslope berm and toe channel to divert water run-off to prevent erosion and transportation of sediments. •Soil that is cleared during initial construction of the PCD's should only be stockpiled for a short period and used to rehabilitate mined out areas or banks of PCD. •Repair all erosion damage as soon as possible and in any case not later than six months before the termination of the Maintenance Period to allow for sufficient rehabilitation growth. •Ensure that channels do not discharge straight down the contours. These must be aligned at such an angle to the contours that they have the least possible gradient. •Revegetation of disturbed areas should be undertaken as soon as activities have ceased to prevent further soil loss due to erosion.	**Low**

ASPECT	ACTIVITIES	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
	Leaking of hydrocarbons from vehicles and machinery. Temporary fuel storage.	Soil contamination will have a detrimental effect on resource availability for stockpiling and re-use during rehabilitation of the PCDs and other disturbed areas. Hydrocarbon contamination of soils could occur as a result of oil/diesel leaks from heavy machinery and dirty water run-off from workshops and the servicing and repair of machines.	**Moderate**	•Water falling on areas polluted with oil/diesel or other hazardous substances must be contained. Any excess or waste material or chemicals should be removed from the site and discarded in an environmental friendly way. •Care must be taken when handling any substance that has the potential to cause soil pollution. •In the case of spills, immediate action should be taken to clean up the spill and isolate the contaminated soil. Spillages or leakages must be treated according to an applicable procedure as determined by a plan of action for the specific type of disturbance; Spill kits should be on-hand to deal with spills immediately. •Records should be kept and updated regarding spills and soil contamination. •Machine breakdowns should be attended to promptly in order to prevent oil spills. •Drip trays should be placed under vehicles and machinery that have a visible leak. •Chemical storage facilities should be bunded and paved to prevent soil contamination. ● Construction vehicles should be inspected for oil and fuel leaks regularly and frequently. Vehicle maintenance will not be done on site except in emergency situations in which case mobile drip trays will be used to capture any spills. Drip trays should be emptied into a holding tank and returned to the supplier.	**Low**

ASPECT	ACTIVITIES	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
Biodiversity	Clearance of vegetation, stripping of soils and stockpiling of soils during construction.	Direct habitat destruction of fauna / flora habitat. Habitat fragmentation	**Moderate**	•Peripheral impacts around the excavation area on the surrounding vegetation of the area should be avoided and a monitoring programme should be implemented to ensure the impacts are kept to a minimum, while the rehabilitation of the site should be prioritised after the development has been completed; •During construction, sensitive habitats must be avoided by construction vehicles and equipment, wherever possible, in order to reduce potential impacts. Only necessary damage must be caused and, for example, unnecessary driving around in the veld or bulldozing natural habitat must not take place; •All development activities should be restricted to specific recommended areas. •Storage of road-building equipment, fuel and other materials should be limited to demarcated areas. Layouts should be adapted to fit natural patterns rather than imposing rigid geometries. •The entire development footprint should be clearly demarcated prior to initial site clearance and prevent construction personnel from leaving the demarcated area; •Where trenches pose a risk to animal safety, they should be adequately cordoned off to prevent animals falling in and getting trapped and/or injured. This could be prevented by the constant excavating and backfilling of trenches during the berm construction. • No construction / disturbance outside approved areas	**Moderate**

ASPECT	ACTIVITIES	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
		Loss of sensitive species at the Lylyveld South PCD	**High**	•Permits to be in place for removal of protected plant and tree species. Protected plant and tree species which cannot be transplanted, can be replaced from local genetic stock. •Protected animal species will likely leave the area when construction begins. •Avoid sensitive habitats. •Construction activities to take place in a phased manner, in a uniform direction from one side to the other of the PCD footprint so as to ensure that as far as possible faunal species can naturally disperse out of the area ahead of activities;	Low
		Spread and establishment of alien invasive species	**Moderate**	•Invasive vegetation should be monitored and controlled. •Remove existing populations of legislated weeds to reduce source populations. •Control involves killing the plants present, killing the seedlings which emerge, and establishing and managing an alternative plant cover to limit re-growth and re-invasion. • Rehabilitate disturbed areas as quickly as possible to reduce the area where invasive species would be at a strong advantage and most easily able to establish. • Institute a monitoring programme to detect alien invasive species early, before they become established and, in the case of weeds, before the release of seeds. •Alien vegetation must be removed from the study area during in line with the NEMBA Alien and Invasive Species Regulations (2016)	**Low**

ASPECT	ACTIVITIES	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
		Dumping of material outside designated areas leading to loss of terrestrial habitat. Increased fire frequency, as well as uncontrolled fires due to increased human activity will impact on plant community. Unregulated movement of mine vehicles through the Lylyveld PCD Infrastructure Area. Increased risk of poaching due to increased personal movement in the Lylyveld PCD Infrastructure Area. Permanent loss of SCC foraging and breeding habitat	**Moderate**	It is recommended that construction activities take place in a phased manner, in a uniform direction from one side to the other of the PCD footprint so as to ensure that as far as possible faunal species can naturally disperse out of the area ahead of activities; •Restrict vehicles to travelling only on designated roadways to limit the ecological footprint of the proposed PCD; • No uncontrolled fires whatsoever should be allowed; •No dumping of waste should take place. If any spills occur, they should be immediately cleaned up; • In the event of a breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced preventing the ingress of hydrocarbons into the topsoil; • No trapping or hunting of any faunal species is to take place;	**Low**

ASPECT	ACTIVITIES	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
Surface Water	Discharge of contaminated water Sediment run-off	Hydrocarbon spillages from leaking vehicles or machinery resultant elevated hydrocarbon concentrations in runoff water. Sedimentation of the Gamagara River from uncontrolled water run-off from exposed bare soils.	**Moderate**	• The footprint of disturbed areas will be minimised. • "No-go" zones will be delineated for construction •Appropriate storm water management measures will be implemented. •No Servicing of construction vehicles will take place onsite. •Bunded containment facilities will be provided for hazardous materials, such as fuel and oil. •Spill-sorb or a similar product will be kept on site, and used to clean up hydrocarbon spills in the event that they should occur. •The Sishen waste management procedure will be implemented for the construction phase. •Appropriate sewage management will be implemented during the construction, which will entail portable chemical toilets.	**Low**
Groundwater	Leaking of Hydrocarbons from vehicles and machinery. Temporary fuel storage.	Hydrocarbon spillages from vehicles moving on site, fuel storage, servicing areas or construction equipment itself, with resultant elevated hydrocarbon concentrations seeping into groundwater. Any impact on the quantity or quality of water in the system has the potential to affect the quality and assurance of supply to the community and agriculture. Pollution from latrines	**Moderate**	• No Servicing of construction vehicles to take place. • Drip trays to be available for leaking vehicles of machinery • Also See surface water mitigation above	**Low**

ASPECT	ACTIVITIES	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
Heritage	Site clearance for construction of PCD & trenches at Lylyveld South	Impact on identified archaeological material Impact on subsurface archaeological resources.	**Moderate**	• If a deposit is identified a controlled sampling of the material found should be done; • In the event that substantive material is uncovered, it is recommended that a display is considered in a convenient location; Archaeological monitoring during the Construction Phase is also required. • Should any Stone Age material or any archaeological material be identified, all construction work in that area must immediately stop and the ECO or archaeologist (if already present on site) must demarcate a construction free area around the discovery; • If the ECO made the discovery, the archaeologist must be contacted immediately to visit the construction site to assess the exposed material. After assessing the exposed material, the archaeologist would provide recommendations for the exposed material that may range from destruction without mitigation (if the exposed material is found to be of little significance) to archaeological mitigation (if the exposed material is found to be significant).	**Low**

ASPECT	ACTIVITIES	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
		Impact on Palaeontological Resources. impact on fossil materials	**Low**	• Should fossil remains be discovered the ECO responsible for these developments should be alerted immediately. Such discoveries ought to be protected (preferably in situ) and the ECO should alert SAHRA (South African Heritage Research Agency) so that appropriate mitigation (e.g. recording, sampling or collection) can be taken by a professional palaeontologist. • The specialist involved would require a collection permit from SAHRA. Fossil material must be curated in an approved collection (e.g. museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.	**Low**
Socio-Economics	Procurement of good and services	Local procurement and enterprise development	**High Positive Impact**	• Preferential procurement plan.	**High Positive Impact**
		Dust, noise, impacting the community's quality of life and livelihoods	**Moderate**	• Continued support to facilitate an Environmental Forum for engagement with community. • Dust suppression initiatives' Existing dust monitoring. Implementation of mitigation measures and EMP. • Effective engagement with affected parties, around the project in particular.	**Low**

Table 13: Operational phase impacts for the proposed overflow dam at the Aldag PCD and Lylyveld South PCD

ASPECT	ACTIVITIES	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
Soil, Land Use and Land Capability	Overflow of silt trap or PCD at Lylyveld and overflow dam at Aldag.	Contamination and erosion of soils as result of silt traps not functioning properly or damages to the liner	**Low**	•Regular routine inspections of PCDs checking the functioning of the liner system and the functioning of sediment control systems, •The slopes of the wall should be inspected for any sign of seepage, cracks, movement, erosion, ant nests and burrows by animals or reptiles.	**Low**
Biodiversity	Previously disturbed and/or rehabilitated areas	Proliferation of alien species	**Moderate**	•Implementation of invasive vegetation monitoring and control programme. •Remove existing populations of legislated weeds to reduce source populations •Alien vegetation must be removed from the study area during the operational phases, in line with the NEMBA Alien and Invasive Species Regulations (2016)	**Low**

ASPECT	ACTIVITIES	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
		Dumping of material outside designated areas leading to loss of terrestrial habitat. Increased fire frequency, as well as uncontrolled fires due to increased human activity will impact on plant community. Unregulated movement of mine vehicles through the Lylyveld PCD Infrastructure Area. Increased risk of poaching due to increased personal movement in the Lylyveld PCD Infrastructure Area. Permanent loss of SCC foraging and breeding habitat	**Moderate**	•The operational footprint must be kept as small as possible in order to minimise impact on the surrounding environment; •Edge effects of operational activities need to be actively managed to minimise further impacts to the receiving environment, with specific consideration to erosion control and alien floral species management; • Restrict vehicles to travelling only on designated roadways to limit the ecological footprint of the proposed PCD; •No uncontrolled fires whatsoever should be allowed; •No dumping of waste should take place. If any spills occur, they should be immediately cleaned up; •In the event of a breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced preventing the ingress of hydrocarbons into the topsoil; • No trapping or hunting of any faunal species is to take place;	**Low**
Surface water	Overflow of silt trap or PCD at Lylyveld and overflow dam at Aldag.	Contamination in the event that the PCDs overflow	**Moderate**	Surface water monitoring. Monitoring of new structures to ensure integrity and continuing functionality	**1.8**
	Containment of dirty stormwater through operations of the dams at Aldag and Lylyveld	The PCDs will prevent pollution and runoff to the Gamagara. The PCDs will have a positive impact on surface water quality and separation of clean and dirty water	**High Positive Impact**	•The construction of the PCD is considered an adequate measure to prevent downstream water contamination.	**High Positive Impact**

ASPECT	ACTIVITIES	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
Groundwater	Overflow of silt trap or PCD at Lylyveld and overflow dam at Aldag.	Pollution of water resources through seepage/spillage / and overflow of PCDs. Pollution as result of damages to the liner. Impact on groundwater quality (seepage of pollutants to groundwater). Alter the hydrological characteristics of groundwater	**Moderate**	•Regular routine inspections of PCDs checking the functioning of the liner system. •Stormwater management should be implemented effectively. •Downgradient monitoring boreholes to drilled and monitored as part of the Sishen Mine groundwater monitoring programme at the Lylyveld PCD.	**Low**

Table 14: Decommissioning and Closure phase impacts for the proposed overflow dam at the Aldag PCD and Lylyveld South PCD

Risk	ACTIVITIES	POTENTIAL RISK	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
Air Quality	Movement of vehicles and operation of machinery as well as demolitions of structures resulting in entrainment of dust.	Increase in fugitive dust emissions particularly due to an increase in particulate dust levels (PM10 and PM 2.5)	**Moderate**	• Implementation of Sishen Mine Dust Management Plan utilising a combination of watering, chemical stabilization and the reduction of surface wind speed through the use of windbreaks and source enclosures. • Ensure the minimisation of extent of disturbed areas, reduction of frequency of disturbance; early revegetation and stabilisation of disturbed soil. • Vegetation cover retards erosion by binding the soil with a root network, by sheltering the soil surface and by trapping material already eroded. • Sheltering occurs by reducing the wind velocity close to the surface, thus reducing the erosion potential and volume of material removed. • The trapping of the material already removed by wind and in suspension in the air is an important secondary effect. • Vegetation is also considered the most effective control measure in terms of its ability to also control water erosion	**Low**

Risk	ACTIVITIES	POTENTIAL RISK	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
Soil, Land Use and Land Capability	Demolition of PCDs and placement of topsoil for rehabilitation purposes.	Proper management measures must be implemented to ensure that wind and water erosion are limited at soil rehabilitation areas. Areas where infrastructure demolition took place is also highly susceptible to soil erosion. Soil erosion will lead to the physical degradation of the soil. Sediments and contaminants could be transported to the Gamagara, resulting in sedimentation and alteration of aquatic habitats. Additionally, soil erosion will lead to changes in the ecological characteristics of any disturbed area i.e. establishment of alien invasive species resulting in the loss of natural habitat for indigenous fauna and flora. Additionally, soil erosion will lead to a shortage of soil/material for the successful rehabilitation of disturbed areas.	**Moderate**	•Activities during wet conditions should be restricted or closely monitored to prevent soil erosion. •Soil that is placed on disturbed areas during rehabilitation should be protected by establishment of vegetation as soon as possible to prevent water run-off from causing erosion and transportation of sediments. •Stockpiling locations should be selected strategically and placed in higher laying areas. •Due consideration should be given during planning of rehabilitation. •Revegetation of disturbed areas should be undertaken as soon as activities have ceased to prevent further soil loss due to erosion. • Removal and safe disposal of liner material. • Assessment and possible soil clean-up underneath the liner system.	**Low**

Risk	ACTIVITIES	POTENTIAL RISK	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
	Transportation of soil for rehabilitation purposes.	Soil will be recovered from stockpiles by means of an excavator and soil will be transported to rehabilitation area by means of dump trucks. During haulage, soil can spill over the edges of the dump trucks if trucks are overloaded. This will result in loss of soil and insufficient topsoil resources needed for rehabilitation of disturbed areas.	**Very Low**	•Dump trucks should not be overloaded. •Dump trucks should have a freeboard of 250mm when hauling soil. •Dedicated haul roads should be used, and any spillage of soil should be collected.	**Very Low**
	Demolition of infrastructure and final rehabilitation	Potential hydrocarbon spillages could contaminate soil resources. Should mitigation measures not be implemented, the soils subject to the spill will be contaminated and lose their function. General waste, as well as demolished infrastructure and materials could contaminate, and compact soil resources should the waste not be disposed offs	**Moderate**	• All waste should be removed from the area and disposed of at authorised facilities. No waste must be buried or burned. • A spill prevention and emergency spill response plan should be developed and implemented to mitigate any hazardous substance spillages. • A rehabilitation plan must be developed and implemented. Removal and safe disposal of liner material. • Assessment and possible soil clean-up underneath the liner system. The contaminated areas must not be rehabilitation (replacing topsoil and revegetated) until the contamination has been remediated.	**Low**
Biodiversity	Demolition of infrastructure	Demolition and removal of infrastructure will require vehicles and machinery and may result in the destruction of previously	**Moderate**	• Any disturbance of sensitive faunal habitat and species of conservation concern must be actively avoided. In this regard, Restrict activities to only designated areas to prevent further destruction of vegetation.	**Low**

Risk	ACTIVITIES	POTENTIAL RISK	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
		undisturbed vegetation and the compaction of soils. Disturbance of faunal habitat as part of demolition and closure activities.		• Implementation of invasive vegetation monitoring and control programme. • Edge effect control needs to be implemented within construction areas, with specific consideration to erosion control and alien floral species management. • No trapping, collecting or hunting of faunal species must be allowed during any phases of the proposed mining development; • Disturbed and cleared areas need to be revegetated with indigenous grass species to help stabilise the soil surface • All alien plants within the study area should be cleared, with follow up activities running concurrently for one year; and Soils that has been compacted must be ripped and profiled in line with the surrounding area.	
	Final rehabilitation	Alien invasive vegetation may be established on disturbed areas, competing for resources with indigenous vegetation.	**Moderate**		**Low**
		Potential ineffective rehabilitation of exposed and impacted areas leading to permanent loss of faunal habitat	**Moderate**		**Low**
		Ineffective rehabilitation of exposed and impacted areas leading to permanent losses of faunal habitat and diversity	**Moderate**		**Low**
		Failure to implement a well-conceived biodiversity action plan, rehabilitation plan and alien floral control plan during the decommissioning and closure phase	**Moderate**		**Low**

Surface Water	General decommissioning and rehabilitation	Impacts resulting from general rehabilitation and decommissioning works will be similar to those during the construction phase, with earthworks related to rehabilitation and the movement of construction equipment on the site. Impacts may arise from: • Erosion of soils during rainfall events, with elevated suspended solids in the runoff water. •Resultant elevated suspended solids in the watercourses, as well as sedimentation in the watercourses. •Hydrocarbon spillages from fuel storage, servicing areas or construction equipment itself, with resultant elevated hydrocarbon concentrations in runoff water, watercourses. These impacts are expected to be relatively small, with the resultant impact post decommissioning being positive in comparison with the operational phase.	**Moderate**	The following mitigation measures will be implemented: • The footprint of disturbed areas will be minimised. •The storm water management infrastructure and PCD's will be decommissioned last, if at all, to ensure adequate storm water management during the rehabilitation phase. •Servicing of construction vehicles will take place only in dedicated areas that are equipped with drip trays. •Bunded containment and settlement facilities will be provided for hazardous materials, such as fuel and oil. •Spill-sorb or a similar type product will be kept on site and used to clean up hydrocarbon spills in the event that they should occur. •Erosion protection measures will be implemented at steep areas. •A waste management plan will be developed for the construction phase, which will include the handling of contaminated materials / soils found on site. •All traces of hydrocarbons and residual waste will be removed before infrastructure is demolished. •Contaminated soils will be excavated and placed on the discard facilities prior to their rehabilitation, or removed from site by an appropriately licensed waste contractor. • An appropriate sewage management strategy will be implemented during the decommissioning phase. •Water quality monitoring will be undertaken downstream of the construction areas, before and during construction where practical, in order to detect any increase in suspended solids or turbidity.	**Very Low**

Risk	ACTIVITIES	POTENTIAL RISK	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
	Risk on surface water quality - Water management infrastructure & PCDs	Impacts may arise from: • Erosion of soils during rainfall events, with elevated suspended solids in the runoff water. •Resultant elevated suspended solids in the watercourses, as well as sedimentation in the watercourses These impacts are expected to be relatively small, with the resultant impact post decommissioning being positive in comparison with the operational phase.	**Low**	The following mitigation measures will be implemented: •This infrastructure will be decommissioned and rehabilitated last.	**Very Low**

9.1 Summary of specialist reports.

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT (Mark with an X where applicable)	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
Terrestrial Ecology	A walkdown of the PCD footprint is to be undertaken prior to the commencement of operational activities in order mark individual Vachellia erioloba within the PCD footprint	**X**	6.3 (Page 23)
	The necessary permits need to be acquired pertaining to the removal of floral SCC that are located within the study area prior to the development of the PCD, and the following should be ensured: • Where feasible, effective relocation of individuals to suitable similar habitat in the vicinity of the study area; • All rescue, and relocation plans should be overseen by a suitably qualified specialist;	**X**	6.3 (Page 24)
	It is recommended that construction activities take place in a phased manner, in a uniform direction from one side to the other of the PCD footprint so as to ensure that as far as possible faunal species can naturally disperse out of the area ahead of activities;	**X**	6.3 (Page 24)
	The operational footprint must be kept as small as possible in order to minimise impact on the surrounding environment;	**X**	6.3 (Page 24)
	Edge effects of operational activities need to be actively managed to minimise further impacts to the receiving environment, with specific consideration to erosion control and alien floral species management;	**X**	6.3 (Page 24)
	Restrict vehicles to travelling only on designated roadways to limit the ecological footprint of the proposed PCD;	**X**	6.3 (Page 24)
	No uncontrolled fires whatsoever should be allowed;	**X**	6.3 (Page 24)
	No dumping of waste should take place. If any spills occur, they should be immediately cleaned up;	**X**	6.3 (Page 24)

	In the event of a breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced preventing the ingress of hydrocarbons into the topsoil;	**X**	6.3 (Page 24)
Heritage Impact Assessment	If a deposit is identified, a controlled sampling of the material found should be done;	**X**	9 (Page 65)
	This work must be done in such a way as to augment the current research questions and field work such as the excavations at the Kathu Townlands Site and Kathu Pan;	**X**	9 (Page 65)
	These test excavations and sampling must be done after a permit has been granted under Section 35 of the NHRA (Act 25 of 1999) to a qualified and experienced Stone Age archaeologist;	**X**	9 (Page 65)
	In the event that substantive material is uncovered, it is recommended that a display is considered in a convenient location;	**X**	9 (Page 65)
	An archaeologist suitably qualified in Stone Age fieldwork and research must be appointed to undertake an Archaeological Watching Brief during the Construction Phase of the project. The appointed archaeologist will be responsible for the following: • Provide training to the project Environmental Control Office (ECO) in Stone Age archaeology and the identification of Stone Age artefacts and sites. The ECO will be responsible for daily on-site monitoring during the Construction Phase with the appointed archaeologist visiting the site every two weeks. • Conduct an archaeological monitoring program whereby the construction site is visited once every two weeks for at least the first three months of the project. • On-site assessment of any Stone Age material exposed during construction and the provision of recommendations for the way in which the exposed material must be mitigated. • Compile and submit an archaeological monitoring report at the end of the monitoring process.	**X**	9 (Page 66)
	During the monitoring undertaken everyday on-site by the ECO and once every two weeks by the archaeologist, all construction work must be closely monitored. Should any Stone Age materi archaeological material be identified, all construction work in that area must immediately stop and th archaeologist (if already present on site) must demarcate a construction free area around the discovery. made the discovery, the archaeologist must be contacted immediately to visit the construction site to exposed material. After assessing the exposed material, the archaeologist would provide recommendati exposed material, which may range from destruction without mitigation (if the exposed material is foun little significance) to archaeological mitigation (if the exposed material is found to be significant).	**X**	9 (Page 66)

9.2 Environmental Impact Statement

9.2.1 Summary of the key findings of the environmental impact assessment.

The environmental impacts associated with the proposed project are largely low to moderate with no high impacts anticipated. The most significant impacts are:

- During the Construction Phase:
    - Lylyveld South PCD:

      The most significant impact relating to the construction phase is the destruction of terrestrial habitats due to the construction of the Lylyveld South PCD. This includes the possibility of removal of protected plant and tree species. Other impact related to soils (sedimentation, compaction, and contamination); surface and groundwater contamination (Hydrocarbon leakages from construction vehicles and machinery) and air quality impact (increase in fugitive dust emission). None of these impacts are considered to be high significance and with appropriate mitigation these impacts can be effectively manged.

    - Overflow dam at Aldag PCD:

      No potential significant environmental impacts at Aldag as the area is located in the already disturbed mining area. Other impact related to soils (sedimentation, compaction, and contamination); surface and groundwater contamination (Hydrocarbon leakages from construction vehicles and machinery) and air quality impact (increase in fugitive dust emission) will be managed in accordance with the proposed EMP. Embarrassed

      The proposed construction of the overflow dam at Aldag PCD and the Lylyveld South PCD is required to address a current problem at Sishen Mine. These dams are required to will ensure that Sishen Mine will be able to contain all dirty water from dirty and affected areas. The project should be considered as largely positive and will ensure protection of surface and groundwater resources.

- During the Operational Phase:
    - Lylyveld South PCD:

      Operational impact is limited to potential overflow of the PCD into the Gamagara River; which can affect the surface water quality through sedimentation and contamination. The construction of the Lylyveld South PCD, however has a significant positive impact on the management of dirty water within the Lylyveld south mining area.

- Overflow dam at Aldag PCD:

  Operational impact is limited to potential overflow of the dam onto land and subsequently into clean water diversion channels which can affect the surface water quality through hydrocarbon contamination. The construction of the overflow dam at Aldag PCD, however has a significant positive impact on the management of dirty water within the Aldag area.

- Other impact related to both sites during the operational phase include: Proliferation of alien species, Contamination and erosion of soils as result of silt traps not functioning properly or damages to the liner. None of these impacts are considered of high significance and with appropriate mitigation these impacts can be effectively manged.

- During the Decommissioning and Closure Phase:

  Impacts resulting from general rehabilitation and decommissioning works will be similar to those during the construction phase, with earthworks related to rehabilitation and the movement of construction equipment on the site. These impacts can be effectively manged through recommended management measures.

9.2.2 Final Site Map

The final site map is attached as Appendix G.

9.2.3 Summary of the positive and negative impacts and risks of the proposed activity and identified alternatives

The biggest risks of the project are inadvertent damages to protected species as well as surface water and groundwater pollution. It is very likely that the development will have a permanent negative high impact on subsurface archaeological resources, because the area is a continuous cultural landscape and the occurrence of artefacts in the proposed area more than likely suggests more will be found, especially once excavations begin. With the implementation of mitigation measures this impact and risk can be reduced from high to moderate. The mitigation measures will enable the identification of additional archaeological resources and the collection of data that could add to the current research questions.

Final placement and the operation of the PCD will result in a loss of terrestrial habitat and Species of Conservation Concern, notably *Vachellia erioloba*. However, the terrestrial habitat is not of a sensitive nature and individuals of *Vachellia erioloba* which cannot be transplanted, can be replaced from local genetic stock. Prior to the implementation of mitigation measures, impacts are expected to be of moderate during the construction and operational phases, decreasing to a low impact with the implementation of mitigation measures. Positive impact is associated with the operation of the PCD's. The PCD's will have a positive impact on surface water quality and separation of clean and dirty water. The PCD's will furthermore prevent pollution and runoff to the Gamagara.

9.2.4 Proposed impact management objectives and the impact management outcomes for inclusion in the EMPr

The objectives of impact mitigation and management are to:

- Primarily pre-empt impacts and prevent the realisation of these impacts -PREVENTION.
- To ensure activities that are expected to impact on the environment are undertaken and controlled in such a way so as to minimise their impacts – MODIFY and/or CONTROL.
- To ensure a system is in place for treating and/or rectifying any significant impacts that will occur due to the proposed activity – REMEDY.
- Implement an adequate monitoring programme to:
    - Ensure that mitigation and management measure are effective.
    - Allow quick detection of potential impacts, which in turn will allow for quick response to issue/impacts.
    - Reduce duration of any potential negative impacts.

Environmental impact management outcomes are:

- Conduct construction activities responsibly and ensure operation is compliant with legislative requirements.
- Protect the biophysical environment as far as possible, specifically wetlands and riverine areas and any protected species observed on site.
- Protect the water resources in the area as far as possible.
- Ensure atmospheric pollution is kept to a minimum:
- Ensure adequate rehabilitation
- Ensure socially responsible activities.
- Protect historical sites if they are observed on site.

9.2.5 Aspects for inclusion as conditions of Authorisation.

- No activity is to occur within wetlands and their 100m buffer zones, within rivers and their 100-m buffer zone / 1:100-year flood line without the necessary authorisation under NEMA and NWA.
- Protected species must remain in situ until the necessary permits are obtained under NEM:BA.
- Heritage sites and 50m buffer zones will be preserved at all times unless the necessary permits are obtained under SAHRA.
- Rehabilitation must be applied on an on-going basis and no sites must be left exposed for more time than necessary to obtain the necessary data.
- Sishen Mine Dust management plan must be implemented.
- Additional groundwater and surface water monitoring locations should be established up and down stream of the Gamagara River and new groundwater boreholes downgradient from the Lylyveld PCD.
- All mitigation as listed in Section 9 must be adhered to.

9.2.6 Description of any assumptions, uncertainties and gaps in knowledge.

The assessment of environmental impact is by nature a very quantitative assessment based on the assessor's experience and knowledge. The assessment also attempts to predict what might likely result in future as a result of the proposed activities.

The conclusions and recommendations made in this report, especially the impact assessment and proposed management measures have to be routinely checked through monitoring programmes during the construction and operational phases. Management measure to address impact identified through monitoring needs to be adequately managed to address any shortcoming identified during the various phases of the project.

9.2.7 Reasoned opinion as to whether the proposed activity should or should not be authorised

9.2.7.1 Reasons why the activity should be authorized or not.

There is no reason why this activity should not be authorised. The risks of the PCD activity are minimal and can be easily mitigated by following the EMP, which will reduce impacts to acceptable levels which will easily recover.

The proposed construction of the overflow dam at Aldag PCD and the Lylyveld South PCD is

required to address a current problem at Sishen Mine. These dams are required to will ensure that Sishen Mine will be able to contain all dirty water from dirty and affected areas. The project should be considered as largely positive and will ensure protection of surface and groundwater resources. Sishen Mine is committed in keeping dirty and clean water systems separate by implementing storm water management measures and will maintain the system to ensure the integrity and the functionality of the system. The proposed overflow dam at Aldag PCD and Lylyveld South PCD is another project to ensure Sishen commitment to separate dirty and clean water are realised.

9.2.7.2 Conditions that must be included in the authorisation

Refer to section 9.2.5

9.2.8 Period for which the Environmental Authorisation is required.

The current Life of Mine (LoM) is up until 2039.

9.2.9 Undertaking

The applicant representative, Mashau Fhatuwani (ID: 8311075442080), hereby confirms the undertaking to ensure implementation and compliance with the basic assessment report and environmental management programme.

9.2.10 Financial Provision

The estimated financial provision required for the rehabilitation and closure of the overflow dam at Aldag and Lylyveld PCD is **R 1 954 080.93 (LOM) excl. VAT**. A summary of the financial provision estimate associated with the overflow dam at Aldag and Lylyveld PCD is included in the table below (Table 15). Detailed sheets are provided in Appendix G.

Table 15: SUMMARY OF THE OVERFLOW DAM AT THE ALDAG PCD AND THE LYLYVELD SOUTH PCD FINANCIAL PROVISION

Item	Description	Cost
1	Stormwater Management Infrastructure	
1.1	Aldag Pollution Control Dam (Overflow dam)	**R 166 024.62**
1.2	Lylyveld Pollution Control Dam	**R 453 437.33**
1.3	Trenches and berms	**R 806 305.42**
1.4	Rehabilitation	**R 350 669.83**
	Contingency (10%)	**R 177 643.72**
Total		**R 1 954 080.93**

The next detailed update of Sishen Mine's closure cost will be done in 2018, of which the

proposed overflow dam at Aldag and Lylyveld PCD will form part of. The updated assessment will be submitted to the DMR once completed.

9.2.10.1 Explain how the aforesaid amount was derived.

The financial provision for the overflow dam at Aldag and Lylyveld PCD has been calculated according to regulation 6 of the financial provision for prospecting, exploration, mining or production operations regulations (GNR 1147, November 2015). These regulations prescribe the required minimum content.

The model used to develop the closure cost for the mining area was developed in Microsoft Excel. An itemised list of all the required action was included, which contained measurements of the infrastructure to be removed, demolished and areas to be rehabilitated. An appropriate rate was applied to each action to be implemented. The final preferred layout was utilised to measure all the affected areas as a result of the proposed mining activity.

9.2.10.2 Confirm that this amount can be provided for from operating expenditure.

Sishen Mine makes financial provision for closure by means of the KIO Rehabilitation Trust Fund, with any shortfall between the immediate closure cost estimate and the balance in the Trust Account being funded by means of bank guarantees. These reviews are done annually.

9.2.11 Specific Information required by the competent Authority

9.2.11.1 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 (Act 107 of 1998).

9.2.11.1.1 Impact on the socio-economic conditions of any directly affected person.

The PCD activities are expected to be limited and thus opportunities for employment will be low. However, consideration will be given to local and services where practicable

9.2.11.1.2 Impact on any national estate referred to in section 3(2) of the National Heritage Resources Act

Section 3(2) of the National Heritage Resources Act, No. 25 of 1999 provides a description of all items that is classified as national estate. The EAP has evaluated the list in comparison with the project site. The results of the assessment are provided below in table 16 with recommendations to the environmental officer where there was uncertainty.

Table 16: IMPACT ON NATIONAL ESTATE

National Estate Item	Present	Comment
(a) places, buildings, structures and equipment of cultural significance;	N	
(b) places to which oral traditions are attached or which are associated with living heritage;	N	
(c) historical settlements and townscapes;	N	
(d) landscapes and natural features of cultural significance;	N	
(e) geological sites of scientific or cultural importance;	N	
(f) archaeological and palaeontological sites;	Y	Archaeological residues in the form of a low-density surface scatter of what may be Middle Stone Age stone tools are known to occur in the vicinity of the Lylyveld South PCD, although no such material was found on site. There is however a high potential that such material will occur at the site. No palaeontological sites were identified
(g) graves and burial grounds, including—	N	.
(i) ancestral graves;		
(ii) royal graves and graves of traditional leaders;		
(iii) graves of victims of conflict;		
(iv) graves of individuals designated by the Minister by notice in the Gazette;		
(v) historical graves and cemeteries; and		
(vi) other human remains which are not covered in terms of the Human Tissue Act, 1983 (Act No. 65 of 1983);		
(h) sites of significance relating to the history of slavery in South Africa;	N	
(i) movable objects, including—		
(i) objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;	Y	Archaeological residues in the form of a low-density surface scatter of what may be Middle Stone Age stone tools are known to occur in the vicinity of the Lylyveld South PCD, although no such material was found on site. There is however a high potential that such material will occur at the site. No palaeontological sites were identified.

National Estate Item	Present	Comment
(ii) objects to which oral traditions are attached or which are associated with living heritage;	N	
(iii) ethnographic art and objects;	N	
(iv) military objects;	N	
(v) objects of decorative or fine art;	N	
(vi) objects of scientific or technological interest; and	N/A	
(vii) books, records, documents, photographic positives and negatives,	N/A	

9.2.12 Other matters required in terms of sections 24(4)(a) and (b) of the Act

Section 24(4)(b)(i) of the Act requires the EAP to conduct an investigation of the potential consequences of impacts of alternatives to the activity on the environment and assessment of the significance of those potential consequences. No alternative sites were considered as result of the overflow dam at Aldag PCD being limited to the location of the existing approved PCD. Furthermore, the Lylyveld PCD is limited to its position mainly because it is required at the lowest elevation to ensure runoff and containment of dirty water. No other area down gradient is feasible due to the adverse effects to the environment.

PART B
ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

10. DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME.

10.1 Details of the EAP,

Name of The Practitioner: EXM Advisory Services (Pty) Ltd

Tel No.: 010 007 3617

Fax No.: 086 616 0443

e-mail address: roelof@exm.co.za

TABLE 17: EXPERTISE OF THE EAP.

EAP	Qualification	Years' experience
Mr. Roelof Letter	BSc Geography and Environmental Management (UJ) BSc (hons) Environmental Management (UNISA) LLM Environmental Law (UCT)	8 Years
Mrs Lynné Viljoen	LLM Environmental Law (NWU)	2 Years

CV's with experience is attached as APPENDIX A: CV'S OF THE EAP TEAM.

Roelof has over 7 years of experience been responsible for several integrated environmental management projects in a diverse range of fields. He has gained valuable experience in the mining and waste sectors. His responsibilities have included: legal compliance auditing; due diligence studies; project management; environmental impact assessment; closure planning and the development of environmental management plans. He has been responsible for numerous environmental assessment processes and water use license audits for mining operations in South Africa. A detailed CV has been attached as annexure A

10.2 Description of the Aspects of the Activity

Sishen Mine, part of the Sishen Iron Ore Mining Company (Pty) Ltd, located near Kathu, has been in operation since the 1950's and operates under an existing mining right (DMR Ref: NC 259 MR) and an approved EMPr (2002, as amended). The Department of Water and Sanitation (DWS) require mining operations to separate clean and dirty stormwater under Regulation GNR. 704, 1999 (Regulations on use of water for Mining and Related Activities aimed at the Protection of Water Resources) in terms of the National Water Act, 1998 (NWA). To ensure compliance with this requirement, Sishen Mine is currently in the process of improving the management of the dirty and clean water systems to ensure alignment with the provisions GNR. 704. The infrastructure proposed includes:

- A Pollution Control Dam (PCD) located near the existing Aldag Filling Station within the mine (Overflow PCD at Aldag); and
- A PCD at the existing Lylyveld South Mining Areas (Lylyveld South PCD).

The development of these dams is motivated by the requirement to contain dirty water run-off from the catchment during a 1 in 50-year storm event in accordance with GNR. 704.

10.2.1 Proposed overflow PCD at Aldag

The Aldag PCD is being developed to contain dirty water run-off from the Aldag filling station and also the primary and secondary crusher area of the JIG plant within Sishen Mine. The existing approved Aldag PCD is undersized at 4 000 m^3. A second 6000 m^3 overflow dam is thus required, which will be directly connected to the current planned dam providing an overall storage volume of 10 000 m^3. The overflow dam will cover and area of 3 ha and will be developed adjacent to Aldag PCD in an already transformed area within the mine (see Plate 1). The recovered water from the dams will be recycled and used at the JIG plant as process water.

The Aldag PCD together with the proposed overflow dam have been sized as follows:

- The two dams with a volume of 10 000 m^3 can retain a 1:50 year 24-hour storm event based on potential water levels in the dam (normal operating level based on stochastic modelling over the wet seasons) before the design storm, with a probability of exceedance beyond the 75% percentile.
- The storage volume will be able to contain a 1:50 year, 24-hour flood volume of 8 185m^3 assuming the dam is empty before the storm, and with a 10% allowance for climate change impacts.
- The dams will be able to contain a 1:100 year 24-hour flood volume of 8 483m^3 assuming the dam is empty before the storm.

- The proposed overflow dam will have the same liner as the existing approved PCD. The liner will be constructed to comply with a Class C liner (Refer to Figure 4; according to National norms and standards for the disposal of waste to landfill (GN R. 636 of 2013).
- It is critical for the PCD's to be pumped empty as soon as possible after a rainfall event and should be designated as a priority source of water for the JIG plant.

A layout plan has been provided in Figure 2. The design report and associated preliminary designs of the proposed overflow PCD at Aldag is provided in Appendix B.

10.2.2 Lylyveld South PCD

A PCD with a capacity of 25 800 m^3 has been approved for the Lylyveld South mining operations. The dam has however been constructed. A larger PCD of 38 800 m^3 is however required to ensure that all dirty water run-off from the Lylyveld South area is contained during a 1:50 year 24-hour storm, as required by GNR. 704. The proposed larger PCD will be constructed in an undisturbed area within the Lylyveld South mining area covering an area of ~4 ha (see Plate 2).

The Lylyveld PCD will collect stormwater run-off stormwater from the Lylyveld South mining area as well as the waste rock dumps and prevent stormwater from mining area (dirty water run-off) from entering the Gamagara River, thus preventing siltation of the river. The PCD will be constructed approximately 250 meters from the Gamagara River, thus being outside the 1:100 flood area. It should however be noted that the Lylyveld South mining operation does not comprise any activities that present a significant pollution potential. No maintenance workshops, ore processing facilities, wash bays etc. is located in the area.

The Lylyveld PCD has been designed to have two separated compartments. The water inflows to the dam will first pass through a silt trap/compartment with a capacity of 13 000 m^3. The silt trap/compartment will be lined, and the design will allow light machine access for desilting. It is however not large enough to accommodate a 1:50 year flood. The water will then overflow into the second compartment with a capacity of 25 800 m^3.

The capacity of the PCD was calculated based on the summation of the 1:50 year design rainfall (24 hour) event for the Lylyveld South catchment area and excluded the additional volumes of water that originate from preceding rainfall events. Space constraints due to topography prohibit the development of a larger dam. The PCD has been designed to operate empty, however to ensure the PCD is operated empty water from the dam will be abstracted for mainly dust suppression purposes.

Note that clean and dirty water trenches and berms will be constructed to ensure that dirty water run-off enters the Lylyveld South PCD. Three diversion berms of ~5 km by 1 m deep will be constructed to prevent runoff from mixing with runoff from dirty water areas. These diversions are comprised of a channel and berm component. The purpose of the diversions is to divert upstream/upslope clean water which would otherwise flow into the dirty area. Dirty water channel will ensure dirty water generated on the site does not spill into the environment more frequently than permissible.

The proposed Lylyveld South PCD will be constructed with an appropriate liner, as indicated in Table 4, to ensure prospection of groundwater.

A layout plan has been provided in Figure 15 below. The design report and associated preliminary designs of the proposed Lylyveld South PCD and associated trenches and berms is provided in Appendix B.

10.3 Composite Map

A map which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities showing how areas are to be avoided is provided as Figure 14 and Figure 15.

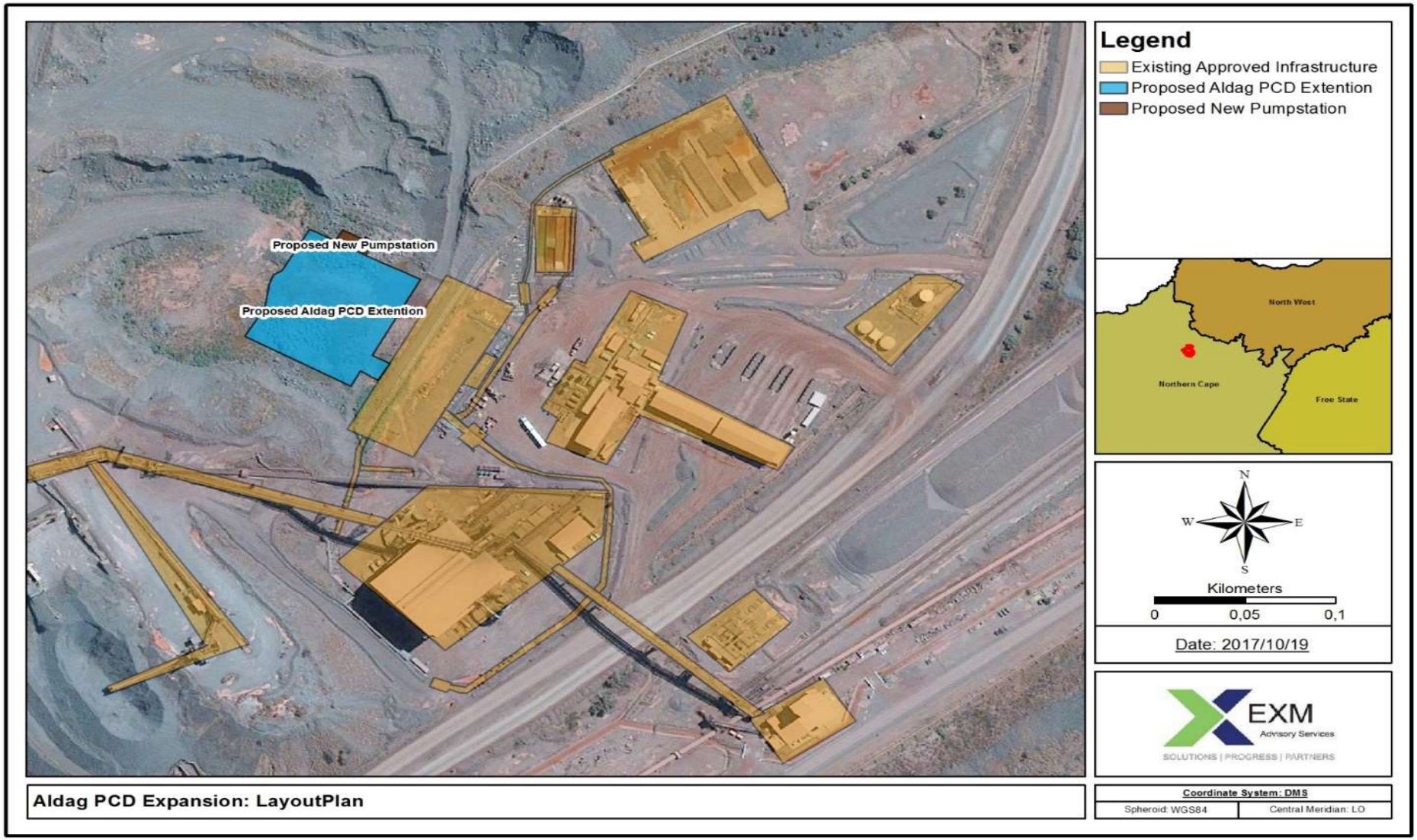


FIGURE 14: NEW OVERFLOW DAM AT ALDAG PCD LAYOUT PLAN

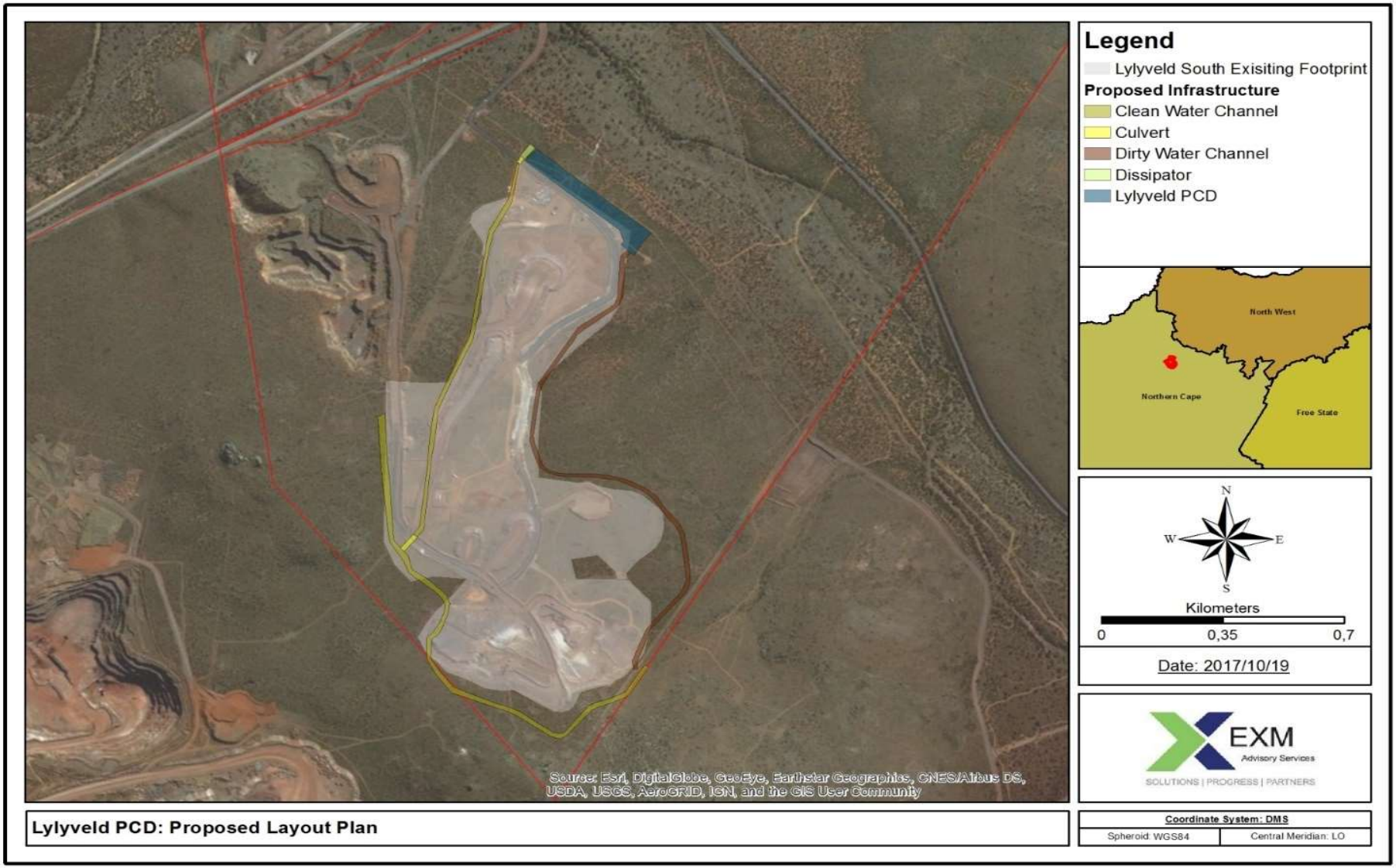


FIGURE 15: LYLYVELD PCD: LAYOUT PLAN

10.4 Description of Impact management objectives including management statements

Please refer to Table 12, 13 and 14. Also note the following objectives for the project:

- Not to pollute the groundwater resource
- Not to pollute the surface water resource
- Not to harm ecologically sensitive areas
- To reduce the cumulative air quality of the mine by staying within the standards prescribed
- Not to impact on sites of Archaeological importance
- To enhance the socio-economic status of the surrounding area
- To provide a safe environment for workers to work in

10.4.1 Determination of closure objectives.

A closure vision and closure objectives were developed for Sishen Mine as part of the Sishen Closure Plan process. The Sishen Closure Vision aims to make sure the Sishen zone of influence is a safe, stable, non-polluting and healthy environment with predominantly grazing potential supporting small-scale, socio-economic enterprises. Following from the closure vision, closure objectives can be defined. The primary objective for closure is to strive towards achieving closure that will be widely accepted and cost-effective for the Mine. The more important closure objectives relevant to the rehabilitation of the mine are as follows:

- A walk-away solution for closure with limited to non-significant long-term liabilities that require management.
- Rehabilitation is of a high quality and must be sustainable into the predictable future.
- Proposed post-closure land-uses are sustainable.
- Legal compliance has been achieved.
- Authorities will be satisfied with the extent of rehabilitation and closure criteria.
- The DMR will be satisfied to issue a closure certificate with limited or no significant conditions attached.
- That ground and surface water will not be polluted once the mine is closed.
- That all land rehabilitated is safe and useable, similar to the pre-mining situation.
- The rehabilitated land must be physically and chemically stable.
- The safety zone of the open pit is established, and suitable measures taken to prohibit access.
- The Mine residue sites (waste rock, plant discard and slimes) and pit area must be made safe and stable and be utilised as waste land.

The post-closure land-use options for the mine residue sites are linked to the closure vision and objectives and include the following:

- Game and cattle farming.
- The mine residue sites must be made safe and stable (grazing not included on residue sites).
- Allow industrial activity post closure in the mining area, where appropriate.
- Small-scale, socio-economic business opportunities can be implemented.

10.4.2 Volumes and rate of water use required for the operation.

Water will only be used at the site during the construction phase, however water usage will fall within the approved water rates in the approved WUL of the Sishen Mine. The overflow dam at Aldag will also reduce groundwater requirements as the water will be reused as process water. The proposed construction of the dams does however required authorisation to amend the Sishen Mine WUL in terms of section 21g of the NWA.

10.4.3 Has a water use licence has been applied for?

The Water Use Licence Application was submitted on Tuesday the 28th of November 2017 to the Department of Water and Sanitation. The application submitted is to approve both dams in terms of section 21(g) of the NWA.

10.5 Impacts to be mitigated in their respective phases

Measures to rehabilitate the environment affected by the undertaking of any listed activity

Table 18: Environmental Management Programme for the overflow dam at Aldag and Lylyveld PCD (Construction, Operations and Decommissioning and closure phases).

ACTIVITIES/ASPECT	IMPACT	PHASE	AREA	PROPOSED MITIGATION/MANAGEMENT MEASURES	COMPLIANCE WITH STANDARDS/ACTS OR ANGLO MANAGEMENT TOOLS	RESPONSIBLE PARTY	SCHEDULING
AIR QUALITY							
Operation of construction vehicles and machinery resulting in tailpipe emissions and entrainment of dust.	Increase in fugitive dust emissions particularly due to an increase in particulate dust levels (PM10 and PM 2.5)	Construction/ Decommissioning and closure	All Areas (8 ha)	1) Implementation of Sishen Mine Dust Management Plan utilising a combination of watering and chemical stabilization to reduce road dust. 2) Dust suppression must be performed via a dust suppression watering truck, on the site roads, construction camps and other construction areas. 3) Vehicles to be used during the construction phase are to be kept in good working condition and should not be the source of excessive fumes. 4) Air filters on all mechanized equipment must be properly designed and maintained. 5) Proper rehabilitation of disturbed areas is required in order to minimize the occurrence of bare patches of exposed soil. Ensure the minimisation of extent of disturbed areas, reduction of frequency of disturbance; early revegetation and stabilisation of disturbed soil.	NEMAQA: National Ambient Air Quality Standards	Environmental and Mining Departments	Throughout the life of mine
VISUAL ENVIRONMENT							
Operation of vehicles and machinery	Visual impacts as a result of construction	Construction/ Operations	Lylyveld PCD (4 ha)	1) •See Air Quality mitigation above.	N/A	Environmental Department	Throughout the life of mine

ACTIVITIES/ASPECT	IMPACT	PHASE	AREA	PROPOSED MITIGATION/MANAGEMENT MEASURES	COMPLIANCE WITH STANDARDS/ACTS OR ANGLO MANAGEMENT TOOLS	RESPONSIBLE PARTY	SCHEDULING
Clearance of Natural Vegetation	activities. This will primarily involve the deterioration of the local scenic quality and an alteration to the area's sense of place. An expected increase in visibility and visual exposure of the PCD operations. Dust will have a particular impact on visual aesthetic			2) Minimize clearance of vegetation. Retain natural trees, shrubbery and grass species wherever possible. 3) •Ensure the amount of bare soil exposed is minimized by staging earthworks in phases and leaving as much ground cover intact as possible during construction. The removal of vegetation, must be limited to the construction footprint area.			
SOIL, LAND USE AND LAND CAPABILITY							
Vehicular movement on site during the transportation of construction material, vegetation clearance, haulage of stripped topsoil and any other construction activity that requires heavy vehicle movement on site.	Soil compaction will lead to the deterioration of soil fertility and soil potential. Additionally, soil compaction will limit the permeability of the soil in terms of root penetration.	Construction	Lylyveld PCD (4 ha)	1) Clearly demarcate all construction areas and restrict the activities of contractors and employees to these areas. 2) Restrict all vehicle movement to the absolute minimum and use dedicated roads. 3) Existing roads should be used as far as possible. 4) Heavy vehicles, such as excavators, may only leave roads or parking areas when specific work needs to be undertaken and the go ahead has been given for work to be carried out. 5) Compliance in terms of contractor activities and vehicular movement must be monitored and reported on weekly. 6) Minimize clearance of vegetation.	GN704 and the DWA Best Practices (DWA, 2006a)	Environmental and mining departments	Throughout the construction period

ACTIVITIES/ASPECT	IMPACT	PHASE	AREA	PROPOSED MITIGATION/MANAGEMENT MEASURES	COMPLIANCE WITH STANDARDS/ACTS OR ANGLO MANAGEMENT TOOLS	RESPONSIBLE PARTY	SCHEDULING
				7) Topsoil stockpiles should be kept as small as possible to prevent compaction of the soils at the bottom of the stockpile. 8) Vegetation clearance and soil stripping should not be undertaken during wet conditions to prevent soil compaction. 9) During stripping of soils, contractors should be supervised regarding their activities. 10) Soil Ripping should be undertaken in areas that will not form part of the infrastructure planed,but have been affected by construction activities. These areas should be revegetated and maintained.			
Clearance of vegetation, stripping of soils and stockpiling of soils during construction.	Soil erosion and sedimentation. Effective management measures must be implemented to ensure that wind and water erosion are limited at soil stockpile areas and rehabilitation areas. Soil erosion will lead to the physical degradation of the soil. Soil erosion will lead to changes in the ecological characteristics of any disturbed area i.e. establishment of	Construction/ Decommissioning	Aldag and Lylyveld PCD's (8 ha)	1) During vegetation clearance and soil stripping, contractors and operators should be supervised regarding their activities. 2) Construction during wet conditions should be restricted or closely monitored to prevent soil erosion. 3) Soil that is stripped during construction activities should be stockpiled and stockpiles should be protected by an upslope berm and toe channel to divert water run-off to prevent erosion and transportation of sediments. 4) Soil that is cleared during initial construction of the PCD's should only be stockpiled for a short period and used to rehabilitate mined out areas or banks of PCD. 5) Repair all erosion damage as soon as possible and in any case not later than six months before	GN704 and the DWA Best Practices (DWA, 2006a)	Environmental and mining departments	Throughout the construction period

ACTIVITIES/ASPECT	IMPACT	PHASE	AREA	PROPOSED MITIGATION/MANAGEMENT MEASURES	COMPLIANCE WITH STANDARDS/ACTS OR ANGLO MANAGEMENT TOOLS	RESPONSIBLE PARTY	SCHEDULING
	alien invasive species resulting in the loss of natural habitat for indigenous fauna and flora. Soil erosion will lead to a shortage of soil/material for the successful rehabilitation of disturbed areas.			the termination of the Maintenance Period to allow for sufficient rehabilitation growth. 6) Ensure that channels do not discharge straight down the contours. These must be aligned at such an angle to the contours that they have the least possible gradient. 7) Revegetation of disturbed areas should be undertaken as soon as activities have ceased to prevent further soil loss due to erosion.			
Leaking of Hydrocarbons from vehicles and machinery. Temporary fuel storage.	Soil contamination will have a detrimental effect on resource availability for stockpiling and re-use during rehabilitation of the PCD's and other disturbed areas. Hydrocarbon contamination of soils could occur as a result of oil/diesel leaks from heavy machinery and dirty water run-off from workshops and the servicing and repair of machines.	Construction & Decommissioning	Aldag and Lylyveld PCD's (8 ha)	1) Water falling on areas polluted with oil/diesel or other hazardous substances must be contained. Any excess or waste material or chemicals should be removed from the site and discarded in an environmental friendly way. 2) Care must be taken when handling any substance that has the potential to cause soil pollution. 3) In the case of spills, immediate action should be taken to clean up the spill and isolate the contaminated soil. Spillages or leakages must be treated according to an applicable procedure as determined by a plan of action for the specific type of disturbance; Spill kits should be on-hand to deal with spills immediately. 4) Records should be kept and updated regarding spills and soil contamination. 5) Machine breakdowns should be attended to promptly in order to prevent oil spills.	GN704 and the DWA Best Practices (DWA, 2006a)	Environmental and mining departments	Throughout the construction period

ACTIVITIES/ASPECT	IMPACT	PHASE	AREA	PROPOSED MITIGATION/MANAGEMENT MEASURES	COMPLIANCE WITH STANDARDS/ACTS OR ANGLO MANAGEMENT TOOLS	RESPONSIBLE PARTY	SCHEDULING
				6) Drip trays should be placed under vehicles and machinery that have a visible leak. 7) Chemical storage facilities should be bunded and paved to prevent soil contamination. 8) Construction vehicles should be inspected for oil and fuel leaks regularly and frequently. Vehicle maintenance will not be done on site except in emergency situations in which case mobile drip trays will be used to capture any spills. Drip trays should be emptied into a holding tank and returned to the supplier.			
BIODIVERSITY							
Clearance of vegetation, stripping of soils and stockpiling of soils during construction.	Direct habitat destruction of fauna / flora habitat. Habitat fragmentation	Construction	Lylyveld PCD (4 ha)	1) Peripheral impacts around the excavation area on the surrounding vegetation of the area should be avoided and a monitoring programme should be implemented to ensure the impacts are kept to a minimum, while the rehabilitation of the site should be prioritised after the development has been completed; 2) During construction, sensitive habitats must be avoided by construction vehicles and equipment, wherever possible, in order to reduce potential impacts. Only necessary damage must be caused and, for example, unnecessary driving around in the veld or bulldozing natural habitat must not take place;	NEMBA, NFA	Environmental Department	Throughout the construction period

ACTIVITIES/ASPECT	IMPACT	PHASE	AREA	PROPOSED MITIGATION/MANAGEMENT MEASURES	COMPLIANCE WITH STANDARDS/ACTS OR ANGLO MANAGEMENT TOOLS	RESPONSIBLE PARTY	SCHEDULING
				3) All development activities should be restricted to specific recommended areas. 4) Storage of road-building equipment, fuel and other materials should be limited to demarcated areas. 5) Layouts should be adapted to fit natural patterns rather than imposing rigid geometries. 6) The entire development footprint should be clearly demarcated prior to initial site clearance and prevent construction personnel from leaving the demarcated area; 7) Where trenches pose a risk to animal safety, they should be adequately cordoned off to prevent animals falling in and getting trapped and/or injured. This could be prevented by the constant excavating and backfilling of trenches during the berm construction. 8) Construction activities must remain within defined construction areas and the road servitudes. 9) No construction / disturbance will occur outside these areas			
	Loss of sensitive species			1) Permits to be in place for removal of protected plant and tree species. 2) Protected plant and tree species which cannot be transplanted, can be replaced from local genetic stock. 3) Protected animal species will likely leave the area when construction begins.	NEMBA, NFA	Environmental Department	Once of prior to construction and regular monitoring throughout the construction period

ACTIVITIES/ASPECT	IMPACT	PHASE	AREA	PROPOSED MITIGATION/MANAGEMENT MEASURES	COMPLIANCE WITH STANDARDS/ACTS OR ANGLO MANAGEMENT TOOLS	RESPONSIBLE PARTY	SCHEDULING
				4) Avoid sensitive habitats. It is recommended that construction activities take place in a phased manner, in a uniform direction from one side to the other of the PCD footprint so as to ensure that as far as possible faunal species can naturally disperse out of the area ahead of activities;			
	Spread and establishment of alien invasive species	Construction/ Operations/ Decommissioning and closure	Aldag and Lylyveld PCD (8 ha)	1) Invasive vegetation should be monitored and controlled. 2) Remove existing populations of legislated weeds to reduce source populations. 3) Institute strict control over materials brought onto site, which should be inspected for potential invasive invertebrate species and steps taken to eradicate these before transport to the site. 4) Routinely fumigate or spray all materials with appropriate low-residual insecticides prior to transport to or in a quarantine area on site. 5) Control involves killing the plants present, killing the seedlings which emerge, and establishing and managing an alternative plant cover to limit re-growth and re-invasion. 6) Rehabilitate disturbed areas as quickly as possible to reduce the area where invasive species would be at a strong advantage and most easily able to establish. 7) Institute a monitoring programme to detect alien invasive species early, before they become established and, in the case of	NEMBA; CARA; Sishen Mine Alien and invasive management procedure	Environmental Department	Throughout the life of the mine

ACTIVITIES/ASPECT	IMPACT	PHASE	AREA	PROPOSED MITIGATION/MANAGEMENT MEASURES	COMPLIANCE WITH STANDARDS/ACTS OR ANGLO MANAGEMENT TOOLS	RESPONSIBLE PARTY	SCHEDULING
				weeds, before the release of seeds. 8) Alien vegetation must be removed from the study area during in line with the NEMBA Alien and Invasive Species Regulations (2016)			
	Dumping of material outside designated areas leading to loss of terrestrial habitat. Increased fire frequency, as well as uncontrolled fires due to increased human activity will impact on plant communities. Unregulated movement of mine vehicles through the Lylyveld PCD Infrastructure Area. Increased risk of poaching due to increased personal movement in the Lylyveld PCD Infrastructure Area. Permanent loss of SCC foraging and breeding habitat	Construction/ Operations/ Decommissioning and closure	Lylyveld PCD (4 ha)	It is recommended that construction activities take place in a phased manner, in a uniform direction from one side to the other of the PCD footprint so as to ensure that as far as possible faunal species can naturally disperse out of the area ahead of activities; 1) Restrict vehicles to travelling only on designated roadways to limit the ecological footprint of the proposed PCD; 2) No uncontrolled fires whatsoever should be allowed; 3) No dumping of waste should take place. If any spills occur, they should be immediately cleaned up; 4) In the event of a breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced preventing the ingress of hydrocarbons into the topsoil; 5) No trapping or hunting of any faunal species is to take place;	NEMBA, NEMA	Environmental and project department	Throughout the Life of the mine
Demolition of infrastructure	Demolition and removal of infrastructure will	Decommissioning and closure	All Areas	Any disturbance of sensitive faunal habitat and species of conservation	NEMA	Environmental and mining Departments	At end of life of mine

ACTIVITIES/ASPECT	IMPACT	PHASE	AREA	PROPOSED MITIGATION/MANAGEMENT MEASURES	COMPLIANCE WITH STANDARDS/ACTS OR ANGLO MANAGEMENT TOOLS	RESPONSIBLE PARTY	SCHEDULING
	require vehicles and machinery and may result in the destruction of previously undisturbed vegetation and the compaction of soils. Disturbance of faunal habitat as part of demolition and closure activities.			concern must be actively avoided. In this regard, Restrict activities to only designated areas to prevent further destruction of vegetation. Implementation of invasive vegetation monitoring and control programme. Edge effect control needs to be implemented within construction areas, with specific consideration to erosion control and alien floral species management. No trapping, collecting or hunting of faunal species must be allowed during any phases of the proposed mining development; Disturbed and cleared areas need to be revegetated with indigenous grass species to help stabilise the soil surface All alien plants within the study area should be cleared, with follow up activities running concurrently for one year; and Soils that has been compacted must be ripped and profiled in line with the surrounding area.			
Final Rehabilitation	Alien invasive vegetation may be established on disturbed areas, competing for resources with indigenous vegetation.						
	Potential ineffective rehabilitation of exposed and impacted areas leading to permanent loss of faunal habitat						
	Ineffective rehabilitation of exposed and impacted areas leading to permanent losses of faunal habitat and diversity						

ACTIVITIES/ASPECT	IMPACT	PHASE	AREA	PROPOSED MITIGATION/MANAGEMENT MEASURES	COMPLIANCE WITH STANDARDS/ACTS OR ANGLO MANAGEMENT TOOLS	RESPONSIBLE PARTY	SCHEDULING
	Failure to implement a well-conceived biodiversity action plan, rehabilitation plan and alien floral control plan during the decommissioning and closure phase						
SURFACE WATER							
Discharge of contaminated water Sediment run-off	Hydrocarbon spillages from servicing or construction equipment itself, with resultant elevated hydrocarbon concentrations in runoff water.	Construction	All Areas (8 ha)	1) The footprint of disturbed areas will be minimised. 2) "No-go" zones will be delineated for construction 3) Appropriate storm water management measures will be implemented. 4) No Servicing of construction vehicles will take place onsite. 5) •Bunded containment facilities will be provided for hazardous materials, such as fuel and oil. 6) Spill-sorb or a similar product will be kept on site, and used to clean up hydrocarbon spills in the event that they should occur. 7) The Sishen waste management procedure will be implemented for the construction phase. 8) Appropriate sewage management will be implemented during the construction, which will entail portable chemical toilets.	NWA & NEMA	Environmental and project departments	Throughout the construction period

ACTIVITIES/ASPECT	IMPACT	PHASE	AREA	PROPOSED MITIGATION/MANAGEMENT MEASURES	COMPLIANCE WITH STANDARDS/ACTS OR ANGLO MANAGEMENT TOOLS	RESPONSIBLE PARTY	SCHEDULING
General decommissioning and rehabilitation	Impacts resulting from general rehabilitation and decommissioning works will be similar to those during the construction phase, with earthworks related to rehabilitation and the movement of construction equipment on the site. Impacts may arise from: • Erosion of soils during rainfall events, with elevated suspended solids in the runoff water. •Resultant elevated suspended solids in the watercourses, as well as sedimentation in the watercourses. •Hydrocarbon spillages from fuel storage, servicing areas or construction equipment itself, with resultant	Decommissioning and closure	All Areas	The following mitigation measures will be implemented: 1) The footprint of disturbed areas will be minimised. 2) The storm water management infrastructure and PCD's will be decommissioned last, if at all, to ensure adequate storm water management during the rehabilitation phase. 3) Servicing of construction vehicles will take place only in dedicated areas that are equipped with drip trays. 4) Bunded containment and settlement facilities will be provided for hazardous materials, such as fuel and oil. 5) Spill-sorb or a similar type product will be kept on site and used to clean up hydrocarbon spills in the event that they should occur. 6) Erosion protection measures will be implemented at steep areas. 7) Sishen waste management procedure will be implemented the decommissioning and closure phase, which will include the handling of contaminated materials / soils found on site. 8) All traces of hydrocarbons and residual waste will be removed before infrastructure is demolished. 9) Contaminated soils will be excavated and placed on the discard facilities prior to their rehabilitation,or removed from site by an appropriately licensed waste contractor.	NEMA	Environmental and mining Departments	At end of life of mine

ACTIVITIES/ASPECT	IMPACT	PHASE	AREA	PROPOSED MITIGATION/MANAGEMENT MEASURES	COMPLIANCE WITH STANDARDS/ACTS OR ANGLO MANAGEMENT TOOLS	RESPONSIBLE PARTY	SCHEDULING
	elevated hydrocarbon concentrations in runoff water, watercourses. These impacts are expected to be relatively small, with the resultant impact post decommissioning being positive in comparison with the operational phase.			10) An appropriate sewage management strategy will be implemented during the decommissioning phase.			
Risk on surface water quality - Water management infrastructure & PCD's	Impacts may arise from: • Erosion of soils during rainfall events, with elevated suspended solids in the runoff water. •Resultant elevated suspended solids in the watercourses, as well as sedimentation in the watercourses These impacts are expected to be relatively small, with the resultant impact post decommissioning being positive in comparison with	Decommissioning and closure	All Areas	1) This infrastructure will be decommissioned and rehabilitated last.	NEMA	Environmental and mining Departments	At end of life of mine

ACTIVITIES/ASPECT	IMPACT	PHASE	AREA	PROPOSED MITIGATION/MANAGEMENT MEASURES	COMPLIANCE WITH STANDARDS/ACTS OR ANGLO MANAGEMENT TOOLS	RESPONSIBLE PARTY	SCHEDULING
	the operational phase.						
GROUNDWATER							
Leaking of Hydrocarbons from vehicles and machinery. Temporary fuel storage.	Hydrocarbon spillages from vehicles moving on site, fuel storage, servicing areas or construction equipment itself, with resultant elevated hydrocarbon concentrations seeping into groundwater. Any impact on the quantity or quality of water in the system has the potential to affect the quality and assurance of supply to the community and agriculture. Pollution from latrines	Construction and decommissioning and closure	All Areas (8 ha)	1) No Servicing of construction vehicles to take place. 2) Drip trays to be available for leaking vehicles of machinery 3) Also See surface water mitigation above	NWA &NEMA	Environmental and project departments	Throughout the construction period
HERITAGE							
Site clearance for construction of PCD & trenches at Lylyveld South	Impact on identified archaeological material Impact on subsurface archaeological resources.	Construction	Aldag & Lylyveld PCD	1) If a deposit is identified a controlled sampling of the material found should be done; In the event that substantive material is uncovered, it is recommended that a display is considered in a convenient location;	NHRA	Environmental Department (ECO assigned)	Throughout the construction period

ACTIVITIES/ASPECT	IMPACT	PHASE	AREA	PROPOSED MITIGATION/MANAGEMENT MEASURES	COMPLIANCE WITH STANDARDS/ACTS OR ANGLO MANAGEMENT TOOLS	RESPONSIBLE PARTY	SCHEDULING
				2) Archaeological monitoring during the Construction Phase is also required. 3) Should any Stone Age material or any archaeological material be identified, all construction work in that area must immediately stop and the ECO or archaeologist (if already present on site) must demarcate a construction free area around the discovery; 4) If the ECO made the discovery, the archaeologist must be contacted immediately to visit the construction site to assess the exposed material. After assessing the exposed material, the archaeologist would provide recommendations for the exposed material that may range from destruction without mitigation (if the exposed material is found to be of little significance) to archaeological mitigation (if the exposed material is found to be significant).			

ACTIVITIES/ASPECT	IMPACT	PHASE	AREA	PROPOSED MITIGATION/MANAGEMENT MEASURES	COMPLIANCE WITH STANDARDS/ACTS OR ANGLO MANAGEMENT TOOLS	RESPONSIBLE PARTY	SCHEDULING
	Impact on Palaeontological Resources. impact on fossil materials	Construction	Aldag & Lylyveld PCD	1) Should fossil remains be discovered the ECO responsible for these developments should be alerted immediately. Such discoveries ought to be protected (preferably in situ) and the ECO should alert SAHRA (South African Heritage Research Agency) so that appropriate mitigation (e.g. recording, sampling or collection) can be taken by a professional palaeontologist. 2) The specialist involved would require a collection permit from SAHRA. Fossil material must be curated in an approved collection (e.g. museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.	NHRA	Environmental Department (ECO assigned)	Throughout the construction period
SOCIO-ECONOMICS							
Procurement of good and services	Local procurement and enterprise development	Construction/ Operations/D ecommissionin g and closure	Aldag and Lylyveld PCD	1) Preferential procurement plan.	MPRDA	Social Affairs and HR Departments	Prior to the commenceme nt of construction period
	Dust, noise, impacting the community's quality of life and livelihoods			1) Continued support to facilitate an Environmental Forum for engagement with community. 2) Dust suppression initiatives' Existing dust monitoring. Implementation of mitigation measures and EMP. 3) Effective engagement with affected parties, around the project in particular.	NEMA, NWA, MPRDA	Environmental Department	Throughout the life of the project

10.6 Impact Management Outcomes

Refer to section 10.5

10.7 Impact Management Actions

Refer to section 10.5

10.8 Financial Provision

10.8.1 Determination of the amount of Financial Provision.

10.8.1.1 Sishen Closure Vision

The SIOC closure plans and the associated financial provision on the closure objectives, goals and requirements as identified in the Global Sishen Closure Plan (2008), findings of the specialist studies conducted, AA Mine Closure Toolbox and the Anglo Environment Way. These objectives, goals and requirements are identified below:

1) Safety and health of people and animals are safeguarded from hazards resulting from the suspended mining operations;
2) Environmental damage or residual environmental impacts are minimised to the extent that they are acceptable to all parties involved;
3) The land is rehabilitated to achieve a condition approximating its natural state, or so that the envisaged end use of the land can be achieved;
4) The physical and chemical stability of the remaining structures should be such that risk to the environment through naturally occurring forces is eliminated;
5) Mine closure is achieved efficiently, cost effectively, and in compliance with the laws of South Africa;
6) The social impacts resulting from mine closure are managed in such a way that establishment of a socially stable community in line with the principles of sustainable development is facilitated.
7) The Sishen closure vision is to make sure the Sishen zone of influence is a safe, stable, non–polluting and healthy environment with predominately grazing potential supporting small scale socio-economic enterprises.

10.8.2 Confirm specifically that the environmental objectives in relation to closure have been consulted with landowner and IAP's.

Sishen has presented the closure objectives to interested parties on various occasions and in various EMPr reports.

10.8.2.1 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.

The proposed project only addresses the proposed PCD's and final rehabilitation of the area would mostly result in all the infrastructure being removed and the area reshaped and revegetated according to the provisions of Table 19. The extent of the proposed PCD's is contained in Figure14 and 15.

10.8.2.2 Explain why it can be confirmed that the rehabilitation plan is compatible with the closure objectives.

Refer to section 11.8.1.1

10.8.2.3 Calculate and state the quantum of the financial provision required to manage and rehabilitate the environment in accordance with the applicable guideline.

The most recent financial planning for closure of Sishen Mine was completed in November 2016. **Financial provision** is made for **premature closure costs** (the cost of rehabilitation of current disturbance at the mine). The current pre-mature closure liability at Sishen Mine as communicated to the DMR is R 2 439 677 182. The latest estimated LOM final rehabilitation cost has been estimated at R 19 707 989 621. The rehabilitation of waste rock dumps and stockpiles accounts for 98% of the final rehabilitation cost.

Closure Costing Methodology

The financial provision for the overflow dam at the Aldag PCD and Lylyveld South PCD has been calculated according to regulation 6 of the financial provision for prospecting, exploration, mining or production operations regulations (GNR 1147, November 2015). These regulations prescribe the required minimum content.

The model used to develop the closure cost for the mining area was developed in Microsoft Excel. An itemised list of all the required action was included, which contained measurements of the infrastructure to be removed, demolished and areas to be rehabilitated. An appropriate rate was applied to each action to be implemented. The final preferred layout was utilised to measure all the affected areas as a result of the proposed mining activity.

Closure Costing Assumptions

The following assumptions have been made during the calculation of the financial provision:

- At mine closure, all infrastructure will be removed from the site;
- All concrete will be removed up to 700mm below ground level;
- All general rehabilitation will involve the following:
  - General clean-up of the affected area
  - Appropriate contouring will be done to mimic final topography;
  - The footprint areas will be ripped.
  - A 150mm layer of topsoil will be place on all affected areas;
  - Once topsoil is replaced fertilizer and organic matter will be incorporated before seeding of the area.
  - The PCD's and trenched will be removed including the lining and residual sediment. The residual sediments will be placed on the discard dump.

Closure Costing

The estimated financial provision required for the rehabilitation and closure of the overflow dam at Aldag and Lylyveld PCD project is **R 1 954 080.93** (LOM) **excl. VAT**. A summary of the financial provision estimate associated with the overflow dam at Aldag and Lylyveld PCD is included in the table 19. Detailed sheets are provided in Appendix H.

TABLE 19: SUMMARY OF THE OVERFLOW DAM AT THE ALDAG PCD AND THE LYLYVELD SOUTH PCD FINANCIAL PROVISION

Item	Description	Cost
1	**Stormwater Management Infrastructure**	
1.1	Aldag Pollution Control Dam (Overflow dam)	**R 166 024.62**
1.2	Lylyveld Pollution Control Dam	**R 453 437.33**
1.3	Trenches and berms	**R 806 305.42**
1.4	Rehabilitation	**R 350 669.83**
	Contingency (10%)	**R 177 643.72**
Total		**R 1 954 080.93**

The next detailed update of Sishen Mine's closure cost will be done in 2018, of which the proposed overflow dam at Aldag and Lylyveld PCD will form part of. The updated assessment will be submitted to the DMR once completed.

10.8.2.4 Confirm that the financial provision will be provided as determined.

This report constitutes additional infrastructure and is not for a new mining project. However, Sishen Mine is in regular communication with the DMR regarding the required updates to its financial provision. A Bank guarantee will be provided for the project. After the 2018 detailed

closure assessment any shortfalls between the estimated closure cost and the overall closure cost calculated will then be covered by means of bank guarantees.

10.9 Mechanisms for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon, including

The monitoring program in Table 20 below will be implemented by Sishen Mine:

Table 20: Integration of project into the existing Sishen Mine Monitoring Programme

No	Environmental component	Frequency of monitoring	Frequency of reporting
1	EMPR performance assessment (internal)	Compliance with the approved EMPR will be audited internally by the Environmental Manager on an annual basis. Ad-hoc audits will be undertaken by the Environmental Department.	Records of internal audits will be retained.
2	EMPR performance assessment (external)	The MPRDA Regulations (Regulation 55) states that the frequency of performance assessment reporting shall be in accordance with the period specified in the approved EMPR, every 2 years or as agreed in writing by the Minister. This performance assessment will be undertaken by an independent third party	A formal EMPR Performance Evaluation Report will be submitted to the DMR every 2 years
3	Water quantity & quality monitoring	Monitoring of surface and ground water resources will take place according to the DWA IWUL. The current water quality monitoring network is shown in Figure 9 The mine's water quality monitoring is conducted by an external consultant	Water quantity & quality monitoring results will be reported to DWA as per the IWUL requirements. These results will be reported to DMR on an annual basis
4	Rehabilitation progress monitoring	Rehabilitation will be undertaken in accordance with the mine's 5-Year Rehabilitation Plan	Progress made with the implementation of the 5-Year Rehabilitation Plan will be reported to DMR on an annual basis

No	Environmental component	Frequency of monitoring	Frequency of reporting
5	Biodiversity Monitoring	Biodiversity monitoring will be undertaken according to the biomonitoring protocol. Biodiversity monitoring will be undertaken jointly by the mine and external consultants	Biodiversity monitoring results will be reported to DMR on an annual basis
6	Progress with implementation of storm water management plan	The Department of Water and Sanitation approved the mines SWMP. Implementation to start 2016	Progress with implementation of the mine's storm water plan will be reported to DMR and DWA on an annual basis
7	EMS audits (internal)	Internal EMS audits will be undertaken by a team of internal auditors according to a yearly audit schedule	Records of internal EMS audits will be retained at the mine
8	EMS audits (external)	An external EMS audit will be undertaken by an independent third party on an annual basis	Records of external EMS audits will be retained at the mine
9	IWUL performance audit (external)	An external IWUL performance audit will be undertaken by an independent third party on an annual basis	The outcomes of the IWUL performance audit will be submitted to DWA and DMR on an annual

10.10 Indicate the frequency of the submission of the performance assessment/ environmental audit report.

Table 21: Frequency of the submission of the performance assessment/ environmental audit report

No.	Environmental Component	Frequency of Monitoring	Frequency of reporting
1	EMPR performance assessment (internal)	Compliance with the approved EMPR will be audited internally by the Environmental Manager on an annual basis. Ad-hoc audits will be undertaken by the Environmental Department.	Records of internal audits will be retained.
2	EMPR performance assessment (external)	The MPRDA Regulations (Regulation 55) states that the frequency of performance assessment reporting shall be in accordance with the period specified in the approved EMPR, every 2 years or as agreed in writing by the Minister. This performance assessment will be undertaken by an independent third party	A formal EMPR Performance Evaluation Report will be submitted to the DMR every 2 years

10.11 Environmental Awareness Plan

10.11.1 Manner in which the applicant intends to inform his or her employees of any environmental risk which may result from their work.

Sishen Mine has established a programme for SHEQ competence, training and awareness. The procedure is revised from time-to-time as deemed appropriate by the mine. Environmental awareness training at Sishen Mine takes place in accordance with this procedure. Three levels of training have been identified in the procedure, namely general awareness training, job specific training and competency training. All employees receive SHEQ awareness training through the mine's e-learning system. Training for specific operations is based on the risk-based needs of a specific section and environmental awareness modules are used for this purpose.

10.11.2 Manner in which risks will be dealt with in order to avoid pollution or the degradation of the environment.

Sishen Mine developed and implemented an Environmental Management System (EMS) that complies with the requirements of ISO14001:2015 Environmental Management Systems and is certified by the South African Bureau of Standards. Surveillance audits are conducted annually, and recertification audits every third year. The mine's EMS addresses the following elements of the ISO14001 standard and these, in conjunction with the environmental commitments in section 11.5, ensure that potential environmental impacts arising from the mine's activities are managed appropriately:

- An environmental policy that includes commitments to prevent pollution, comply with applicable legal requirements and provides a framework for setting environmental objectives and targets
- A register of environmental aspects and impacts with a view to implementing operational control measures to limit environmental impacts
- A register of all applicable legal requirements to ensure legal compliance
- A register of environmental objectives and targets that is consistent with the environmental policy and takes into account significant environmental impact and the management thereof, together with a program for achieving the identified objectives and targets
- Resources to ensure implementation of the EMS
- An environmental training and awareness program to ensure that persons performing tasks that could cause significant environmental impacts are aware of such impacts and are competent to perform such tasks
- A communication procedure for internal and external communication in respect of significant environmental aspects

- All Environmental Management System Documentation, as required by the ISO14001 standard, which includes control procedures for documents and records
- Operational control procedures for activities that could cause significant environmental impact to ensure that correct procedures are implemented to minimise potential environmental impacts
- An emergency preparedness and response procedure that identifies potential emergency situations and potential accidents that can impact on the environment to ensure that such situations are dealt with in an appropriate manner
- An environmental monitoring and measurement program to monitor and measure the key characteristics of the operation that can cause significant environmental impact and to gauge the success of implemented mitigation measures
- A procedure for periodically evaluating compliance with applicable legal requirements
- A procedure for dealing with non-conformities in terms of their identification, corrective action and preventative action
- Audit programs and procedures that makes provision for internal and external audits focussing on implementation of the requirements of the EMS and legal requirements
- Management reviews undertaken at planned intervals to ensure the system's continuing suitability, adequacy and effectiveness

The Environmental policy is described below.

Sishen Mine has established an environmental policy that is consistent with the requirements of the ISO14001 standard. With this policy Sishen Mine commits to develop, implement and maintain an Environmental Management System aimed at achieving:

- Upholding of our vision of Zero Harm and the principles of a Zero Mindset, No Repeats and Simple Non-Negotiable Standards
- Ongoing identification, assessment and effective management of SHEQ risks and impacts
- Proactive consideration of SHEQ issues in their planning and decision making
- Compliance with all applicable SHEQ legislation, international obligations, standards and other requirements to which they subscribe
- Establishment of objectives, targets and improvement plans to continuously improve their performance
- Provision of adequate resources to ensure a safe and healthy workplace for their employees and contractors, the maintenance of responsible environmental standards; as

well as to provide quality products and services that comply with and/or exceed customer expectations and ensure customer satisfaction through superior production processes

- Empowering their people through communication, coaching and training to ensure competence in SHEQ management
- Consultation with internal and external stakeholders on relevant matters relating to SHEQ
- Reporting, investigating and learning from incidents by determining contributing factors and implementing corrective and preventive action to ensure the effectiveness of controls
- Prevention, reduction and management identified significant environmental aspects such as use of water, energy, hydrocarbon substances (prevention of pollution), biodiversity, wastes, generation of dust and noise; as well as the efficient use and conservation of natural resources
- Continual improvement of their SHEQ management systems and performance

10.12 Specific information required by the Competent Authority

Sishen Mine makes financial provision for closure by means of the KIO Rehabilitation Trust Fund, with any shortfall between the immediate closure cost estimate and the balance in the Trust Account being funded by means of bank guarantees.

Prior to 8 December 2014 all mining related aspects, including environmental consideration, were regulated in terms of the Mineral and Petroleum Resource Development Act, 2002 (Act No. 28 of 2002) (MPRDA) and the supporting Mineral and Petroleum Resources Development Regulations of 2004 (GN R. 527 of 2004). In terms section 43 of the MPRDA a holder of the mining right remains liable for any environmental degradation and pollution caused during the execution of such right until a closure certificate is issued by the DMR. The requirements and supporting documentation for such closure application by a licence holder was outlined in section 57 of the MPRDA Regulations.

This changed with various amendment being made to the MPRDA and NEMA, including the subsequent promulgation of the Environmental Impact Assessment Regulations of 2014 (GN R. 982 of 2014) and the Regulation pertaining to the financial provisioning for prospecting, exploration, mining or production operations of 2015 (GN R.1147 of 2015). The main purpose of this amendment is to remove all environmental aspects from the ambient of the MPRDA and regulate environmental aspects in terms of NEMA. An application for a closure certificate in terms of MPRDA cannot be granted until an environmental authorisation in terms of NEMA is granted. The

new regulation specifies the requirements and supporting documentation that needs to be submitted as part of a closure application. This includes an annual rehabilitation plan (of applicable), final closure plan and latent risk management plan. In addition, the execution of these plans is linked to a financial quantum that needs to be provided for any the mining right holder. This provision and reports are also required by an existing operation that is not nearing closure.

A mining right holder has until 20 February 2019 to ensure that a review, assessment and adjustment of the financial provision is done according to the financial provisioning regulation of 2015. The plans identified above would need to form part of this requirement. It should also be noted that any financial provisioning approved in terms of the MPRDA is regarded as an approved provision in terms of NEMA Financial provisioning regulation of 2014. However, a holder of a mining right would need to align its provision to the new regulation before the date specified above. Sishen Mine therefore has until 20 February 2019 to align with the new regulations.
The last annual review of the financial quantum in terms of section 41(3) and Regulation 54 of the MPRDA was completed in November 2016. The mine will submit similar reviews on an annual basis.

4) UNDERTAKING

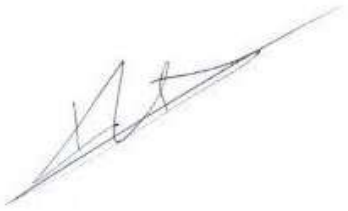
The EAP herewith confirms

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) that the information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by I&AP's are correctly reflected herein. ☒



Signature of the environmental assessment practitioner:

EXM Advisory Services (Pty) Ltd
Name of company:

19/02/2018
Date:

-END-

11. REFERENCES

Airshed Planning Professional (March 2017) Air Quality Impact Assessment for Sishen Iron Ore Mine Draft Rev1

dbAcoustics (December 2016) Baseline Noise Assessment Along the Boundaries of Sishen Mine

Exigo (December 2014) Mine Residue Leachate Assessment Geochemical Study

Lidwala Environmental and Planning Services (March 2013) Biodiversity Action Plan for Sishen Mine, Kathu, Northern Cape

MSA (December 2015) Sishen Mine Integrated Water and Waste Management Plan 2011-2016 Update

12.APPENDICES

APPENDIX A: CURRICULUM VITAE OF EAPS

APPENDIX B: DESIGN REPORT AND ASSOCIATED PRELIMINARY DESIGNS OF THE PROPOSED LYLYVELD SOUTH PCD AND ASSOCIATED TRENCHES AND BERMS

APPENDIX C: PUBLIC PARTICIPATION REPORT

APPENDIX D: TERRESTRIAL ECOLOGICAL HABITAT INTEGRITY INVESTIGATION REPORT

APPENDIX E: HERITAGE IMPACT ASSESSMENT REPORT

APPENDIX F: IMPACT ASSESSMENT TABLES

APPENDIX G: SITE MAP

APPENDIX H: CLOSURE COSTING