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SISHEN MINE

EXTENSION OF MINING ACTIVITIES AT LYLYVELD, UPGRADE OF THE TAILINGS STORAGE FACILITY & IMPLEMENTATION OF TROLLEY ASSIST ELECTRICAL LINES

KATHU, NORTHERN CAPE

ENVIRONMENTAL IMPACT ASSESSMENT
&
ENVIRONMENTAL MANAGEMENT PROGRAMME
PART A

DRAFT FOR PUBLIC AND AUTHORITY REVIEW

SAMRAD REFERENCE: NC-00112-MR/259 AND NC-00152-MR/259

EXM Advisory Services

ENVIRONMENTAL • MINERAL RIGHTS • SOCIAL & SD

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PART A

DRAFT FOR PUBLIC AND AUTHORITY REVIEW

NAME OF APPLICANT: Sishen Iron Ore Company (Pty) Ltd – Sishen Mine

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REF NUMBER: NC-00112-MR/259 and NC-00159-MR/259

TO BE SUBMITTED FOR AUTHORISATION IN TERMS OF:

SECTION 102 OF THE MINERALS AND PETROLEUM RESOURCES DEVELOPMENT ACT

LISTED ACTIVITIES UNDER THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT AND NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT

PREPARED BY: EXM Advisory Services (Pty) Ltd

DATE: 2019/12/12

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Name	**Designation**	**Signature**	**Date**
Kerry Fairley	EAP Director Pr.Sci.Nat		2019/12/12
Trevor Hallatt	Senior Environmental Scientist Pr.Sci.Nat.		2019/12/12

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ACRONYMS AND ABBREVIATIONS

Abbreviation	Explanation
BID	Background Information Document
CBA	Critical Biodiversity Area
DMR	Department of Mineral Resources
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMC	Ecological Management Class
EMPr	Environmental Management Programme
ESA	Ecological Support Area
GHG	Greenhouse Gases
GNR	Government Notice
IAP	Interested and Affected Party
LOM	Life of Mine
Mtpa	Million tons per annum
LSA	Late Stone Age
mamsl	Metres above mean sea level
Mbs	Metres below surface
MPRDA	Mineral and Petroleum Resources Development Act
MSA	Middle Stone Age
NAAQS	South African National Ambient Air Quality Standards
NDCR	National Dust Control Regulations
NEMA	National Environmental Management Act
NEM: AQA	National Environmental Management Air Quality Act
NEM: BA	National Environmental Management Biodiversity Act
NEM: WA	National Environmental Management Waste Act
NFEPA	National Freshwater Ecosystem Priority Areas
NHRA	National Heritage Resources Act
PES	Present Ecological Status
PM10	Particulate matter less than 10 microns
PM2.5	Particulate matter less than 2.5 microns
ROM	Run of Mine
RWD	Return Water Dam
SACNASP	South African Council for Natural & Scientific Professionals
SAHRA	South African Heritage Resource Agency
SAMRAD	South African Mineral Resources Administration (System)
SDF	Spatial Development Framework
SIOC	Sishen Iron Ore Company (Pty) Ltd
SLP	Social Labour Plan
TOPS	Threatened or Protected Species
WML	Waste Management Licence

1. EXECUTIVE SUMMARY

1.1 Introduction and Purpose

Sishen Mine is an existing mining operation, operating under an existing mining right (NC 259 MR) and approved Environmental Management Programme (2002, as amended) for the mining and processing of iron ore, located near Kathu in the Gamagara Local Municipality of the Northern Cape Province. Sishen proposes to conduct additional activities at the operations which include the extension of mining and associated activities at the existing Lylyveld North and South operations, upgrading of the existing Tailings Storage Facility (TSF) and to develop Trolley Assist (electrical lines to facilitate haul truck movement on certain ramps) Infrastructure.

The expansion of the Lylyveld operations will entail additional pit areas, expansion of the Waste Rock Dumps (WRD)and product stockpile. The expansion will allow for the continuation of the current mining activities at Lylyveld beyond the originally planned life (2022) in line with current production rates of approximately 1 million tons per annum until 2032 (i.e. the current life of mine).

The current TSF and associated infrastructure is old and needs to be upgraded in order to improve the effectiveness and efficiency of the operation of the tailings management at the site. The amendments will extend the life of the facility and ensure safe tailings management for the life-of-mine. An improved stormwater management system will also be installed as part of the upgrade project.

New electrical lines will be developed as a ring feed to the Trolley Assist Infrastructure to be developed along some of the haul road ramps at Sishen Mine. The Trolley Assist Infrastructure will be established on the authorised footprint of the Western Waste Rock Dumps (WRD) and Vliegveld Waste Rock Dump and within the southern pushback pit area which are constructed in a phased manner as required by the mining operations.

The location of the project is indicated in Figure 1-1.

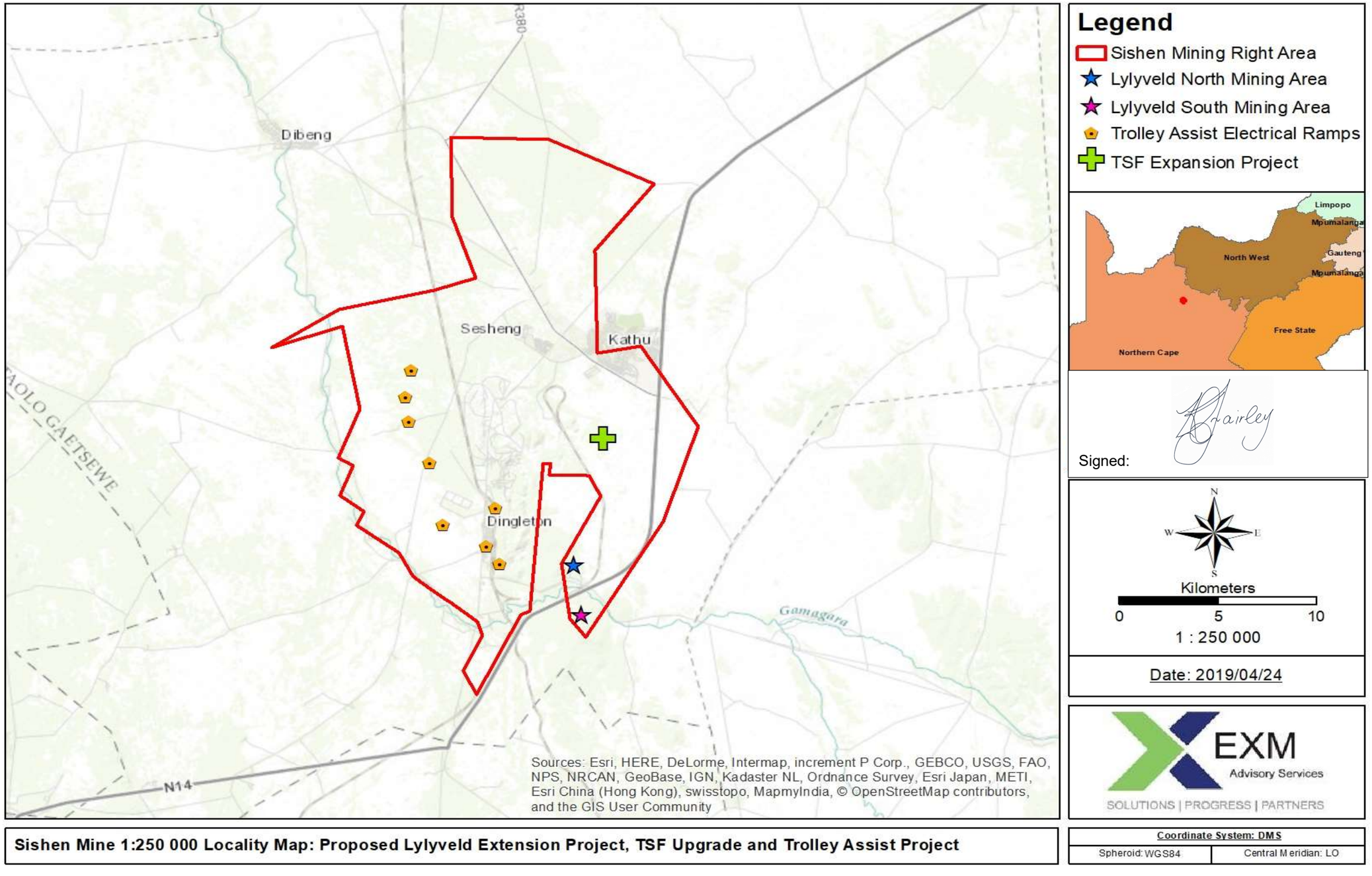


FIGURE 1-1: LOCALITY MAP SHOWING SISHEN MINE MINING RIGHT BOUNDARY AND THE LOCATION OF LYLYVELD SOUTH, TSF FACILITY AND PROPOSED TROLLEY ASSIST ELECTRICAL RAMPS

The purpose of this report is to present the results of the Environmental Impact Assessment (EIA) undertaken for the Lylyveld North and South Expansion, TSF Upgrade and Trolley Assist Infrastructure development. The EIA has been completed in support of the following applications for environmental authorisation:

- Section 102 of the Minerals and Petroleum Resources Development Act for the amendment of the Sishen Mine Environmental Management Programme.
- Environmental Impact Assessment Regulations GNR. 982-985 of 4 December 2014, as amended for Activities 10, 24, 34, 46 and 56 of Listing Notice 1 for the development and expansion of pipelines, the widening of roads and the amendment of the water use licence for waste rock dumps and Activity 15 of Listing Notice 2 for the clearance of indigenous vegetation.
- Waste Management Activities 7, 11 and 13 of Regulation GN. 921 of 29 November 2013, as amended under National Environmental Management: Waste Act for the deposition of waste rock material.

1.2 Environmental Impacts

A summary of the key environmental impacts associated with the project area provided in Table 1-1. The table shows the significant rating of the impacts without the implementation of mitigation measures. The implementation of mitigation measures will lower the significance of the impacts as indicated in the table.

The key impacts are summarised below:

1.2.1 Employment, Local Procurement and Economic Development

- The construction phase of the TSF upgrade project will provide approximately 125-150 temporary jobs.
- 90% of services required for the TSF Upgrade will be sourced locally.
- The Lylyveld expansion project will result not result in additional permanent employment opportunities. The proposed expansion project will however increase the life of operations at Lylyveld from 2022 to 2032 which will ensure that the current employment of 132 persons and local procurement associated with the operations remain for an additional 10 years.

TABLE 1-1: SUMMARY OF KEY POSITIVE AND NEGATIVE IMPACTS IDENTIFIED FOR THE MITIGATED AND UNMITIGATED SCENARIOS

IMPACT CATEGORY	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
LYLYVELD EXTENSION				
Surface Water Resources	Contamination of surface water resources due to contaminated run-off from mining, stockpile and WRD areas.	Moderate	Expand surface water management infrastructure for the containment of dirty water run-off and the diversion of clean water to incorporate new mining and disposal areas at Lylyveld South. Review stormwater management requirements for Lylyveld North and implement in accordance with GNR. 704.	Low
Surface Water Resources	Disturbance of wetlands due to haul road widening	Moderate	Implement revised layout plan with no widening to take place within the 500 m buffer of the wetland.	Low
Air Quality	Increased dust emissions due to increased footprint of the expansion activities	Moderate	Implement Sishen Mine Dust Management Plan. Enforce speed limit. Conduct dust suppression on unpaved road, i.e. wet suppression or chemical stabilisation. Continue to implement complaints management procedure. Proper maintenance of dust monitoring equipment. Monitor effectiveness of dust control measures and revise dust management plans in response. Limit footprint of exposed areas during development of expansion activities. Manage tipping heights. Rehabilitation of disturbed areas as per rehabilitation plan.	Low
Neighbouring Land Use	Disturbance of power line servitude for the realignment of the haul road.	High	Obtain the necessary permissions from Eskom of crossing of the servitude and adhere to the conditions of the wayleave.	Low
Neighbouring Land Use	Damage to the N14 road due to blasting.	Moderate	Implement revised layout to ensure that pit does not encroach on 100 m from infrastructure. Sishen to comply with legal requirements in terms of the Mine Health and Safety Act. This will include a safety risk assessment.	Moderate
Neighbouring Land Use	Damage to railway infrastructure.			
Biodiversity	Disturbance of vegetation and habitats for the development of lay down areas, HME maintenance area, expanded WRD and pit areas	Moderate	Mark all individuals of Species of Conservation Concern Obtain relevant permits for the removal of SCC. Restrict vehicles to travelling only on designated roadways to limit the ecological footprint of the expansion activities; No uncontrolled fires whatsoever should be allowed; No collection of firewood, floral SCC or medicinal floral species must be allowed by construction or mining personnel; Restrict footprint of expansion to the predetermined extent. No trapping or hunting of any faunal species is to take place Conduct rehabilitation according to the Sishen rehabilitation plan	Low
Traffic impacts	Safety risk due to haul trucks crossing DR 3333	High	Adequate dust suppression must be conducted on the haul road. Apply chemical dust suppression on haul road 100 meters from the intersection. Conduct sweeping at the intersection to get rid of loose particles. Adequate signage must be placed at the intersection. Consider surfacing the intersection for 40 m on either side to allow loose material to be overloaded prior to the intersection.	Moderate
Traffic impacts	Risk of blasting at Lylyveld South to vehicle travelling on the N14	Moderate	Implement revised layout plan with 100 m buffer from N14. Sishen to comply with legal requirements in terms of the Mine Health and Safety Act. This will include a safety risk assessment.	Low

IMPACT CATEGORY	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
Visual Environment	Increased visual intrusion and loss of scenic quality (Lylyveld South).	Moderate	Optimise the backfilling/infilling of pits with waste rock to minimise the footprint of the waste rock dumps. Backfilling/infilling must be viewed as the first option. Concurrent rehabilitation must be conducted in terms of the Sishen Mine rehabilitation plan. The footprint of the expansion activities must be limited to the mitigated/revised layout	Low
SOCIO-ECONOMICS	Continued opportunity for local procurement for haulage of ore due to the extension of the life of operations.	Moderate Positive	Preferential procurement plan for local service providers.	Moderate Positive
	Continued opportunity for local employment due to extension of life of operations.	Moderate Positive	Contractors to adhere to preferential local employment in line with Sishen Mine targets and commitments.	Moderate Positive
	Strained relationships with selected stakeholders due to unmet expectations of economic benefits from the mine	Moderate	Engagement plan to ensure that stakeholders are being kept up to date with the project and the opportunities for local community members – management of expectations. Project to align with Sishen's Public Affairs Department and provide support where required. Effective engagement with key stakeholders.	Moderate
TSF UPGRADE				
Water Consumption	Improvement in operations efficiency resulting in water saving and increased return water for use in processing.	Moderate Positive	Optimise the capacity of infrastructure to allow for water to be returned for use in the process.	Moderate Positive
Surface Water Resources	Contamination of surface water resources due to overflow of stormwater management infrastructure.	Moderate	Run-off is to be directed to stormwater management infrastructure (in the process of being upgraded). Clean water to be prevented from entering TSF. Maintain water management infrastructure to ensure operation at maximum capacity.	Moderate
Surface Water Resources	Contamination of surface water resources due to storage and handling of potential pollutants at laydown areas	Moderate	Implement measure for the protection of soil and groundwater. Implement spill prevention and emergency response procedure. Laydown areas to be incorporated within Sishen Mine's existing dirty stormwater management areas.	Low
Biodiversity	Site clearance for upgrade of infrastructure.	Moderate	Mark all individuals of Species of Conservation Concern (SCC) Obtain relevant licences for the removal of SCC. Restrict footprint of expansion to the predetermined extent.	Low
SOCIO-ECONOMICS	Increased demand for local products and services i.e. local procurement opportunities.	Low Positive	Maximise local Procurement to be implemented in line with Sishen's Local Procurement Strategy.	High Positive
	Short-term local employment opportunities.	Low Positive	Resourcing Plan to be developed and aligned with Sishen's commitments for preferential local employment. Contractors to comply with preferential local employment targets in line with Sishen's employment targets. Local employment to be reported on, on a monthly basis and audited.	High Positive
	Added value to the economy due to construction expenditure	Low Positive	Preferential procurement and employment to enhance benefits to local economy.	High Positive
	Potential for infringement of human rights.	Moderate	Contractors to adhere to SIOC's requirements on housing of personnel. ER plan to be in place for the project and to be adhered to by contractors.	Low
	Strained relationships with selected stakeholders due to unmet expectations of economic benefits from the mine	Moderate	Engagement plan to ensure that stakeholders are being kept up to date with the project and the opportunities for local community members – management of expectations. Project to align with Sishen's Public Affairs Department and provide support where required. Effective engagement with key stakeholders.	Low

IMPACT CATEGORY	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
TROLLEY ASSIST INFRASTRUCTURE				
No significant impacts				

1.2.2 Unmet Community Expectations

- Given high unemployment levels in the region, all project at Sishen will be subjected to high expectations of communities of employment. The details of the project, supply chain and employment requirements are to be communicated clearly with stakeholders in an attempt to manage such expectations.

1.2.3 Poor Contractor Management

- Contractors are to adhere to Sishen's requirements with respect to housing of workers, local employment, use of local suppliers and employee relations. Compliance is to be monitored to ensure the maximisation of local economic benefits and protection of workers rights.

1.2.4 Increased Atmospheric Emissions

- The contribution of the expansion of the Lylyveld operations and the TSF Upgrade to dust levels in the area will be low. However, the cumulative impact of the Sishen Mining operations on dust levels is high. Mitigation of any additional impact sources that will contribute to dust levels.

1.2.5 Surface Water Resources

- Spillages and leaks of hydrocarbons from HME used at Lylyveld are to be managed to ensure that soils, surface water and groundwater resources are protected. This includes the use of drip trays under machinery that has the potential to leak. HME that does leak is to be removed from site and repaired as soon as possible. No informal maintenance is to take place at the site.
- The Lylyveld PCD (already authorised) is to be developed to ensure protection of the Gamagara River.
- Laydown areas will also be established for the assembly of equipment and general contractor work during the construction phase of the TSF upgrade and Lylyveld expansion. Spillages associated with the laydown areas has the potential to cause surface water pollution.
- The TSF Upgrade Project will improve stormwater management due to the reinstatement and upgrading of the solution trench. Such water will be recycled for use in the process. Where such water cannot be accommodated the surplus water is to be directed to Sishen's existing stormwater management system. The implementation of the clean water diversion in the area is to be prioritised.

- The haul from Lylyveld to the Sishen process plant area passes in close proximity to 2 wetland pans. No widening is to take place within a buffer of 500 m of these pans.

1.2.6 Loss of Sensitive Biodiversity

- The Lylyveld area and adjacent natural areas have been disturbed by existing mining activities. The expansion activities will therefore not result in significant biodiversity impacts.
- Species of conservation concern (particular protected trees) occur both in the Lylyveld and the TSF Upgrade area. Licences/permits must be obtained for the removal of Species of Conservation Concern.

1.2.7 GHG Emissions

- The implementation of the Trolley Assist System will reduce the use of diesel on site and reduce dependency on fossil fuel. Therefore, greenhouse gas emissions will be reduced as a result of the project.

1.2.8 Surrounding Land Use

- The expansion activities at Lylyveld South will be conducted relatively close to the N14 national route. The original project layout has been amended in order to establish a buffer of 100 m from the N14. No blasting is to take place within 500 m without compliance with the requirements of the Mine Health & Safety Act and the necessary consultation with SANRAL and Transnet.
- The realignment of the existing haul road will pass underneath Eskom power lines. It should be taken into consideration that the existing haul roads already passes underneath the powerlines, in the same area. A wayleave must be obtained from Eskom for the realignment of the haul roads.
- The expansion of the WRD at Lylyveld North will be in (relatively) close proximity to Eskom powerline servitude. The original layout plan was amended and the expansion of the WRD will only allow a 30m zone for rehabilitation purposes and no further envcroachment on the power line servitude will take place.

1.2.9 Heritage Resources

- Insignificant heritage and paleontological resources are present on the areas in which the Lylyveld expansion activities will be undertaken.
- The TSF upgrade will be undertaken on the existing mining footprint and will not result in impacts of heritage resources.

1.2.10 Traffic Impacts

- Traffic impacts due to dust generation from the Haul Road and DR3333 crossing has the potential to cause visibility problems and a high risk of accidents. The deposition of small particles on the haul road also contributes to dust generation.
- The expansion of the pit area at Lylyveld South and associated blasting may result in a risk to vehicles travelling on the N14. No mining activities will take place within 100 m of the road.

1.2.11 Visual Impacts

- Although the Lylyveld activities are surrounded by other mining operations, the activities at Lylyveld South will still be visually intrusive and will result in a loss of scenic quality for users of the N14. Measures, such as maximisation of backfilling opportunities and ongoing rehabilitation are recommended to reduce the impact.

1.3 Conclusions and Recommendations

It is the opinion of the Environmental Assessment Practitioner that the activities associated with the extension of the Lylyveld operations be authorised for the following reasons:

- The socio-economic benefits of the operations will be extended for the life of Sishen Mine;
- The implementation of the mitigated layout means that expanded activities will largely take place in existing disturbed areas;
- Negative impacts identified can be mitigated.

The Upgrade of the TSF should also be authorised for the following reasons:

- The developments will take place within the existing disturbed areas at Sishen Mine;
- The project will allow for improved efficiency including reduced water consumption due to increased slimes densities, improvements in recovery of return water for use in the process and the extension of the life of the existing TSF;
- The upgrade will allow for improved management of seepage (if it occurs) and stormwater management by the reinstatement and upgrading of the solution trench at the toe of the tailings dams.

The implementation of the Trolley Assist Infrastructure is supported as:

- All infrastructure will be developed on waste rock dumps ore within pit areas and will thus not result in further disturbance;
- The infrastructure will result in a significant reduction in diesel consumption and associated tail-pipe emission from haul trucks.

2. CONTACT PERSON AND CORRESPONDENCE ADDRESS

2.1 Details of EAP who prepared the report

Name of The Practitioner: Kerry Fairley

Affiliation: Head Environmental Management Services and Director, EXM Advisory Services

Tel No.: 082 871 2959 or 010 0073617

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

2.2 Expertise of the EAP

Qualifications

- BSc Botany Honours (University of the Witwatersrand)
- Registered as Professional Natural Scientist with the South African Council for Natural and Scientific Professionals (SACNASP) Registration Number: 400054/03

Expertise and Experience

Kerry Fairley has over 20 years of experience in environmental management in the mining industry as one of the most experienced environmental assessment practitioners in South Africa. Kerry is the author of numerous environmental impact assessment reports for both green fields mining projects as well as for expansions and amendment to existing mining operations in South Africa and as well as other African countries (Namibia, Malawi).

Declaration of Independence

The undersigned declare that this report represents an independent and objective assessment of the risks associated with the proposed development.

Curriculum vitae and proof of registration of the EAP is provided in Appendix A.

Name	Affiliation	Designation	Signature	Date
Kerry Fairley	EXM Advisory Services (Pty) Ltd	Pr.Sci.Nat. Director		2019/12/12

3. DESCRIPTION OF THE PROPERTY

Refer to Figures 3-1 and 3-2.

Farm Name:	LYLYVELD EXTENSION Remaining extent of the Farm Lylyveld 545. TAILINGS STORAGE FACILITY (TSF) UPGRADE Remaining extent of the Farm Sekgame 461; Portion 4 of the Farm Sekgame 461; and Portion 1 of the Bruce 544; TROLLEY ASSIST ELECTRICAL LINES Portion 1 of the farm Fritz 540; Remaining Extent of the farm Woon 469; Portion 2 of the farm Sishen 543; Portion 3 of the farm Sacha 543; Portion 21 of the farm Sishen 543; Portion 1 of the farm Sishen 544; Remaining Extent of the Farm Gamagara 541; Portion 1 of the Farm Gamagara 541. Portion 4 of the Farm Gamagara 541; and Portion 16 of the farm Sishen 544.
Application area (Ha)	LYLYVELD EXTENSION The Lylyveld North and South Mining area as well as the haul roads from the Lylyveld area to the Sishen processing plant areas, will be affected by the application. The new undisturbed areas to be authorised as part of the proposed expansion includes approximately 11 ha at Lylyveld North mining area and 27 ha at the Lylyveld South mining area and 7 ha of haul roads (approximately 6.5 km in length) linking these areas to existing haul roads at Sishen Mine. TSF UPGRADE The existing Sishen TSF area will be affected by the application (300 ha) for the development of 4 new return water pipelines. Three new 350 mm pipelines will be put in place to carry tailings to the facility, replacing the existing pipeline infrastructure. Two new pipelines will carry return water from each of the 4 compartments (max diameter of 600 mm) to a new silt trap at the return water dam. TROLLEY ASSIST ELECTRICAL LINES New electrical lines will be developed as a ring feed to the Trolley Assist infrastructure to be developed along some of the haul road ramps at Sishen Mine, namely at the Western Waste Rock Dumps (WWRD), Vliegveld Waste Rock Dump and within the southern pushback pit area. No new areas will be disturbed by the development and approximately 6 800 m of electrical lines will be developed.

Magisterial district:	District Hay (Gamagara Local Municipality)
Distance and direction from nearest town	The Lylyveld Extension Project is located with the Sishen Mine Mining Right area, approximately 12 km south south west of the town of Kathu. The TSF Upgrade Project will take place at the TSF with new pipeline and associated infrastructure to the existing JIG and DMS processing plants. This infrastructure is located approximately 2.7 km south of Kathu. The Trolley Assist electrical lines are to be put in place along some haul truck ramps on the Western Waste Rock Dump, Vliegveld Waste Rock and the southern pushback pit area. The proposed infrastructure is to be developed on the western part of the mining area, approximately 5 km west south west of Deben and 8 km from Kathu.
21 digit Surveyor General Code for each farm portion	LYLYVELD EXTENSION CO41C04100000000054500000 TAILINGS STORAGE FACILITY (TSF) UPGRADE C04100000000046100000 C04100000000046100004 C04100000000054400001 TROLLEY ASSIST ELECTRICAL LINES C04100000000054000001 C04100000000046900000 C04100000000046800003 C04100000000054300001 C04100000000054300002 C04100000000054300016 C04100000000054300021 C04100000000054100000 C04100000000054100004 C04100000000054100001
Locality map	Attach a locality map at a scale not smaller than 1:250 000 (included as Figure 3-3).
Description of the overall activity. (Indicate Mining Right, Mining Permit, Prospecting right, Bulk Sampling, Production Right, Exploration Right, Reconnaissance permit, Technical co-operation permit, Additional listed activity)	LYLYVELD EXTENSION Sishen Mine is planning to expand and amend the existing authorised mining and associated activities taking place within the Lylyveld North and Lylyveld South mining areas. This includes the following activities: Lylyveld North (1) Expansion of the north eastern waste rock dump (WRD) to provide for reshaping during rehabilitation. (2) Expansion of the western WRD to provide for reshaping during rehabilitation. (3) Expansion of product stockpile area

	Lylyveld South (4) Expansion and revision of location of the authorised mining pits at Lylyveld South (5) Development of a new mining pit at Lylyveld South in a previously historically mined out area. (6) Development of new WRD dump at Lylyveld South including partial backfilling of the historical pit area. Haul Road (7) Widening and realignment of parts of the main haul road from Lylyveld from Lylyveld South to Lylyveld North and then from Lylyveld North to the Sishen processing plant area. TSF UPGRADE Sishen Mine is planning to improve the operation of the TSF. This involve the following: (1) Replace 4 x 200 mm diameter DMS & 3 x 150 mm diameter JIG delivery pipelines with 3 x 350 mm combined pipelines. (2) Development of a new booster pump station at the DMS plant. (3) Development of a ~ 200 m^3 tailings mixing tank at the DMS plant. (4) Development of 4 new 600 mm return water pipelines leading to a new silt trap at return water dam. (5) Reinstatement of the solution trench and improvement of water management at the perimeter of the tailings dams. (6) Upgrade of the perimeter service road at the TSF including widening and development of new sections. TROLLEY ELECTRICAL LINES Sishen is planning install a trolley assist system to supply electrical power to haul trucks when driving up certain ramps (name at the Western Waste Rock Dump, Vliegveld Waste Rock and the Southern pushback) at Sishen Mine. The trolley assist system will require the following infrastructure: (1) A 11 kV ring feed power lines and Trolley substations. (2) Trolley overhead transmission lines.

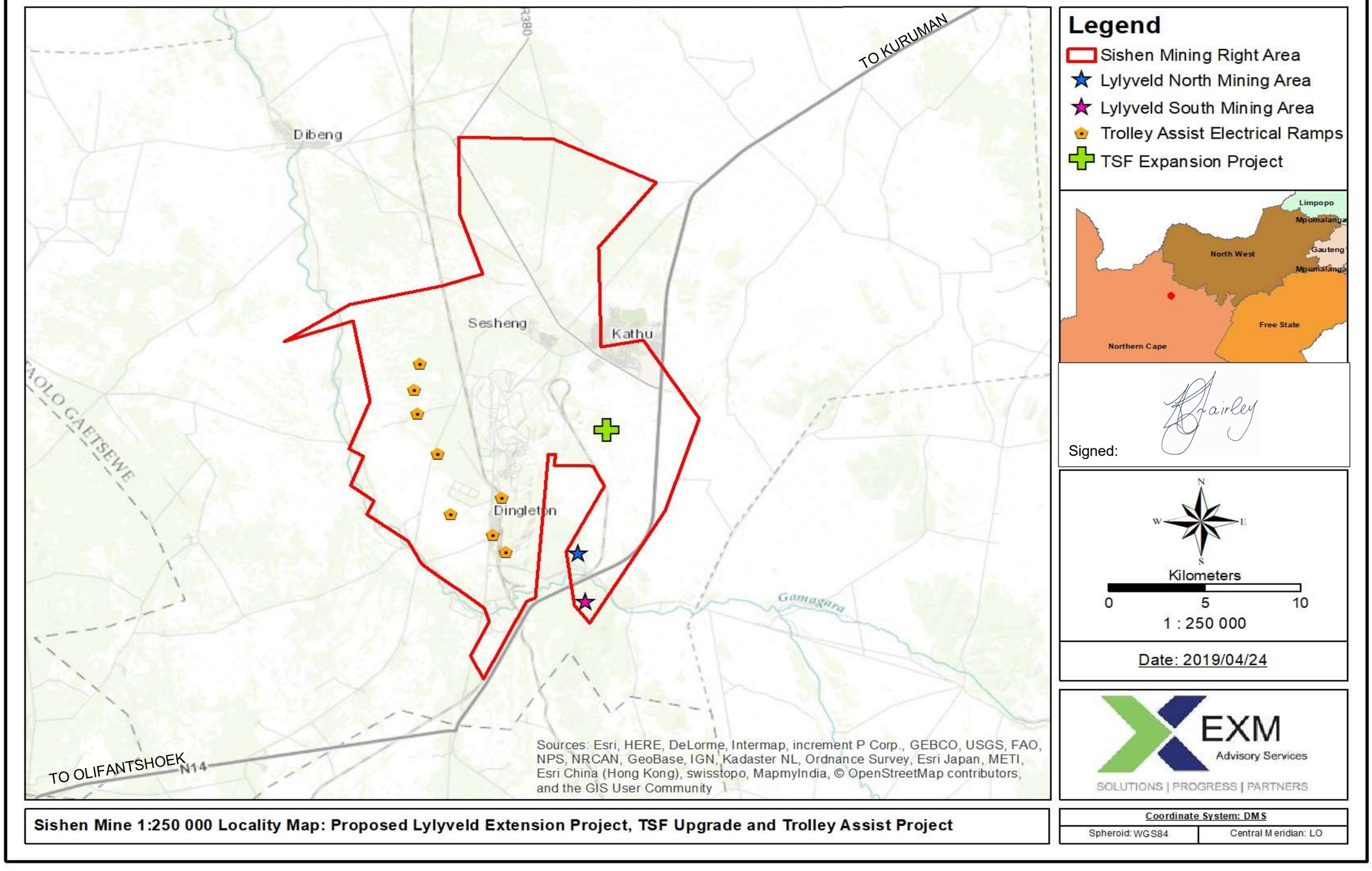


FIGURE 3-1: LOCALITY MAP SHOWING SISHEN MINE MINING RIGHT BOUNDARY AND THE LOCATION OF LYLYVELD SOUTH, TSF FACILITY AND PROPOSED TROLLEY ASSIST ELECTRICAL RAMPS

4. DESCRIPTION OF THE SCOPE OF THE PROPOSED OVERALL ACTIVITY

4.1 Listed and specified activities

NAME OF ACTIVITY **(E.g. For prospecting -** drill site, site camp, ablution facility, accommodation, equipment storage, sample storage, site office, access route **etc…etc…etc** **E.g. for mining**,- excavations, blasting, stockpiles, discard dumps or dams, Loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc…etc…etc.)	**Aerial extent of the Activity** **Ha or m²**	**LISTED ACTIVITY** (Mark with an **X** where applicable or affected).	**APPLICABLE LISTING NOTICE** ***(GNR 983, GNR 984 or GNR 985)***	**WASTE MANAGEMENT AUTHORISATION** (Indicate whether an authorisation is required in terms of the Waste Management Act). **(Mark with an X)**	**APPLICABLE LISTING NOTICE** ***(GNR 921 as amended by GN 633))***
LYLYVELD EXTENSION					
(1) Expansion of the Eastern WRD at Lylyveld North	Current ~11 ha Additional ~2.6 ha Revised ~13.6 ha	**X**	**GNR 984** 15 (site clearance)	**X**	**Category A:** **Activity 13** (expansion of a residue deposit)
(2) Expansion of western WRD at Lylyveld North	Current ~3.53 ha Additional ~1.47 ha Revised ~5 ha		**GNR 983** 34 (water use licence amend.) **GNR 984** 15 (site clearance)	**X**	**Category A:** **Activity 13** (expansion of a residue deposit)
(3) Expansion of the stockpile area at Lylyveld North	Current ~4.8 ha Additional ~1.8 ha Revised ~6.6 ha		**GNR 984** 15 (site clearance)		
(4) Expansion and revised location of mining pits at Lylyveld South	Current ~18 ha Revised ~29 ha	**X**	**GNR 984** 15 (site clearance	**-**	**-**
(5) Development of a new mining pit at Lylyveld South	New ~16 ha	**X**	**GNR 984** 15 (site clearance)	**-**	**-**
(6) Development of new WRD dump at Lylyveld South	New – 21 ha	**X**	**GNR 983** 34 (water use licence amend.) **GNR 984** 15 (site clearance)	**X**	**Category B** **Activity 7** (disposal of hazardous waste to land) **Activity 11** (establishment of residue deposit) **Activity 13** (expansion of a residue deposit)

NAME OF ACTIVITY (E.g. For prospecting - drill site, site camp, ablution facility, accommodation, equipment storage, sample storage, site office, access route etc…etc…etc E.g. for mining,- excavations, blasting, stockpiles, discard dumps or dams, Loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc…etc…etc.)	Aerial extent of the Activity Ha or m²	LISTED ACTIVITY (Mark with an X where applicable or affected).	APPLICABLE LISTING NOTICE (GNR 983, GNR 984 or GNR 985)	WASTE MANAGEMENT AUTHORISATION (Indicate whether an authorisation is required in terms of the Waste Management Act). (Mark with an X)	APPLICABLE LISTING NOTICE (GNR 921 as amended by GN 633))
(7) Widening and realignment of parts of the main haul road from Lylyveld from Lylyveld South to Lylyveld North and then from Lylyveld North to the Sishen processing plant area	Current ~26 ha Additional ~7 ha	X	GNR 983 24 (new section of road) 56 (widening of road)	-	-
TSF UPGRADE					
(1) New 3 x 350 m pipelines with throughput of each >120 l/s.	3 x ~1 500 m 350 mm pipelines to the TSF	X	GNR 983 10 (new pipeline) 46 (upgrading of pipeline system)		
(2) Development of a new booster pump station at the DMS plant.	~ 0.04 ha	-	-	-	-
(3) Development of a ~200 m^3 tailings mixing tank at the DMS plant.	~ 0.02 ha	-	-	-	-
(4) Development of 4 new 600 mm pipelines running to the return water dam.	4 x ~3 800m pipelines of 600mm to RWD	X	GNR 983 10 (new pipeline) 46 (upgrading of pipeline system)		
(5) Reinstatement of solution trench and upgrading of water management at the toe of the tailings dams.	Two trenches of 3 100m and 3 500m length and ~1.5m in width	-	-	-	-
(6) Upgrade of the perimeter service road at the TSF including widening (< 6 m) and development of new sections (< 8m wide).	~ 7 km of service roads ~ 1 ha of new area to be disturbed	-	-	-	-
TROLLEY ELECTICAL LINES					
(1) Development of 11 kV ring feed power lines and substations.	TBA	-	-	-	-
(2) Development of trolley overhead transmission lines along ramps.	~ 10 km	-	-	-	-

4.2 Description of activities to be undertaken

Sishen Mine is an existing mining operation, operating under an existing mining right (NC 259 MR) and approved EMPr (2002, as amended) for the mining and processing of iron ore, located near Kathu in the Gamagara Local Municipality of the Northern Cape Province. Sishen plans to conduct additional activities at the operations which include:

- The extension of mining and associated activities at the existing Lylyveld North and South operations,
- Upgrading of the existing Tailings Storage Facility (TSF); and
- The development of a Trolley Assist System i.e., electrical lines to power haul trucks, at some of the ramps, namely the Western WRD, the Vliegveld WRD and Southern Pushback within the pit.

4.2.1 Extension of Mining & Associated Activities at Lylyveld

Satellite mining activities which form part of the Sishen Mine operations are currently taking place at Lylyveld North and Lylyveld South on the farm Lylyveld 545. The activities involve a truck and shovel operation, with the material being hauled from Lylyveld South to Lylyveld North for stockpiling and then from there to the existing processing infrastructure at Sishen Mine. Currently the operations contribute approximately 1 million tonnes per annum (Mtpa) run of mine (ROM) to the Sishen Mine production. There are currently two contractors responsible for the load and haul operations, employing 132 people, operating in 2 shifts.

Sishen Mine is proposing on expanding the activities at both Lylyveld North and South to allow continued production from these operations. It is planned that the operations will continue in line with current production rates of 1 Mtpa until 2032 and thus beyond the originally anticipated life of Lylyveld which ends in 2022. In order to facilitate the increased life of the Lylyveld operations, provision is now being made for the expansion and development of new mining pit areas, waste rock dumps, product stockpile areas as well as haul roads.

4.2.1.1 Lylyveld North

The following expansions are proposed for Lylyveld North (see Figure 4-1):

- Expansion of the north eastern waste rock dump (WRD) footprint by 20 m to provide for reshaping during rehabilitation.
- Expansion of the western WRD by 30 m to provide for reshaping during rehabilitation.
- Expansion of the existing product stockpile by 1.8 ha.

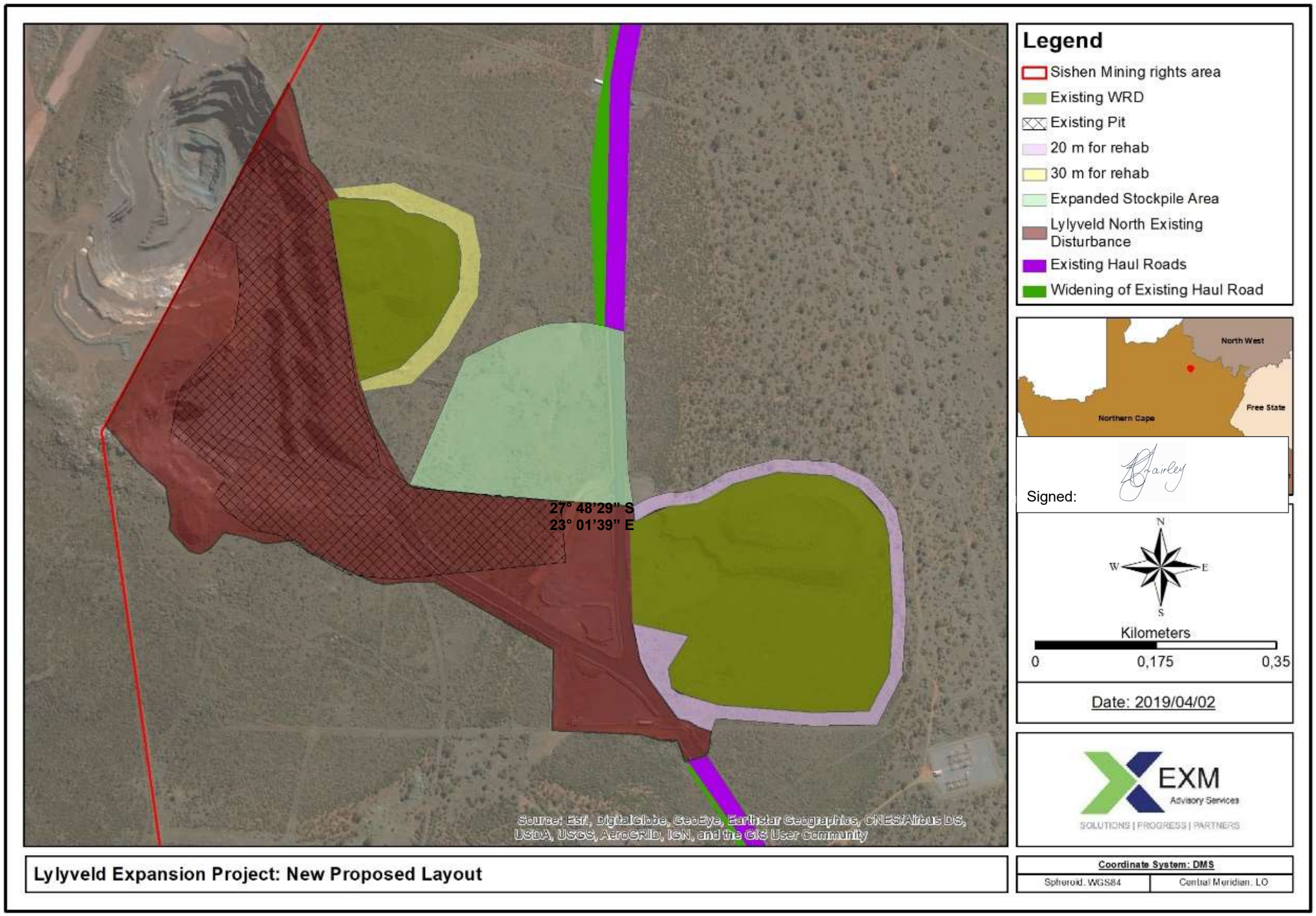


FIGURE 4-1: PROPOSED EXPANSIONS - LYLYVELD NORTH

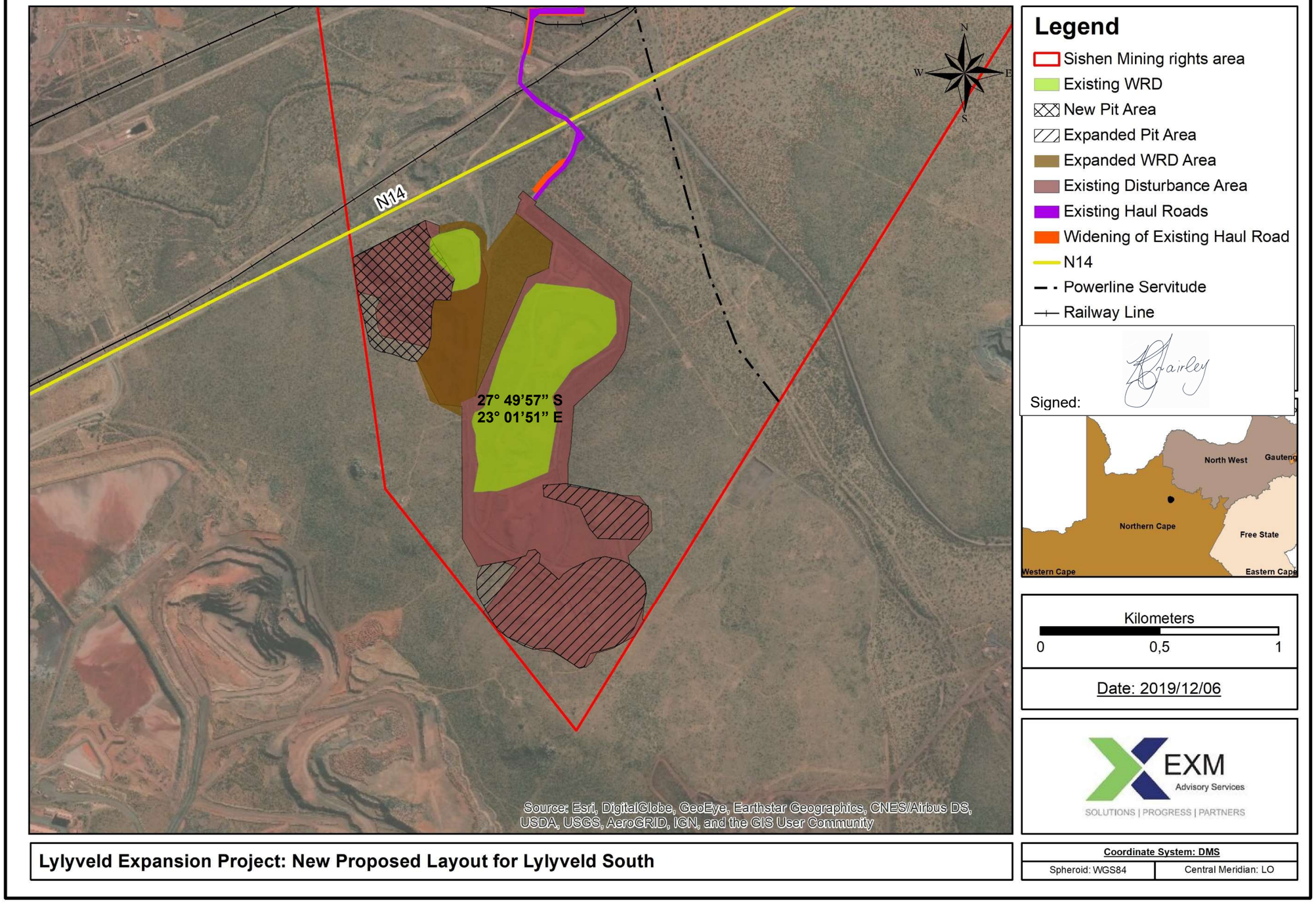


FIGURE 4-2: PROPOSED EXPANSIONS - LYLYVELD SOUTH

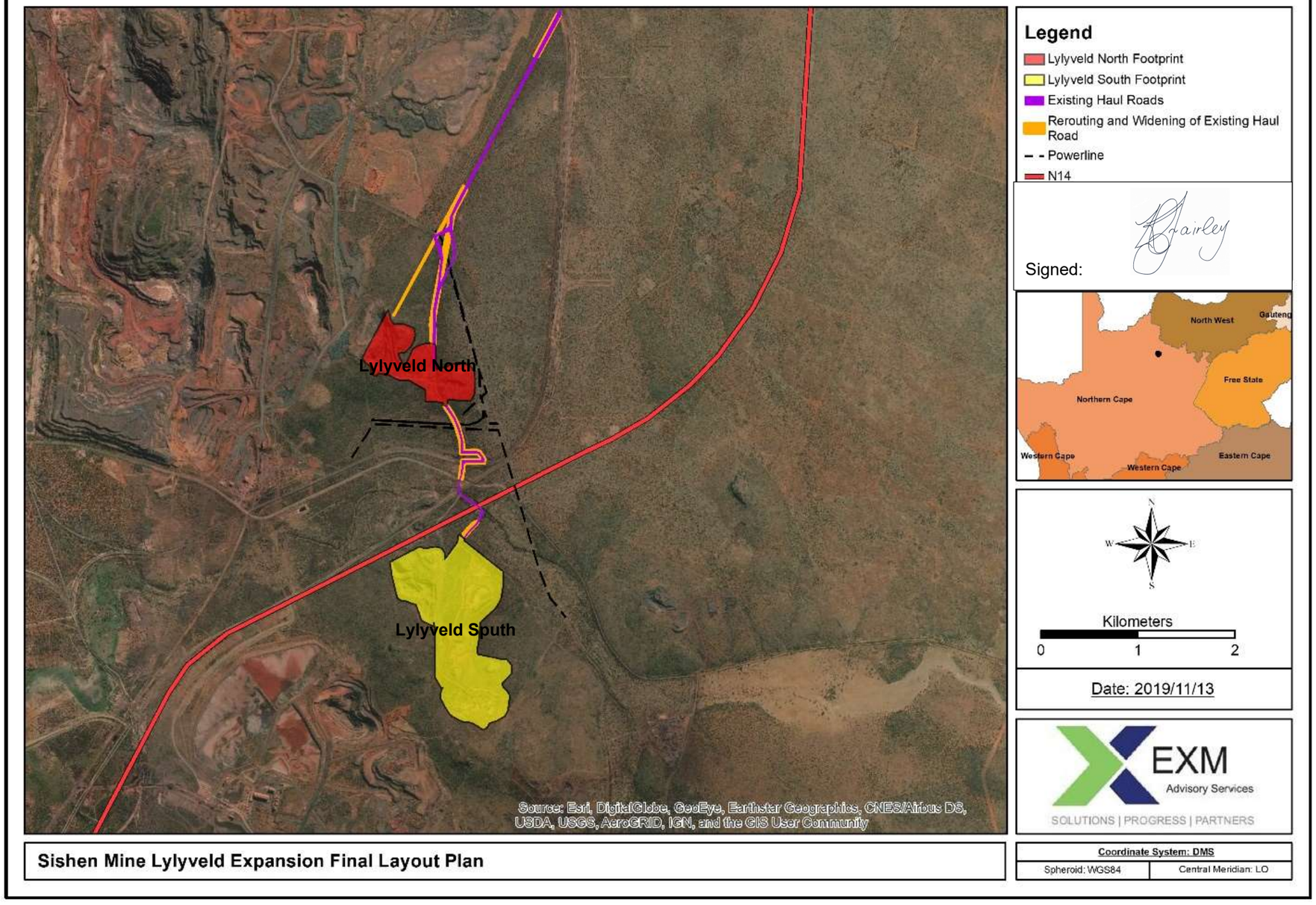


FIGURE 4-3: PROPOSED EXPANSIONS – WIDENING AND REALIGNMENT OF HAUL ROAD

4.2.1.2 Lylyveld South

The following expansions are proposed for Lylyveld South (see Figure 4-2):

- Expansion and revision of location of the authorised mining pits at Lylyveld South.
- Development of a new mining pit at Lylyveld South in a previously historically mined out area. The area has been previously disturbed, but vegetation has since established.
- Development of new WRD dump at Lylyveld South including partial backfilling of the historical pit area.

4.2.1.3 Widening and re-alignment of haul roads

The project will also include the widening of the main haul road (with the exception of the section that crosses the Gamagara River) from Lylyveld South to Lylyveld North to 35 m. The widening excludes the section across the Gamagara River, which will remain unchanged. The haul road from Lylyveld North to the main Sishen mining area will be increased in width to 45 m. It is also proposed that the route be realigned (as indicated in Figure 4-3). The increase in width and the realignment is required to facilitate the safe movement and passing of haul trucks on the road.

4.2.2 Upgrade of the Tailings Storage Facility

Sishen is in the process of optimising the use of the existing facility to improve operational efficiency and increase the life of the current facility (Figure 4-4). Since the project involves optimisation no additional permanent employment positions will be created. The project will involve a capital investment of approximately R 300 million. The project is however expected to create 125 to 150 construction jobs during a period of 24 to 30 months.

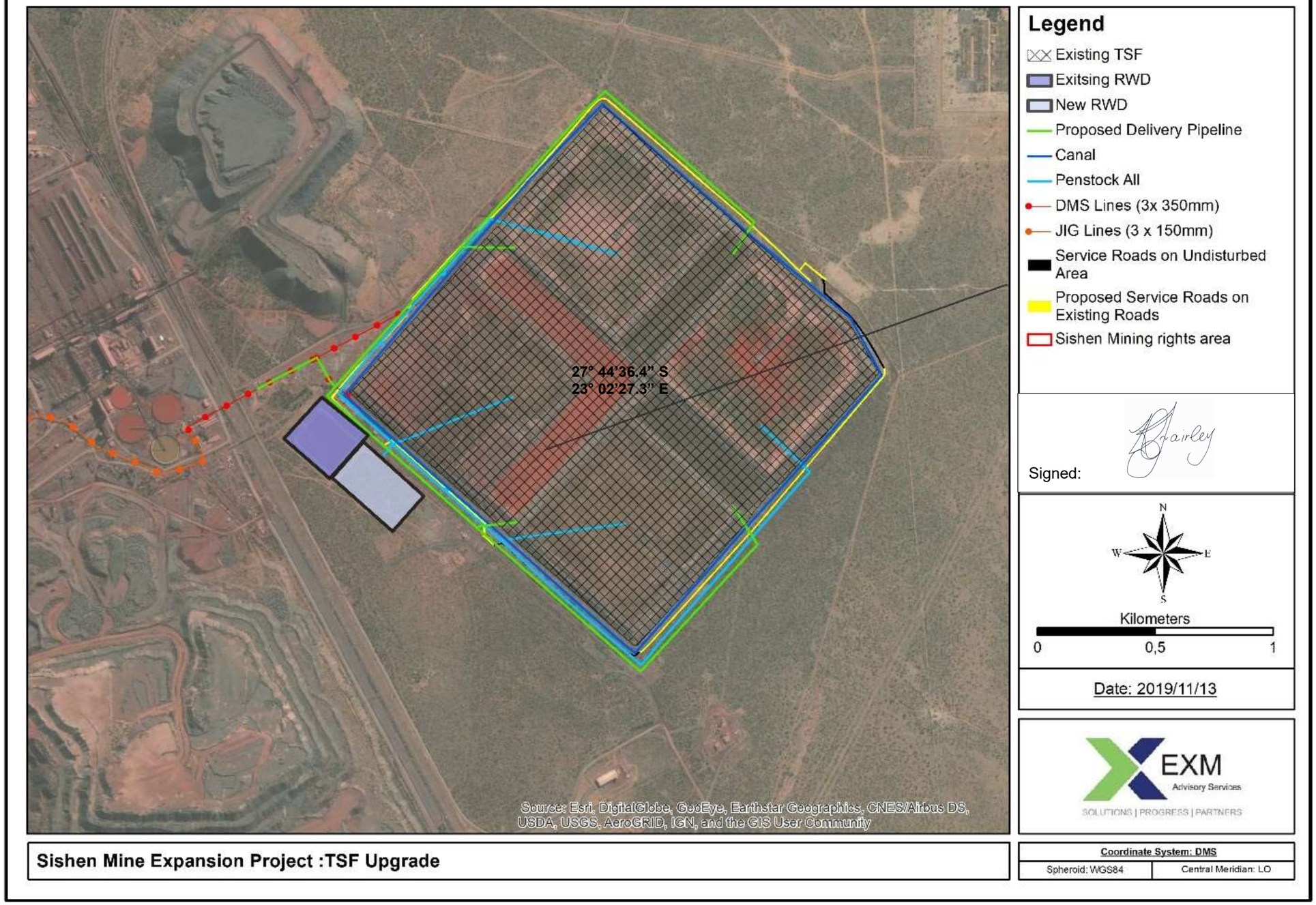


FIGURE 4-4: PROPOSED UPGRADES TO THE SISHEN TAILINGS STORAGE FACILITY

4.2.2.1 Rezoning of Compartments

The current TSF has a surface area of approximately 270 ha and is used for the storage of slimes emanating from the beneficiation process. The TSF is currently operated with slimes originating from the DMS plant deposited into four compartments and slimes from the Jig plant deposited into four legs between the four DMS compartments (see Figure 4-5 and Plate 4-1).

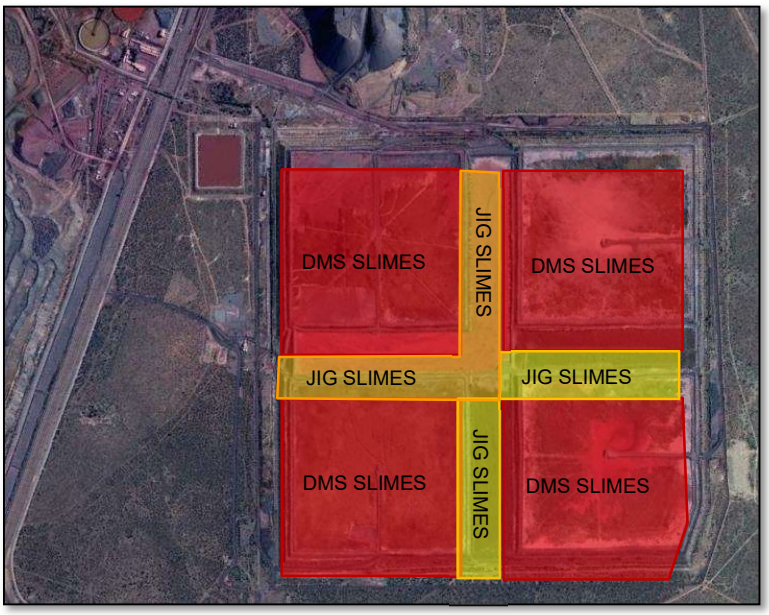


FIGURE 4-5: CURRENT OPERATIONAL LAYOUT OF THE TSF FACILITY

PLATE 4-1: AERIAL VIEW OF CURRENT TSF

In future the slimes from the DMS and Jig will be mixed (see Section 4.2.2.4) and disposed of in 4 compartments (see Figure 4-6). Two compartments will be in operation at any one time.

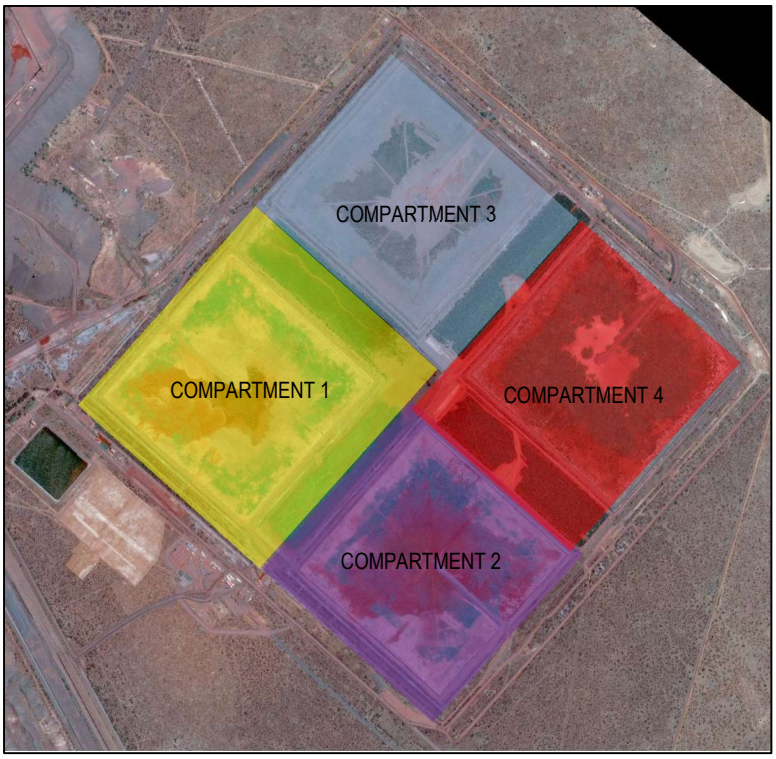


FIGURE 4-6: FUTURE OPERATIONAL LAYOUT OF THE TSF FACILITY

4.2.2.2 Return Water Pipelines

New elevated penstocks and a two new outlet pipes are being put in place at each of the 4 new TSF compartments.

Four new 600 mm pipelines are to be installed to carry return water via a new silt trap to the existing return water dam which supplies water to the process water dam.

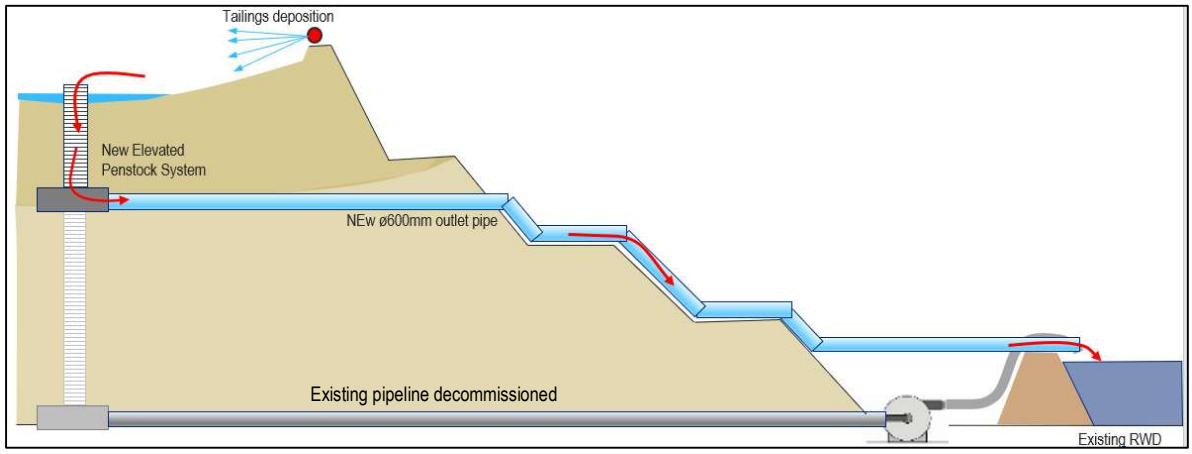


FIGURE 4-7: NEW RETURN WATER SYSTEM

4.2.2.3 Upgraded Perimeter Water Management

The current solution trenches which are in place to collect seepage at the toe of the tailings dams is non-functional (see Plates 4-2 and 4-3)

PLATE 4-2: EXISTING ASBESTOS-LINED SOLUTION TRENCH AT THE TOE OF THE TAILINGS SAMS

PLATE 4-3: EXISTING SOLUTION TRENCH OVERGROWN WITH VEGETATION AND FILLED WITH SEDIMENT

The solution trenches will be reinstated and upgraded for the management of seepage and stormwater. The existing asbestos lining (consisting of a 600 mm diameter half-pipe) shown in Plate 4-2 has already been removed. The remaining concreted-lined trenched will be upgraded by widening (to ~1.5 m) to manage seepage water (should it ever occur) as well as stormwater run-off from the sides of the tailings dams. The drainage outlet pipes at the base of the tailings dams will be extended in order to carry seepage water (should it occur) to the solution trench. Water will be carried to the existing sediment trap, where it is pumped to the return water dam for use in the process. Any water that cannot be managed in the system e.g. during major storm events, will overflow and be captured by the upgraded Sishen stormwater management system, entering the Eastern Stormwater Canal and the Eastern G80 Sump.

4.2.2.4 Slimes Mixing and Pump Station

A new mixing tank (200 m^3) and pump station will be put in place for the purpose of combining the slimes from the Jig plant and the DMS plant. Three new pipelines (350 mm in diameter) will be put in place to carry the combined slimes to the TSF. The existing pipelines from the DMS and the Jig plant will be decommissioned.

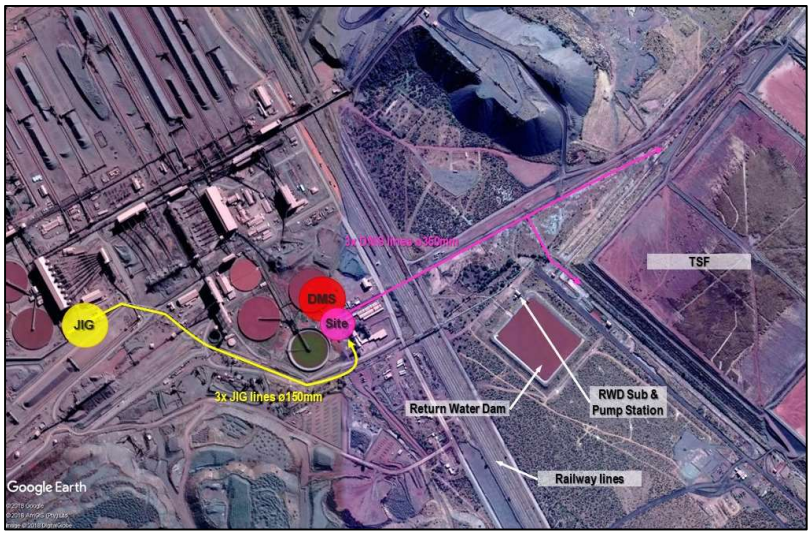


FIGURE 4-8: PROPOSED SLIMES MIXING TANK AND PIPELINES

4.2.2.5 Upgrade of perimeter service road

The perimeter service road at the TSF will be upgraded involving:

- Road widenings;
- New service roads, typically 4-7m wide; and
- Re-routing of the security fence road, typically 4m wide.

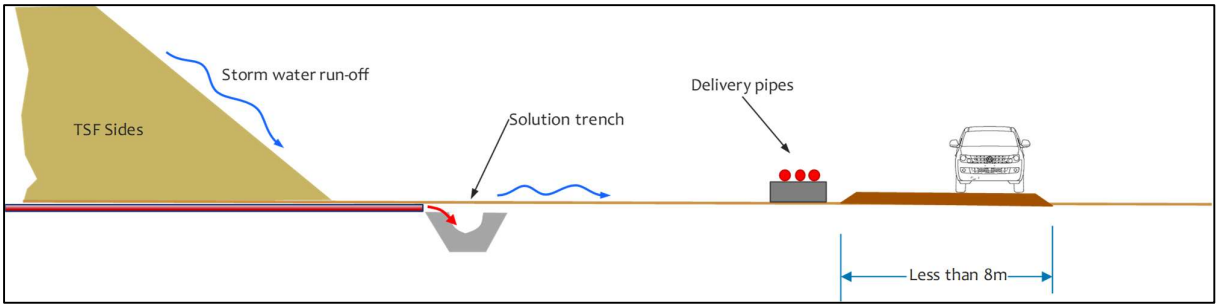


FIGURE 4-9: REVISED TSF PERIMITER LAYOUT

4.2.3 Trolley Assist Electrical Lines

New electrical lines will be developed as a ring feed to the Trolley Assist infrastructure to be developed along some of the haul road ramps at Sishen Mine. The infrastructure required is illustrated in Plate 4-4 and Figure 4-10. The Trolley Assist Infrastructure will be established on the Western WRD, the Vliegveld WRD and the Southern Pushback within the pit (see Figure 4-11). A concept level estimate of R250 million capex is estimated for the implementation of the infrastructure. The Trolley Assist infrastructure will be constructed in a phased manner as required by the mining operations.

The trolley assist system will require the following infrastructure.

- 11 kV ring feed power lines.
- Trolley substations and Trolley overhead transmission lines.

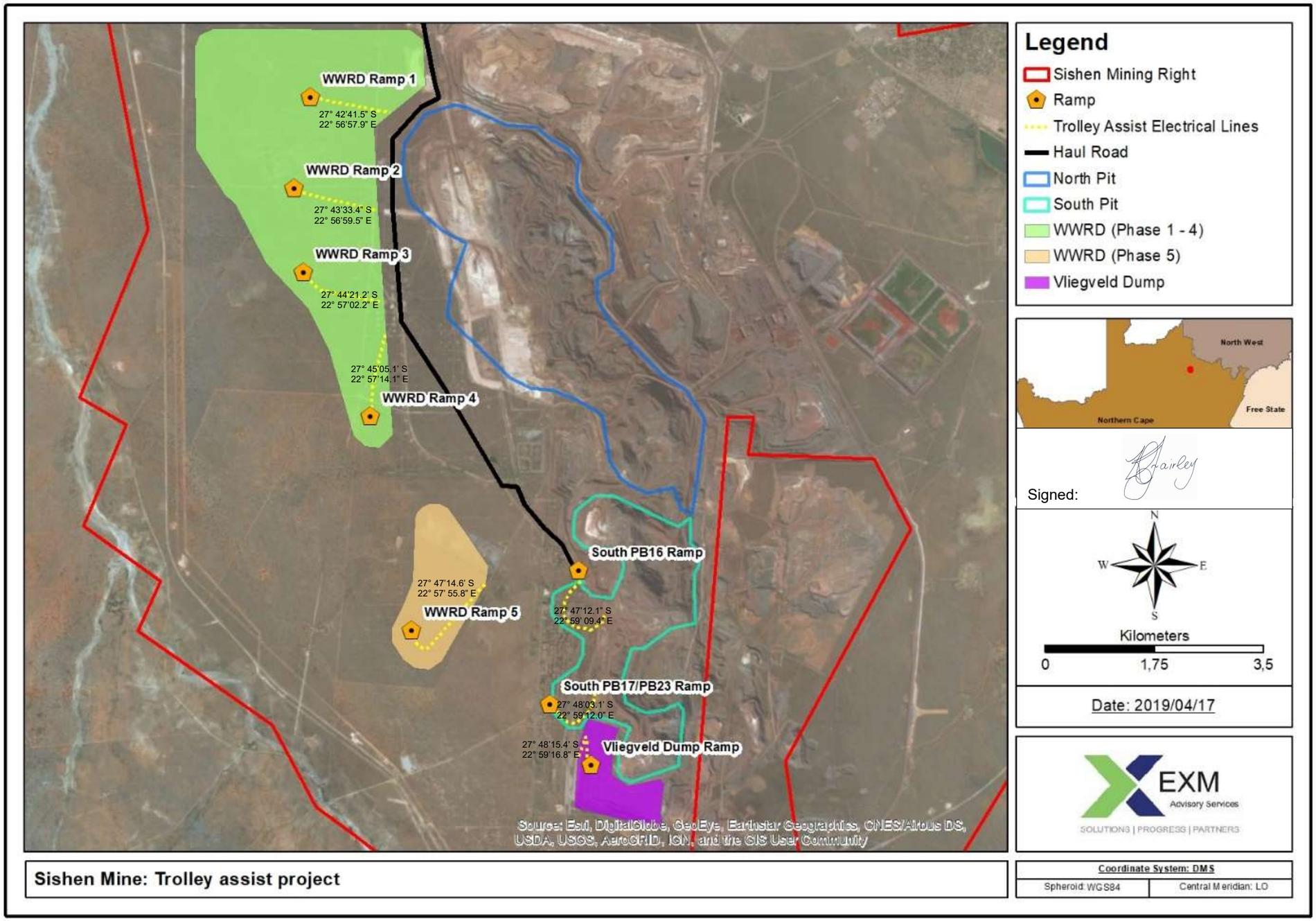


FIGURE 4-10: PROPOSED LOCATION OF TROLLEY ASSIST INFRASTRUCTURE

PLATE 4-4: TROLLEY ASSIST INFRASTRUCTURE

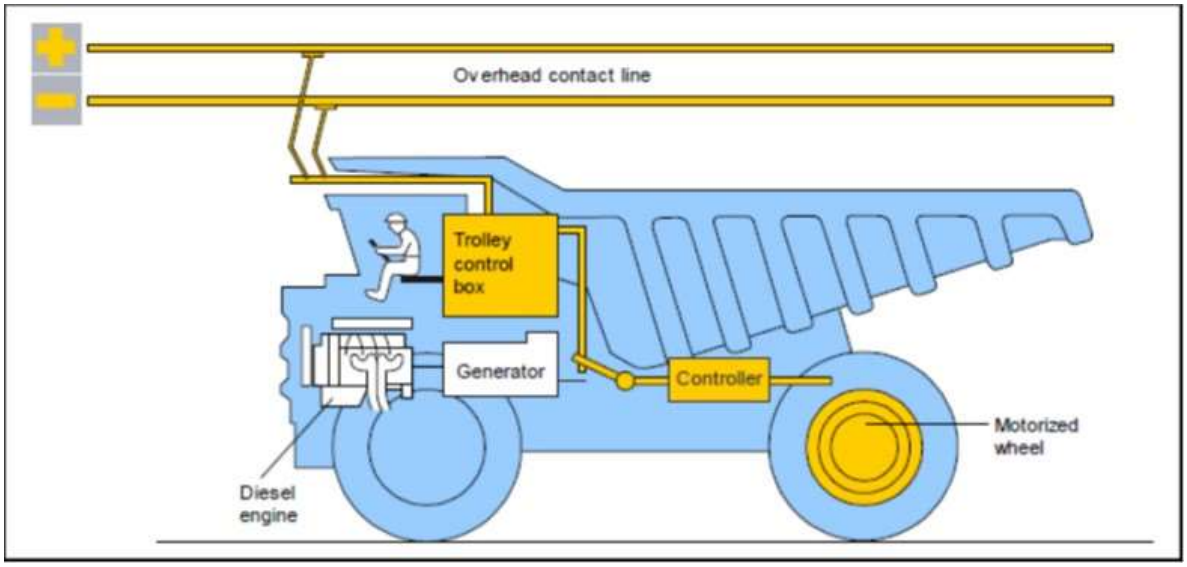


FIGURE 4-11: EXAMPLE OF TROLLEY ASSIST INFRASTRUCTURE

5. POLICY AND LEGISLATIVE CONTEXT

This document has been prepared strictly in accordance with the DMR Report template format and was informed by the guidelines posted on the official DMR website. This is in accordance with the requirements of the MPRDA. In addition, this report complies with the requirements of the National Environmental Management Act (NEMA) (Act 107 of 1998) and the EIA Regulations (2017). This section outlines the key legislative requirements applicable to the project.

5.1 Mineral and Petroleum Resources Development Act (No. 28 of 2002)

The Minerals & Petroleum Resources Development Act (MPRDA) regulates the requirements for a mining right in order to mine a mineral and undertake associated activities. Mining can either include removal of an underground mineral or mineral occurring in a residue deposit or residue stockpile. The MPRDA requires the holder of a mining right not to cause any significant pollution or environmental degradation. The Sishen mining right is valid until 2039. The holder of a mining right is required to comply with the requirements of the approved EMPr (2002), as amended.

The Sishen Mine EMPr and its amendments are approved under Section 39 of the MPRDA, and despite the section being repealed with all future environmental authorisations being regulated under NEMA, existing authorisations remain valid and activities can be considered to be environmentally authorised.

The proposed activities including the expansion of mining and association activities at Lylyveld, the upgrading of the existing TSF and the development of Trolley Assist Infrastructure are not included in the existing approved Sishen Mine EMPr or any amendment thereto. The EMPr thus requires amendment to include:

- A description of the additional activities to take place including upgrade of the TSF, establishment of a Trolley Assist Infrastructure, new and expanded pits, new and expanded WRDs, new and expanded stockpile areas, new haul roads and changes to the existing haul roads at Lylyveld;
- A description of the baseline environment to be affected by the expanded footprint areas;
- A description of additional impacts because of the expanded activities;
- Identification of additional mitigation measures required.

Sections 53 and 54 of the Regulations require the holder of a mining right to make financial provision for rehabilitation and to action closure objectives of the Mine. These sections are however a consequence of Section 41 of the MPRDA (also now repealed) that requires the

holder to make financial provision for closure and rehabilitation of the Mine. Financial provision for mine rehabilitation and closure is now regulated under NEMA and subsequent regulations However, since the MPRDA Regulations are not repealed, Section 53 and 54 can still be considered to applicable.

An application has been submitted in terms of Section 102 of the MPRDA for the amendment of the Sishen Mine EMPr to include the additional activities.

5.2 National Environmental Management Act (No. 107 of 1998)

Section 24 of National Environmental Management Act (NEMA) provides for the Minister of Environmental Affairs to include activities in a list that require environmental authorisation before commencement. This has resulted in the promulgation of Listing Notices 1 (GN. 983), 2 (GN. 984) and 3 (GN. 985) (as amended in 2017) with the Environmental Impact Assessment (EIA) Regulations (GN. 982) of December of 2014 as amended by GN. 324-327 of 7 April 2017, guiding the requirements to undertake an EIA and apply for an environmental authorisation should a listed activity be triggered. As of 4 December 2014, activities at mining operations are also to be authorised under NEMA, with the DMR acting as the Competent Authority.

Activities under Listing Notice 2 (GN. 984) are triggered and thus the application for environmental authorisation requires completion of a scoping and environmental impact assessment (EIA) process in support of environmental authorisation of listed activities.

This includes:

TABLE 5-1: NEMA LISTED ACTIVITIES

Activity No	Description of listed activity	Project Description
LYLYVELD EXPANSION		
Listing Notice 1		
24	The development of a road— (i) [a road] for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or (ii) [a road] with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres.	Development of new haul roads (re-alignment) from Lylyveld

Activity No	Description of listed activity	Project Description
34	The expansion [or changes to] of existing facilities or infrastructure for any process or activity where such expansion [or changes] will result in the need for a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the release of emissions, effluent or pollution.	The amendment of the existing water use licence to accommodate new & expanded waste rock dumps at Lylyveld.
56	The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre— (i) where the existing reserve is wider than 13,5 meters; or (ii) where no reserve exists, where the existing road is wider than 8 metres;	The widening of the existing haul roads from Lylyveld
Listing Notice 2		
15	The clearance of an area of 20 hectares or more of indigenous vegetation, excluding 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.	Clearance of more than 20 ha of indigenous vegetation required for extension of activities at Lylyveld.
TSF UPGRADE		
Listing Notice 1		
10	The development and related operation of infrastructure exceeding 1000 metres in length for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes – (i) With an internal diameter of 0.36 metres or more; or (ii) With a peal throughput of 120 litres per second or more;	New delivery pipelines from mixing tank and return water pipelines at TSF.
24	The development of a road— (i) [a road] for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or	Development of the new service road.

Activity No	Description of listed activity	Project Description
	(ii) [a road] with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;	
46	The expansion and related operation of infrastructure for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes where the existing infrastructure— (i) has an internal diameter of 0,36 metres or more; or (ii) has a peak throughput of 120 litres per second or more; and (a) where the facility or infrastructure is expanded by more than 1 000 metres in length; or (b) where the throughput capacity of the facility or infrastructure will be increased by 10% or more;	The upgrading of the existing delivery and return water pipelines at the TSF.
56	The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre - (i) where the existing reserve is wider than 13,5 meters; or (ii) where no reserve exists, where the existing road is wider than 8 metres.	The widening of the service roads.
TROLLEY ASSIST		
No listed activities triggered.		

Authorisation is being sought for activities applicable to the Lylyveld Expansion Project as well as the TSF upgrade in terms of the EIA Listing Notices 1 & 2 of GNR. 983-945, as amended. There are no listed activities associated with the Trolley Assist Project.

5.3 National Environmental Management: Waste Act (No. 59 of 2008)

In terms of the National Environmental Management: Waste Act (NEM: WA), waste management activities that are listed in regulations published under NEM:WA may not be undertaken without a Waste Management License (WML). The listed activities for which a WML is required are contained in Government Notice (GN) 921. Category A activities require a WML and a Basic Impact Assessment (BA) process must be conducted, and Category B activities require a WML and a full Scoping and EIA process must be conducted. In terms of Schedule 3 of NEM: WA, mining waste (residue stockpiles and deposits) are defined wastes falling under Category A – Hazardous Wastes of NEM: WA which includes waste rock. The

Table below contains the waste management activities that are triggered:

TABLE 5-2: NEM: WA LISTED ACTIVITIES

Activity No	Description of listed activity	Project Description
LYLYVELD EXPANSION		
Category A		
13	The expansion of a waste management activity listed in Category A or B…which does not trigger an additional waste management activity…	The expansion of a residue deposit resulting from mining activities at Lylyveld North.
Category B		
7	The disposal of any quantity of hazardous waste to land.	The disposal of any quantity of hazardous waste to land i.e. mineral residue (waste rock) at Lylyveld South
11	The establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a mining right….in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).	The establishment of a residue deposit resulting from mining activities at Lylyveld South.
TSF UPGRADE		
No activities triggered		
TROLLEY ASSIST		
No activities triggered.		

The new and expanded waste rock dumps at the Lylyveld operations will require authorisation in terms of NEM: WA. Note that the application is combined with the NEMA application and supported by the same process.

Application is made for a Waste Management Licence to authorise the Waste Management Activities Regulation GN. 921 as amended by GN. 633 of 24 July 2015 under NEM: WA for the disposal of waste rock at Lylyveld North and South.

5.4 National Environmental Management: Air Quality Act (No. 39 of 2004)

National Environmental Management: Air Quality Act (NEM: AQA) controls and regulates atmospheric emissions and provides for Listed Activities (GN. 893, November 2010) which have or may have a significant effect on the environment, including health, social conditions, economic conditions, ecological conditions or cultural heritage. Any activity captured under this list require the person undertaking the activity to apply for an Atmospheric Emission Licence (AEL).

Only the on-site storage of diesel may be considered a listed activity applicable to mining activities at Sishen. Subcategory 2.4, "the storage and handling of petroleum products" are however only applicable to permanent immobile liquid storage facilities at a single site with a combined storage capacity of more than 1 000 m^3. The project will not trigger any activities listed in the Regulations and there is therefore no need for an AEL.

The National Ambient Air Quality Standards (NAAQS, GN 1210 of 24 December 2009) provide limits for PM_{10} and $PM_{2.5}$.

TABLE 5-3: SOUTH AFRICAN NAAQS FOR CRITERIA POLLUTANTS $PM_{2.5}$ AND PM_{10}

POLLUTANT	AVERAGING PERIOD	LIMIT VALUE	FEQUENCY OF EXCEEDANCE	COMPLIANCE DATE
$PM_{2.5}$	24 hour	40	4	1 Jan 2016-31 Dec 2029
	24hour	25	4	1 Jan 2030
	1 year	20	0	1 Jan 2016 – 31 Dec 2029
	1 year	15	0	1 Jan 2030
PM_{10}	24 hour	75	4	1 Jan 2015
	1 year	40	0	1 Jan 2015

Dust fallout in residential and industrial areas is regulated by the National Dust Control Regulations (NDCR, GN. 827 of 1 November 2013).

TABLE 5-4: NDCR ACCEPTABLE DUSTFALL RATES

RESTRICTION AREA	DUSTFALL RATE (D) mg/m^2 over a 30-day average	POLLUTANT FRQUENCY OF EXCEEDANCE
Residential areas	D<600	Two within a year, not sequential months
Non-residential areas	600<D<1 200	Two within a year, not sequential months

Activities at Sishen is required to comply with the NAAQS and NDCR.

5.5 National Forests Act (No. 94 of 1998)

Sections 12 and 15 of the National Forests Act, 1998 (Act No. 94 of 1998) requires any person who damages, cuts, destroys, prunes or relocates a nationally protected tree (as listed in Regulation GNR. 690, September 2017) to apply for a licence from the Department of Agriculture, Forestry and Fisheries (DAFF) to do so.

No protected trees were located in the development footprint areas of Lylyveld North and Lylyveld South. However, 3 tree species, namely *Vachellia erioloba* (Camethorn), *Vachellia haematoxylon* (False Camethorn) and *Boscia albitrunca* (Shepherds Tree) do occur in the surrounding habitat and it is possible that the species could occur in the development footprint. A survey is to be undertaken prior to clearance of any natural area to confirm the location of such species and the necessary licence needs to be obtained from DAFF.

Although significantly disturbed and degraded, 2 specimens of *V. erioloba* have been identified in the disturbance footprint at the TSF. A licence will need to be obtained from DAFF prior to removal of these trees.

5.6 Northern Cape Nature Conservation Act (No. 9 of 2009)

Section 49 and 50 of the Northern Cape Nature Conservation Act 9 of 2009 requires any person that intends to undertake a restricted activity in respect of protected plants and animals as set out in Schedule I and Schedule II of the Act to apply for a permit from the Northern Cape Department of Environment and Nature Conservation (DENC). Restricted activities include the removal, replanting or selling of these plants.

No protected plant species were located in the development footprint areas of Lylyveld North and Lylyveld South. However, 3 species, namely Hoodia gordonii (Schedule 1), B, albitrunca and Orbea lutea subsp. lutea do occur in the surrounding habitat and it is possible that the species could occur in the development footprint. A survey is to be undertaken prior to clearance of any natural area to confirm the location of such species and the necessary permit obtained from DENC.

5.7 National Water Act (No. 36 of 1998)

Sishen Mine has an Integrated Water Use Licence (amended in 2016). An application for amendment of water us licence (Sishen Water Use Licence Consolidation) has been submitted to the Department of Water and Sanitation which is pending and includes new and amended water uses for the extension of Lylyveld. Application has been made in terms of Section 21(g) of the National Water Act for new and expanded WRDs at Lylyveld. No additional water is required under Section 21(a) and no additional dewatering under Section 21(j) is required to accommodate the expansions to the pits.

In accordance with GNR. 509 (July 2016), the general authorisation regulations water uses defined in Section 21(c)&(i) of the National Water Act, regulated area of a watercourse in terms of Section 21(c) and (i) of the National Water Act is defined as:

(a) The outer edge of the 1 in 100 year flood line and/or delineated riparian habitate, whichever is the greatest distance…;

(b) In the absence of a determined 1 in 100 year flood line ore riparian area, within 100 m from the edge of a watercourse…;

(c) A 500 m radius of the delineated boundary (extent) of any wetland or pan.

Developments in these areas require authorisation in terms of Section 21(c) and (i) of the National Water Act. All the proposed expansion at Lylyveld lie outside of the regulated zone, with the exception of the widening of the section of the haul road which lies within close proximity to wetland pans (see Section XX). The alternative of not widening the road in this area has thus been added as an alternative to ensure that there is no further risk of disturbance of the wetlands by the road infrastructure.

No new water uses or amendments to the current water uses are applicable to the TSF Upgrade or the Trolley Assist Project.

Regulations for the use of water for mining and related activities aimed at protected water resources (GNR. 704, June 1999) were promulgated in terms of Section 26 of the NWA. These provide for:

- Restrictions on the locality with respect to residue deposits, dam or reservoirs as well as mining activities within the proximity of a watercourse.
- Restriction on the use of material that can pollute a water resource for the purposes of construction.
- Capacity requirements of clean and dirty water systems.
- Protection of water resources from pollution sources at the mine in particular the separation of clean and dirty water and the prevention of spillages from dirty water containment facilities.

No additional exemptions from GNR. 704 have been identified for the Lylyveld Extension, TSF Upgrade or the Trolley Assist Project.

5.8 National Heritage Resources Act (No. 25 of 1999)

The National Heritage Resources Act controls and regulates the interaction with heritage, archaeological, and paleontological artefacts and structures. Sections 34, 35 and 36 require that no person may demolish or alter any structure which is older than 60 years without a

permit issued by the relevant provincial heritage resources agency. The NHRA further requires any person that disturbs any archaeological site, paleontological site or grave cannot do so without a permit.

A Heritage Impact Assessment (including an archaeological and palaeontological assessment) has been undertaken in order to identify any heritage sites within the expanded Lylyveld footprint areas in accordance with Section 38 of the Act. A screening assessment has also been undertaken for the areas to be disturbed by the TSF Upgrade and the Trolley Assist projects. Application for exemption from Section 38 of the NHRA has been applied for. All information has been submitted to the South African Heritage Resources Council (SAHRA). No sites of heritage significance will be disturbed by the developments and a Chance-Find Procedure will be implemented.

6. NEED AND DESIRABILITY OF THE PROPOSED ACTIVITIES

6.1 Lylyveld Expansion

The proposed extension project is required to extend the life of the current operations at Lylyveld. The original planning was for activities to end in 2022. The planned expansions will mean that operations can continue in line with current production rates of approximately 1 Mtpa until the end of the Sishen LOM (currently at 2032). The extension will also facilitate the activities by widening of hauls road and expansion of the stockpile area.

6.2 TSF Upgrade Project

The proposed upgrades also provide for water saving measures by improving on the current operational densities of approximately 1.3 t/m^3, to a new operating range between 1.5 and 1.7 t/m^3 to a maximum of 1.9 t/m^3.

The current TSF and associated infrastructure is old and needs to be upgraded in order to improve the effectiveness and efficiency of the operation of the tailings management at the site. The amendments will extend the life of the facility and ensure safe tailings management for the life-of-mine. An improved stormwater management system will also be installed as part of the upgrade project.

The project allows for the improvement of water management at the facility. The drain pipes at the base of the tailings dams will be extended to ensure that should any seepage from the tailings occur in the future this will enter the solution trench. The solution trench will be reinstated and upgraded (widened) to carry both seepage (if it occurs) as well as stormwater to the existing sediment trap, thus allowing water to be returned to the return water dam and back to the process.

The proposed project allows for minimal disruption in current system operations by providing new equipment and installations that can be constructed independently of existing equipment and installations. In addition, the infrastructure can be positioned where feasible, out of the way of existing systems and operations.

The revised system is primarily automated thereby reducing current problems, inefficiencies and risk associated with manual operation and inherently improving plant availability and protecting existing and new assets. The system also provides for easy operation, improved maintainability, practicality for constructability, and a safe working environment.

6.3 Trolley Assist Infrastructure

With trolley assist lines electric drives in haul trucks can draw power from DC overhead trolley lines and bypass or supplement the diesel engine as the truck's source of power. The power

available for the traction motors is greatly increased. Haul trucks can thus move up ramps faster and reduce cycle times. The operation of haul trucks at Sishen mine is a significant contributor to mining costs. Trolley assist infrastructure will result in improved fuel efficiency and productivity. The procurement of additional haul trucks may not be required due to the improved performance of existing HME.

The aim of introducing the Trolley Assist infrastructure is thus to:

- Reduce haul truck fuel costs.
- Increase production capacity / reduced number of trucks due to higher speed attained on ramps.
- Reduce maintenance costs on the trucks, particularly on the diesel engine, which would normally suffer the greatest wear while operating at full load while on the ramp.
- Provide higher availability and lower life cycle costs for the diesel engine (less operating hours).

The implementation of Trolley Assist infrastructure will also result in environmental improvements (less noise, less diesel consumption, lowered exhaust emissions).

7. MOTIVATION FOR THE PREFERRED DEVELOPMENT FOOTPRINT WITHIN THE APPROVED SITE INCLUDING A FULL DESCRIPTION OF THE PROCESS FOLLOWED TO REACH THE PROPOSED DEVELOPMENT FOOTPRINT WITHIN THE APPROVED SITE

(The determination of the site layout taking into consideration the comparison of the original site plan with a plan which takes (1) environmental features; (2) current land uses, (3) issues raised by IAPs and (4) consideration of alternatives, to the initial layout into account.)

7.1 Lylyveld Extension

7.1.1 Lylyveld North

It was originally proposed that the eastern waste rock dump at Lylyveld north be expanded. However, based on feedback provided by Eskom, the originally proposed footprint will impact on the existing power line servitude. Based on the outcomes of the issues raised by Eskom, the layout has been revised to ensure that the power line is not impacted on by the waste rock dump expansion. The site layout has further been amended according to comments received from DMR. The requirements for the expansion of WRDs has been reassessed and the current approved footprints are deemed to have sufficient capacity.

The footprint was amended to allow for the reshaping of the dumps during rehabilitation, not for disposal purposes. The pit area will not be expanded as originally proposed. The amended layout will also minimise the disturbance of natural habitat and associated biodiversity impacts. Potential impacts on heritage resources will also be minimised due to the amended footprint of the expansion activities

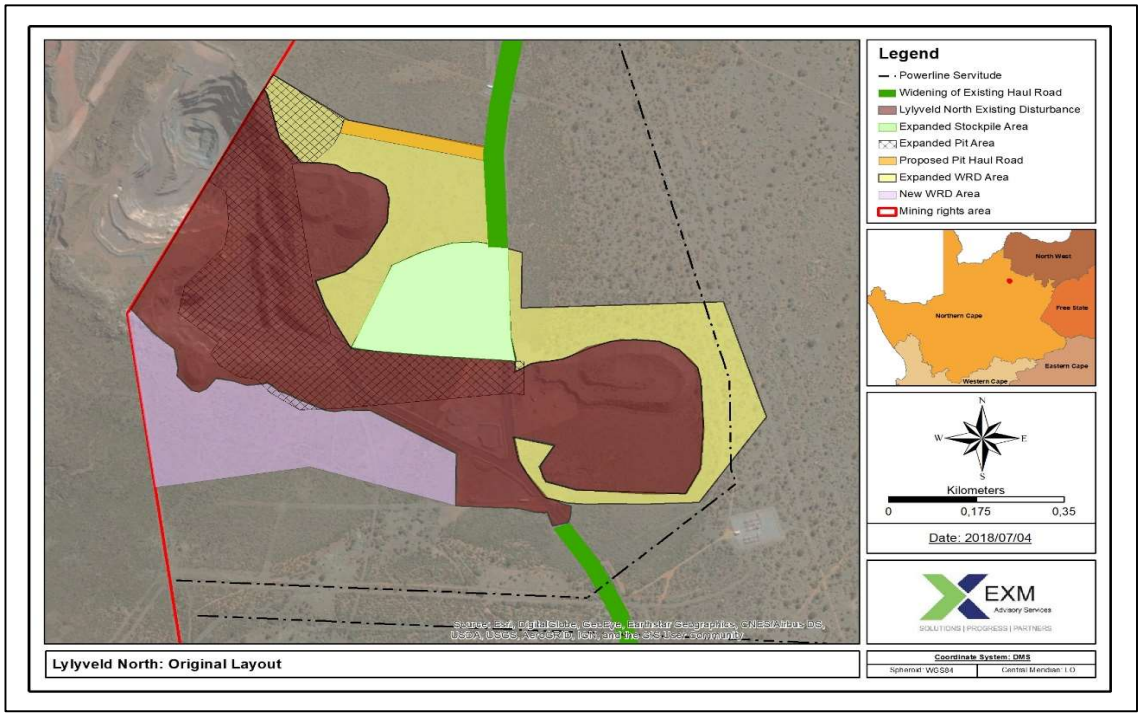


FIGURE 7-1: ORIGINAL LAYOUT OF LYLYVELD NORTH

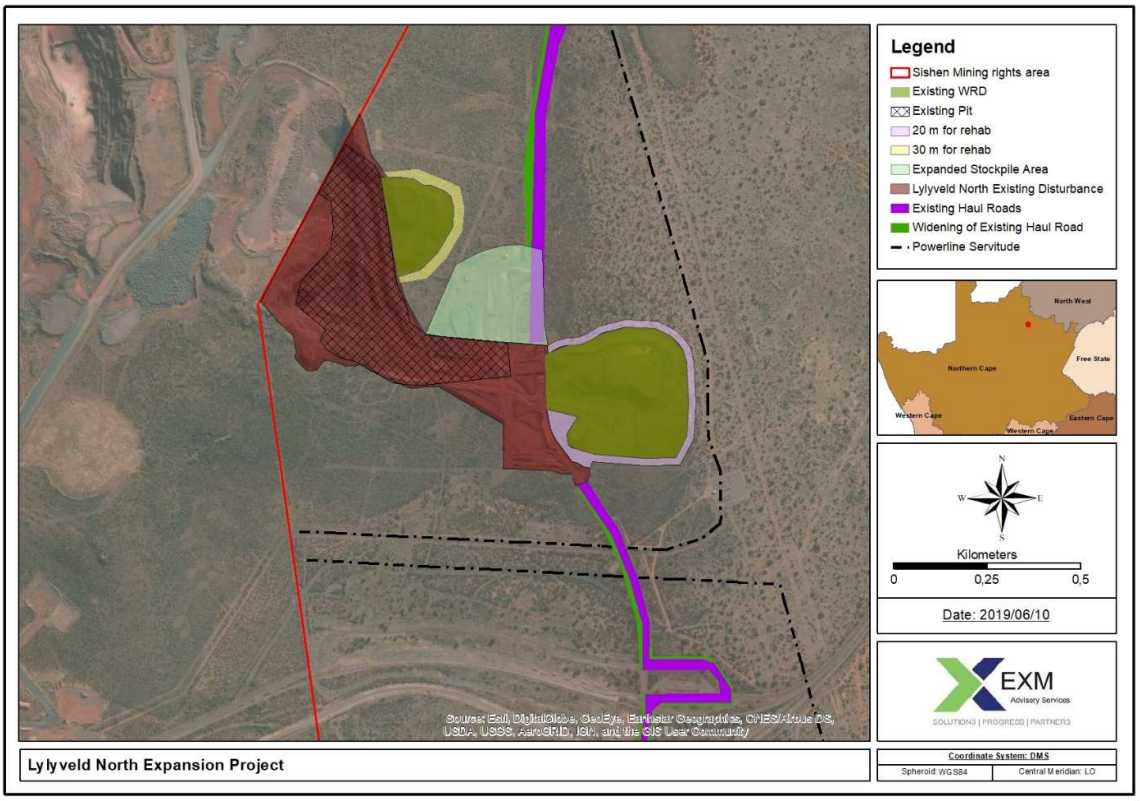


FIGURE 7-2: REVISED LAYOUT OF LYLYVELD NORTH

7.1.2 Lylyveld South

It was originally proposed to construct a new WRD area and to expand the existing WRD area at the Lylyveld South Operations. The DMR emphasised that the option of reducing the need for surface dumping and to rather consider pit infilling/backfilling of waste rock. The site layout has therefore been amended according to comments received from DMR. The revised layout provides for significantly smaller WRDs and the option of partial backfilling of the old historical pit or "new pit area" has now been included (see Figure 7-3 & 7-4).

Sishen has also committed to backfill within the southern pit areas, where possible. The new stockpile area has also been deemed not to be necessary. The footprint area of the new pit area in the old historical mined out area has also been amended to ensure that no mining will take place within 100 m of the N14 road according to relevant guidelines. The amended layout will also minimise the disturbance of natural habitat and associated biodiversity impacts. Potential impacts on heritage resources will also be minimised due to the amended footprint of the expansion activities.

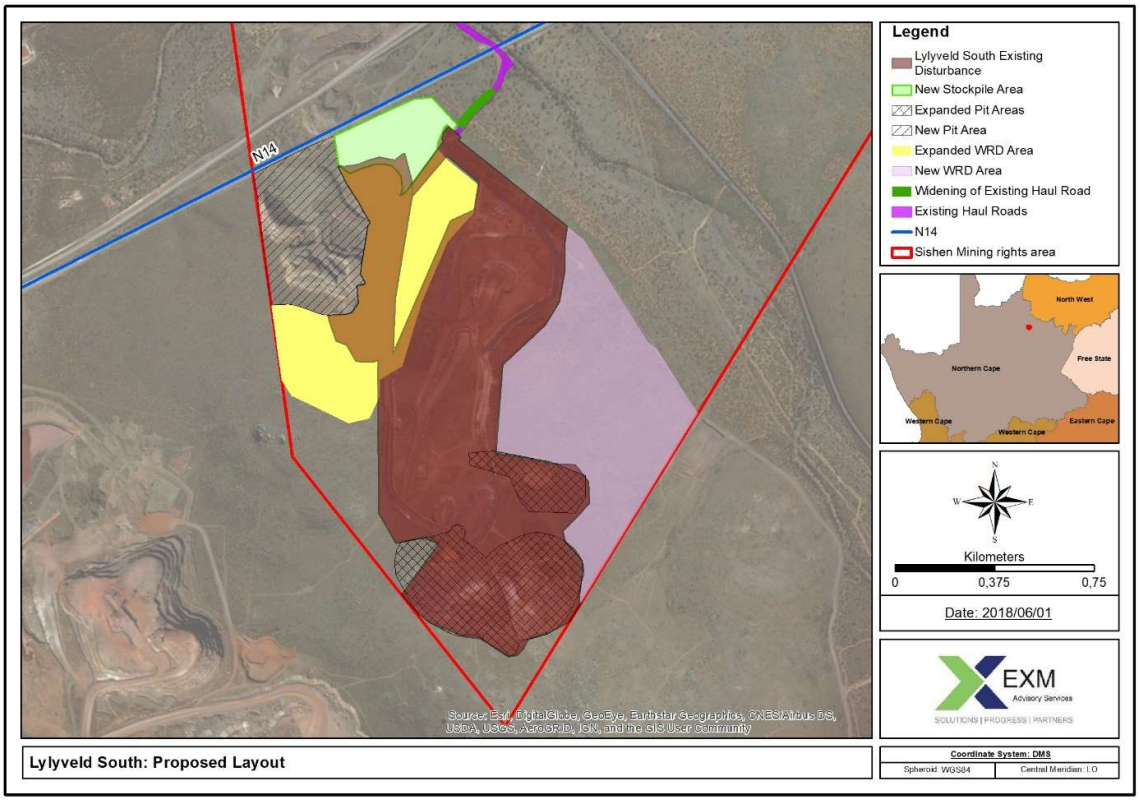


FIGURE 7-3: ORIGINAL LAYOUT OF LYLYVELD SOUTH

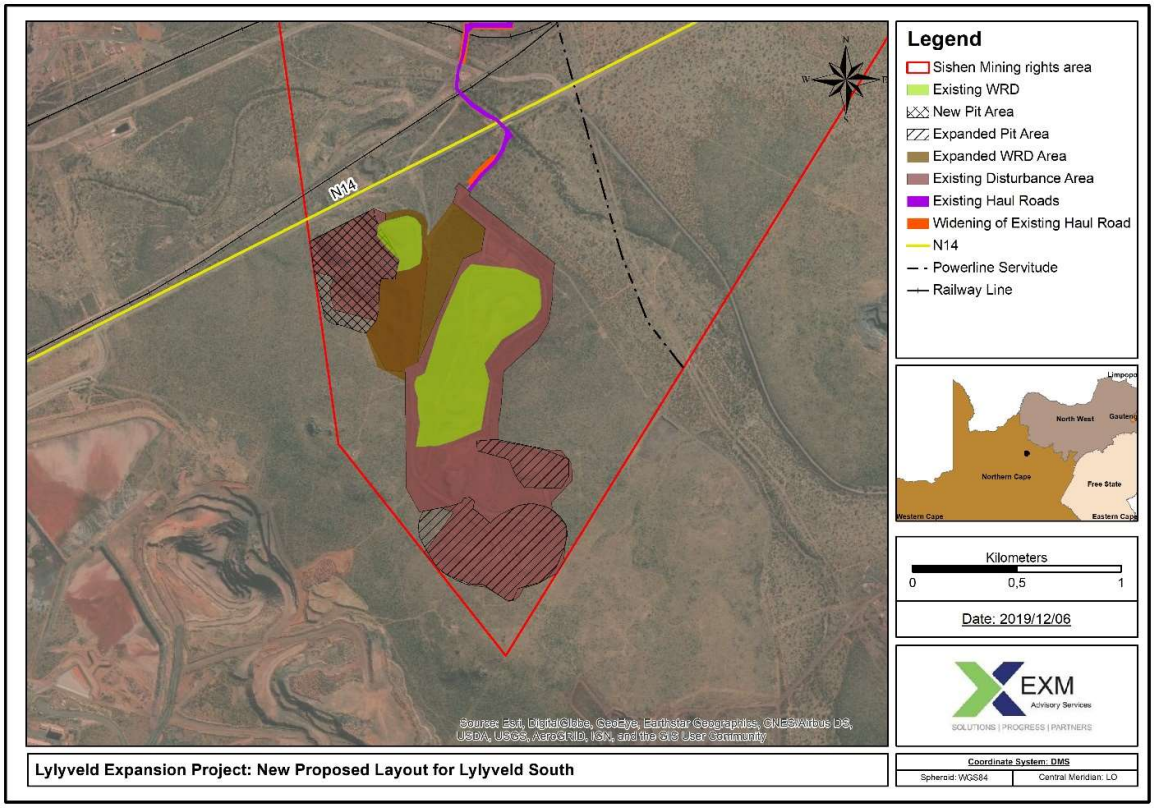


FIGURE 7-4: REVISED LAYOUT OF LYLYVELD SOUTH

7.1.3 Lylyveld South HME Workshop

It was proposed (see Scoping Report, July 2019) that a workshop for the maintenance of Heavy Mobile Equipment (HME) be included in the proposed developments at Lylyveld South. The conceptual idea of the workshop is shown in Plate 7-1.

PLATE 7-1: TYPICAL HME WORKSHOP AREA PLANNED FOR LYLYVELD SOUTH (NOT TO BE IMPLEMENTED)

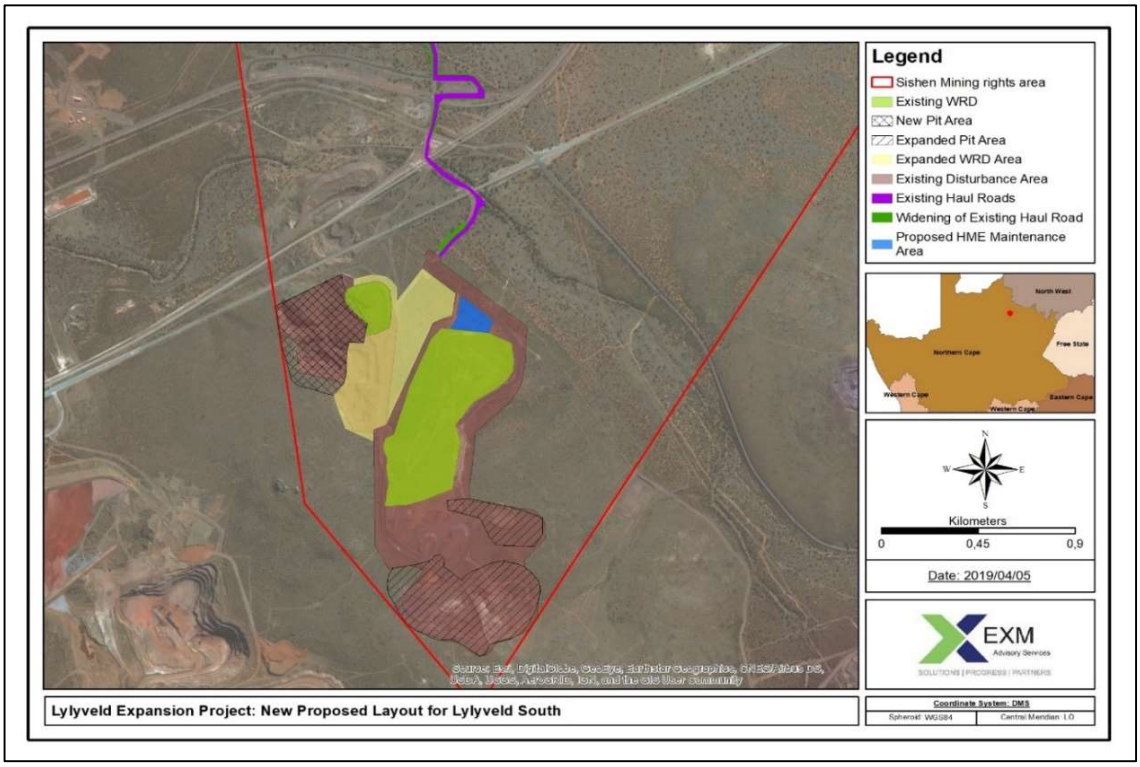


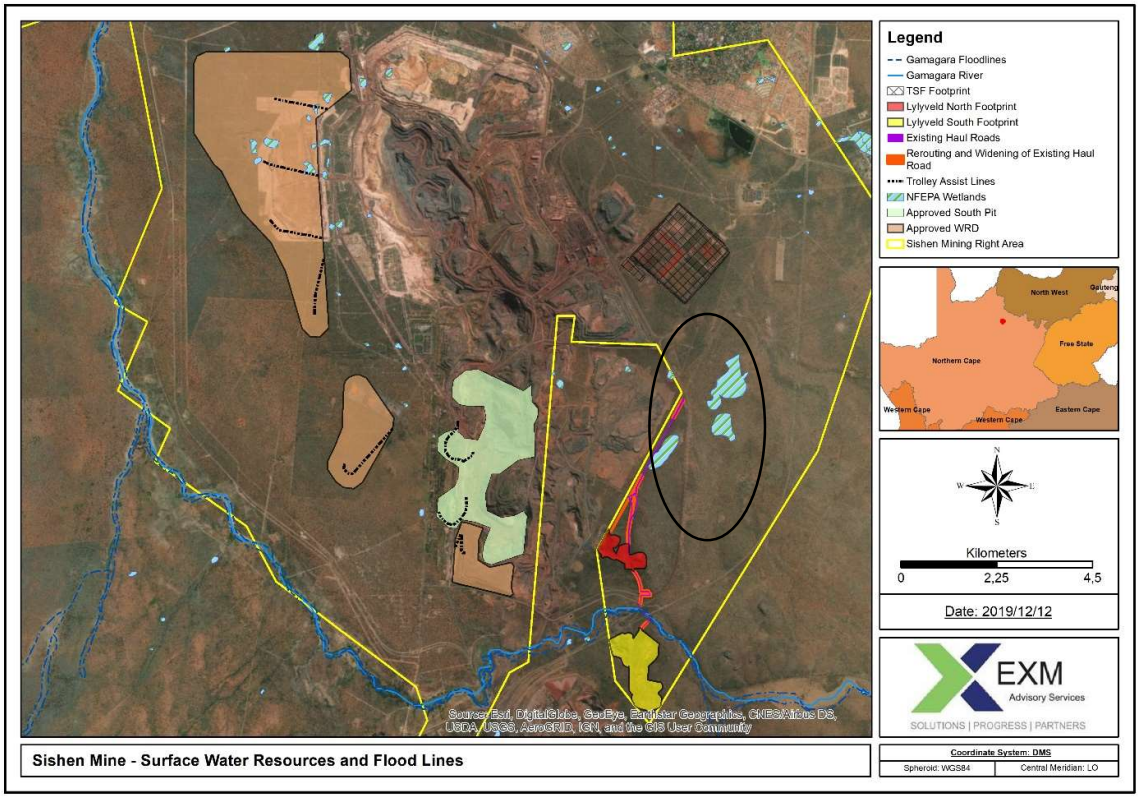
FIGURE 7-5: LOCATION OF PROPOSED HME WORKSHOP (NO LONGER INCLUDED) AT LYLYVELD SOUTH

The purpose of the workshop would be to facilitate maintenance work at Lylyveld, given the long distance to the workshop areas at Sishen Mine, itself.

However, since planning for the implementation of such a workshop area has not advanced and measures to ensure the protection of the environment cannot be confirmed. The PCD to be implemented at Lylyveld South is unlined and is not considered suitable to ensure protection of the surface water from potential contamination from an HME workshop. Additional mitigation measures are considered necessary should an HME workshop be developed. Since no such mitigation measures have been planned, SIOC has decided not to include an HME workshop area at Lylyveld South.

7.1.4 Lylyveld Haul Road

It is proposed that the existing haul road from Lylyveld to the Sishen process plant area be widened to 45 m to facilitate the safe movement of haul trucks on the road. It was however noted during the EIA process that according the National Freshwater Ecosystem Priority Areas database, the haul road passes to the west of a wetland pan (see Figure 7-6)

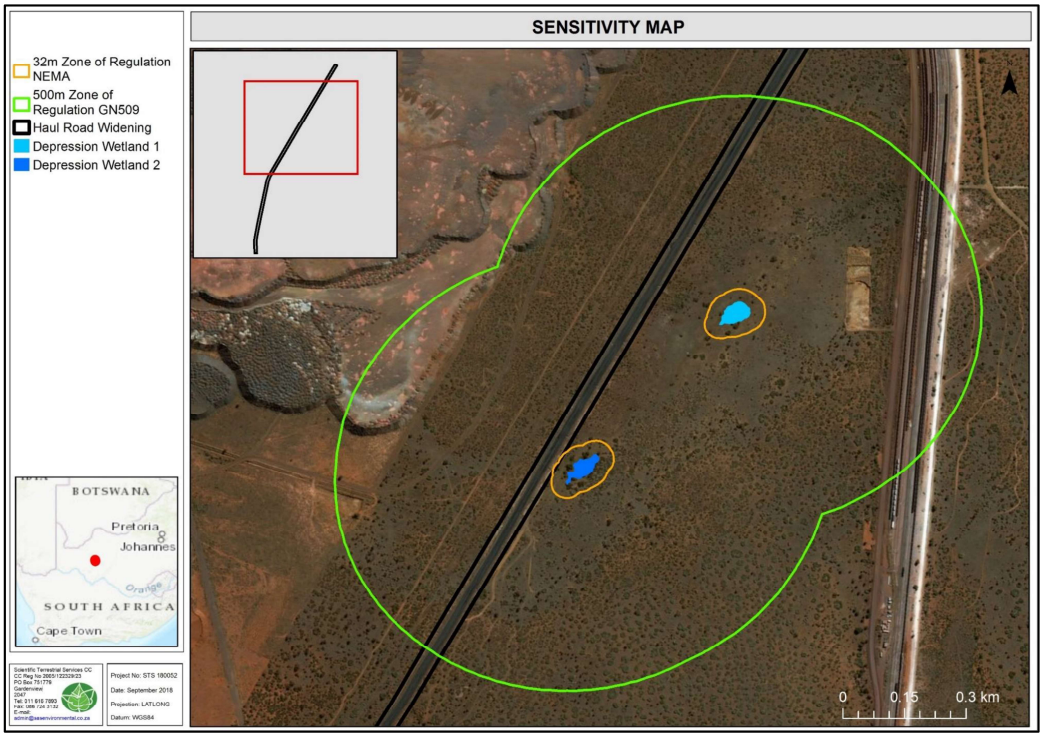


Source: National Freshwater Ecosystem Priority Areas (NFEPA)

FIGURE 7-6: LOCATION OF WETLAND PAN (ACCORDING TO NFEPA) IN PROXIMITY TO HAUL ROAD

A Watercourse Verification study was thus undertaken by Scientific Terrestrial Services (STS, September 2018) to confirm the occurrence and status of the identified wetland:

- From the field verification it was confirmed that the extent of the wetland feature is not as large as depicted on the NFEPA (2011) database. Rather, two depression wetlands were present within the investigation area (and within the extent of the wetland area identified by NFEPA). Refer to Figure 7-6.
- These two depression wetlands, wetland 1 and 2, are approximately 30 m and 140 m respectively, east of the northern portion of the haul road from Lylyveld where expansion is proposed. These wetlands, relative to the proposed activities, are indicated in Figure 7-7.



Source: Water Course Verification Report (STS, 2019)

FIGURE 7-7: LOCATION OF DEPRESSION WETLANDS IN PROXIMITY TO HAUL ROAD FROM LYLYVELD

- Based on observations of the present conditions of these two depression wetlands at the time of the field verification, these wetlands have been significantly modified due to existing mining infrastructure and activities. The natural drainage and hydrology of these systems have been altered by the existing haul roads. It is also important to note that these two depression wetlands have no connectivity to any other natural freshwater resource in the greater area and are endorheic in nature;
- These depression wetlands comprised predominantly of grass species and were dominated by the species *Eragrostis bicolor* and *Chloris virgata*. These species could be considered indicators of wetland areas within the Northern Cape;
- Although no formal assessment of the ecological condition of these wetland features was undertaken, the two depression wetlands in its present ecological state are considered to have been seriously modified and is therefore likely to be of low Ecological Importance and Sensitivity (EIS) and the Present Ecological State (PES) is considered to be largely to seriously modified (Category D or E).

Based on the information above and to prevent further encroachment on the wetlands, the haul road will not be widened within the 500 m buffer zone around the wetland pans (see Figure 7-8.

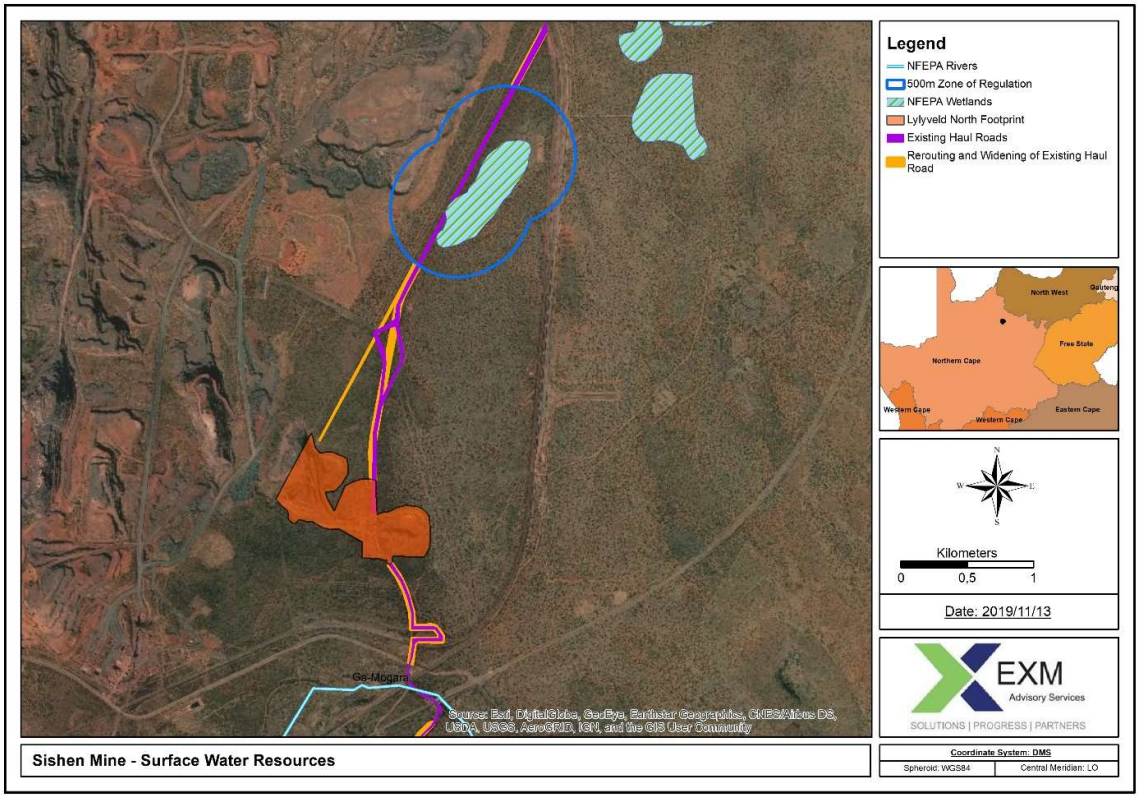


FIGURE 7-8: UPDATED LAYOUT INCLUDING RESTRICTION ON HAUL ROAD WIDENING IN THE VICINITY OF WETLAND PANS

7.2 TSF Upgrade

The stormwater management upgrades proposed for the TSF have been amended to reduce costs and motivate the feasibility of the project. As described in the scoping report (EXM, June 2019), the original stormwater management alternatives included:

- Stormwater run-off from sides of tailings dams to paddocks;
- Silt to settle in paddocks (cleaning required over time);
- A berm with gabion spillway to allow overflow & seepage from the paddock;
- A manhole to monitor seepage water from the base of the tailings dams and to monitor quality.
- The existing solution trench would be redundant.

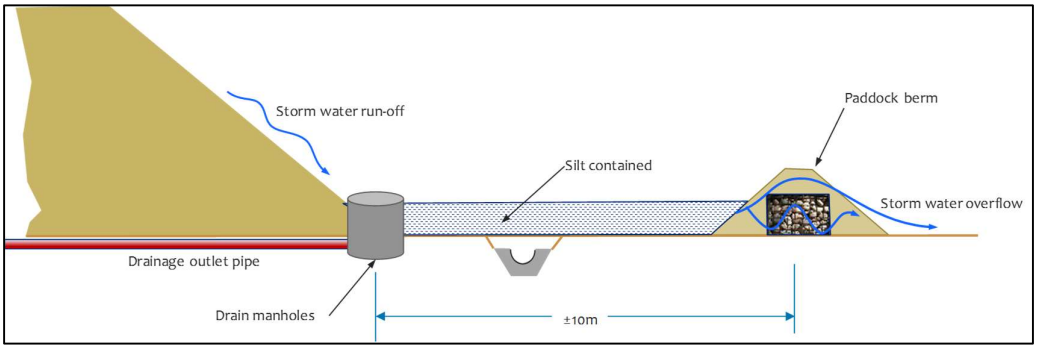


FIGURE 7-9: ORIGINAL PADDOCK SYSTEM PLANNED FOR STORMWATER MANAGEMENT AT TSF

As an alternative to the provision of paddocks at the toe of the TSF for the purposes of containing stormwater run-off at the site, it is proposed that the existing solution trenches be reinstated and upgraded to channel water run-off from the sides of the tailings dams via the existing sediment trap to the return water dam. The manholes will not be developed but the existing drain outlet pipes will be extended to allow seepage (should occur) to enter into the solution trench.

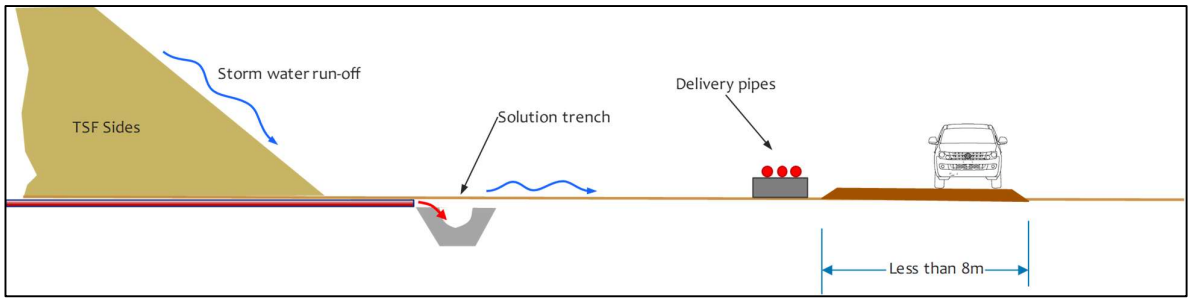


FIGURE 7-10: PLANNED REINSTATEMENT AND UPGRADING OF THE EXISTING SOLUTION TRENCH

This has the benefit of recycling water into the system as return water is used in the process. The trench will however not have sufficient capacity to manage stormwater from major events. Run-off water from the TSF will enter the existing stormwater management system at Sishen Mine. Clean water will be prevented from entering the TSF by the proposed diversion trench to be established at Sishen.

7.3 Option of not implementing the activity

7.3.1 Lylyveld Extension

The no-go alternative would mean that the life of the current satellite operations at Lylyveld will not be extended. This would mean that the additional/extended contribution of Lylyveld to Sishen Mine would end in 2022. In addition, the socio-economic benefits related to procurement and employment at the operations will end at that time.

The benefit of the no-go option will be that identified negative environmental and social

impacts associated with extending the life of the activities will not be realised. These include current negative impacts including those which remain moderately significant such as traffic and safety at the haul road crossing and potential impacts on the Gamagara River.

7.3.2 TSF Upgrade

The no-go alternative will also entail the non-continuation of the upgrade of the TSF and the status quo will remain. The upgrade of the TSF will increase the effectiveness of the system without any delays or back log. The non-continuation of the upgrade will potentially result in inadequate capacity to manage tailings effectively in future and reduced life of the TSF thus leading to the need for a new or expanded facility in the future.

7.3.3 Trolley Assist System

The non-continuation of the electric Trolley Assist System will result in the indefinite use of diesel to power haul trucks in all sections of the mine. Therefore, the financial and environmental benefits of the electric Trolley Assist System will be negated.

8. DETAILS OF THE PUBLIC PARTICIPATION PROCESS FOLLOWED

8.1 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.

- Any organisation of ratepayers that represent the community in the area (if applicable).

- 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 representatives of:

  - Gamagara Municipality
  - Joe Morolong Municipality
  - Ga Segonyana Municipality
  - John Taolo Gaestsewe District Municipality

- Authority or organs of state having jurisdiction in respect of any aspect of the activity, including. The following organs of state have been notified:

  - Department of Water and Sanitation (Northern Cape)
  - Department of Agriculture, Forestry and Fisheries (Northern Cape)
  - Department of Mineral Resources (Northern Cape)
  - Department of Environment and Nature Conservation (Northern Cape)
  - Department of Land Reform and Rural Development (Northern Cape)
  - Department of Economic Development and Tourism (Northern Cape)
  - Department of Roads and Public Works (Northern Cape)
  - Department of Social Development (Northern Cape)
  - South African Heritage Resources Agency

- Persons who responded to the Background Information Document (BID), press advertisements and site posters

- Persons who attended the public meeting during the scoping phase

A list of all parties that have been identified thus far is included as **Appendix B1**

Note that the IAP database was expanded based on feedback received from the DMR on the initial Scoping Report and will continue to be updated as IAPs become apparent throughout the scoping and EIA phases.

8.2 Notifications

In accordance with Section 41(2)(b) of Chapter 6 of the EIA Regulations (GN. 982 of 4 December 2014, as amended), written notification (including BID document by email or facsimile) has been given to all persons on the IAP database. A second round of notification was conducted to inform the I&APs that the project scope has changed, and they were provided 30 days to comment.

Proof of the first and second round of public notification is provided in **Appendix B2.**

Persons on the IAP database were notified of the amended project and invited to the public information-sharing meeting by:

- Email including BID (where email addresses are available); and/or
- SMS (where cell phone numbers are available); and/or
- On-site posters; and/or newspaper advertisements.

8.2.1 Media advertisements and Site Notices

Press advertisements for the original activities were placed in the following newspapers:

- The Volksblad on 21 June 2018 in Afrikaans; and
- The Kalahari Bulletin on 21 June 2018 in English.

The advertisements included an invitation to the public information-sharing meeting.

Two additional advertisements were placed in the following newspapers to inform the I&APs of the amended layouts and new activities included in the application:

- The Volksblad on 10 May 2019 in Afrikaans; and
- The Kalahari Bulletin on 09 May 2019 in English.

Site notices (A2 size) were placed (one in English and one in Afrikaans) at the entrance to Sishen Mine and at the entrance to Lylyveld South.

Notices were also placed at strategic public locations in Kathu including Food Zone, Pick 'n Pay and Spar. Additional site notices were placed at the same locations to inform the I&APs of the amended scope of work. Proof of placement of advertisements and site notices is

included in **Appendix B3 and B4.**

8.3 Public meetings

A public information-sharing meeting was held at Kathu Country Club on Wednesday 27 June 2018. The minutes of the meetings and authority meetings are included in **Appendix B5.**

8.4 Public and authority review of draft scoping report

This original draft scoping report was made available for review from 13 July – 13 August 2018 (30 calendar days) in accordance with Section 40 (3) of the 2014 EIA regulations. The amended draft Scoping report was available for review from the 13 June – 14 July 2019.

The Scoping Report was accepted by the DMR on 29 November 2019 **(see Appendix B7)**.

8.5 Public and authority review of draft EIA and EMPr

The draft EIA Report has been made available for public and authority review from 6 January – 5 February 2020.

8.6 Summary of issues raised by IAPs

Correspondence received to date is included in **Appendix B6.**

DATE	NAME	CORRESPONDENCE RECEIVED	EAPs RESPONSE TO ISSUES AS MANDATED BY THE APPLICANT	CONSULTATION STATUS (consensus, dispute, not finalised, etc.)
AFFECTED PARTIES				
Landowners/Lawful Occupiers of Adjacent Properties				
22/06/2018	Phillip Coetzee	Our office reference LS.BFX.25/3/34 refers: Due to figure 1 on the application, the newly deviated right of way will directly be affected by the proposed expansion as it crosses the railway lines (KHX0993). If you need more information, we will need co-ordinates of the proposed site to enable us to provide a discussion or locality plan to reflect the physical encumbrance area. Thanking you	Transnet will continue to be consulted as part of the EIA process. Sishen will need to comply with the legal requirements with respect to the mining requirements next to infrastructure	Ongoing
22/06/2018	Marina Lourens	Good day Hannah We received this notification but received some questions as below: It is not clear on the plan exactly how close both expansions (metre) will be to our railway line? Will the product be transported over our railway line? Will the vehicles have to make use of our service road? Will there be any effect of de-watering and possible sinkholes? Thanks Marina	The proposed new pit at Lylyveld South will be located within ~150 m of the railway line. Transnet will continue to be consulted with respect to impacts on infrastructure. There is no current indication that the vehicles will make us use of the service road. No additional dewatering is required for the expansion of the activities.	Ongoing
27/06/2018 (Public Meeting)*	Jurgens Becker	Jurgens Becker was questioned as to whether the operation would run for 24-hours a day.	Siko Solofelang indicated that it would continue as current, which is a double-shift operation.	Finalised
27/06/2018 (Public Meeting)*	Jaap Hoffman	Jaap Hoffman questioned if there would be more dust as a result of the expansion	Kerry Fairley indicated that since the dumps were expanding, the dust levels could increase. Traffic levels are likely to remain the same, thus the source of dust from traffic would remain the same.	Resolved.

DATE	NAME	CORRESPONDENCE RECEIVED	EAPs RESPONSE TO ISSUES AS MANDATED BY THE APPLICANT	CONSULTATION STATUS (consensus, dispute, not finalised, etc.)
			The air quality specialist has indicated that the increase in dust levels due to the expansion will be insignificant but given that dust is an existing significant issue in the area mitigation is to be prioritised to keep dust levels to a minimum. Measures for improvement on safety conditions due to dust at the haul road intersection with the DR3333 have also been recommended.	
27/06/2018 (Public Meeting)*	Jaap Hoffman & Alfred Markram	Jaap Hoffman indicated that the haul road crossing from Lylyveld South to North presents a safety risk to users on the road. The dust along the road is a problem which affects visibility for persons using the road. In addition, the haul trucks crossing causes delays to be people using the road. The issue of dust and safety at the haul road crossing was seconded by Jurgens Becker and Alfred Markram	A specialist Traffic Impact Assessment has looked into the safety issues at the intersection. Recommendations have been made as to measures to be put in place to increase safety at this intersection. These are included as mitigation in the report and in the EMPr.	Resolved
27/06/2018 (Public Meeting)*	Jaap Hoffman	JH questioned if the road to Dingleton will remain a public road once persons have been relocated from Dingleton	Siko Solofelang indicated that it is a public road and the mine has no intention of closing the road.	Finalised
27/06/2018 (Public Meeting)*	Attendees at Public Meeting	Concern was raised with respect to mining within close proximity to the N14.	SANRAL will be consulted as part of the EIA process. Sishen will need to comply with the legal requirements with respect to the mining requirements next to infrastructure	Ongoing
23 July 2018	Annelize Harmse	*Please see a copy of the full letter received from Transnet in Appendix B5.1(a)*. In Summary, Transnet raised concerns regarding mining on its properties in terms of Section 28 (1) of the MPRDA, 2002 stating that they do not "grant permission or consent to any prospecting or mining activities on its properties." They also raised concerns regarding mining within 100 m of a railway, in terms of Regulation 17 (6) (a) of the Mine Health and Safety Act, 1996.	*Please see a copy of the full response to Transnet in Appendix B5.1(b)*. In summary, it was confirmed that no mining activities are proposed to take place on any of Transnet's properties, nor within 100 m of its railway line. Further, the widening of the haul road where it crosses the railway line, will not commence before the necessary permissions are obtained.	Finalised
Local Authorities				

DATE	NAME	CORRESPONDENCE RECEIVED	EAPs RESPONSE TO ISSUES AS MANDATED BY THE APPLICANT	CONSULTATION STATUS (consensus, dispute, not finalised, etc.)
Organs of state (Responsible for infrastructure that may be affected Roads Department, Eskom, Telkom, DWA etc.) No comments received yet.				
07/05/2019 Per email	Philani P. Msimango Department of Water and Sanitation	Good Day Can you please clarify if this is additional water uses triggered or is it already covered under the current consolidation? Regards	Hi Philani No additional water uses, the water uses are already covered in the current application. Mr. Msimango responded by indicating that the Department will not comment as the water uses are already applied for.	Finalised
17/07/2018	Philani Msimango	Good Day Kerry I trust that you are well. The above-mentioned project makes reference. I have received the above-mentioned scoping report today for comment. My questions are as follows: • [1] Is this project the same as the one included in the consolidated water use licence application? • [2] Do you need separate comments for this, or can this be addressed as part of the existing application? I would like to include as part of the documentation submitted as part of the authorisation so that any outstanding issues that need to be addressed, can be addressed during the WULA assessment process. Your response and assistance will be highly appreciated. Regards Mr. Philani P. Msimango	Hi Philani Thanks for your email. See responses below. 1) Yes, it is. 2) That is 100%. Note that this is however the draft version of the report which is out for public and authority comment. We will note your response as such in the report submitted to the DMR. Kind regards Kerry Fairley	Finalised
07/05/2019 Per email	Attie Du Toit Eskom	Delano, Kerry, As always, the possibility of any of these activities encroaching on the Eskom powerlines is to be taken into account. From my knowledge all these activities are within the mining area and will not impact Eskom lines. A map of the expansion of the tailings storage in conjunction with the Eskom lines? Thanks Attie	The communication received below regarding the Lylyveld expansion project has reference. 1) The layout of the originally planned scope of work has been amended, taking into account comments received. Please find attached the amended site layout for the project. The footprint of the eastern waste rock dump at Lylyveld north has been reduced to approximately 20 meters from the power lines. The footprint extension is allocated only for rehabilitation purposes, not for the dumping of waste rock.	Ongoing

DATE	NAME	CORRESPONDENCE RECEIVED	EAPs RESPONSE TO ISSUES AS MANDATED BY THE APPLICANT	CONSULTATION STATUS (consensus, dispute, not finalised, etc.)
			2) The only blasting that occurs within 500m (approximately 370m) from a power line is at the southern end of Lylyveld north. This is an existing activity and not part of the expansion. 3) As can be seen in the attached layout document (combined), it is intended to establish a small section of the new haul road underneath the powerlines north of Lylyveld North. A wayleave will be obtained before any construction is undertaken.	
23 July 2018	Annelize Harmse	*Please see a copy of the full letter received from Transnet in Appendix B5.1(a)*. In Summary, Transnet raised concerns regarding mining on its properties in terms of Section 28 (1) of the MPRDA, 2002 stating that they do not "grant permission or consent to any prospecting or mining activities on its properties." They also raised concerns regarding mining within 100 m of a railway, in terms of Regulation 17 (6) (a) of the Mine Health and Safety Act, 1996.	*Please see a copy of the full response to Transnet in Appendix B5.1(b)*. In summary, it was confirmed that no mining activities are proposed to take place on any of Transnet's properties, nor within 100 m of its railway line. Further, the widening of the haul road where it crosses the railway line, will not commence before the necessary permissions are obtained.	Finalised
14 June 2019	Khahliso Makale Eskom	This notice affects the existing Eskom Distribution's power lines, Emil Substation, Sishen/Emil 1 132 Overhead Line, Ferrum/Lewensaar 1 22kV Overhead Line, Sekgame/Sishen 1 132kV Overhead Line, Bulkop/Sekgame 1 132kV Overhead Line, Ferrum/Sishen 1 132kV Overhead Line, Bulkop/Ferrum 1 132kV Overhead Line and Ferrum/Lylyveld 1 132kV Overhead Line which traverses the proposed mining area. The approximate positions of these services are indicated on the attached locality Map. Eskom Distribution will raise no objection to the proposed Mining operations on the abovementioned properties provided Eskom's rights and services are acknowledged and respected at all times.	The document with all the conditions and attachment were provided to Sishen for their consideration.	Ongoing

DATE	NAME	CORRESPONDENCE RECEIVED	EAPs RESPONSE TO ISSUES AS MANDATED BY THE APPLICANT	CONSULTATION STATUS (consensus, dispute, not finalised, etc.)
		Eskom's rights are protected by Wayleave Agreements and Servitudes. The approximate positions of these services are indicated on the attached sketches. Further to the above the following conditions must be adhered to and accepted in writing before any development and or construction. Refer to Annexure B 5 for the full comments		
Traditional Leaders	No comments received yet.			
Competent Authorities affected	No comments received yet.			
INTERESTED PARTIES	**No comments received yet**			

9. THE ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE DEVELOPMENT FOOTPRINT ALTERNATIVES

9.1 Climate

Figure 9-1 illustrates the significant difference between the evaporation and rainfall, which is the cause of the semi-arid landscape associated with the site and surrounds.

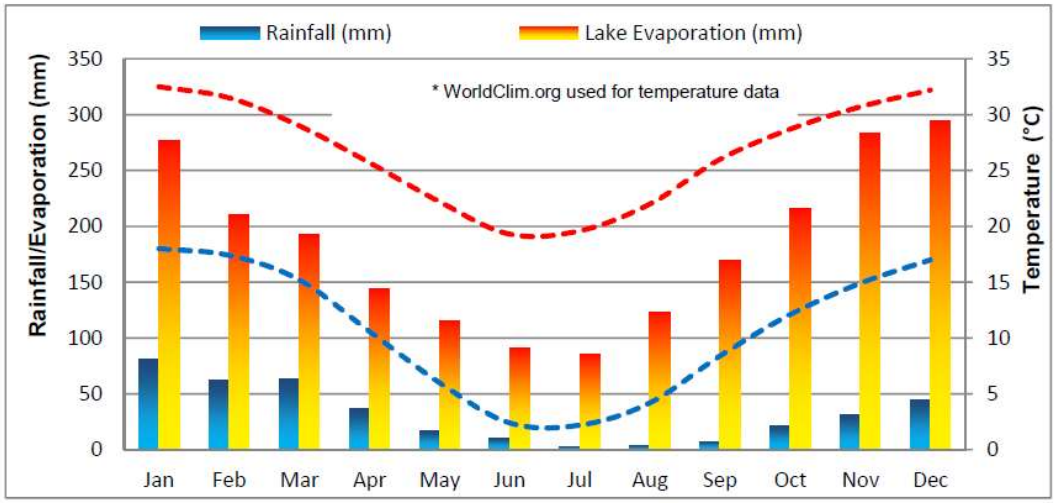


FIGURE 9-1: AVERAGE MONTHLY CLIMATE FOR SISHEN MINE (DESIGN POINT, 2017)

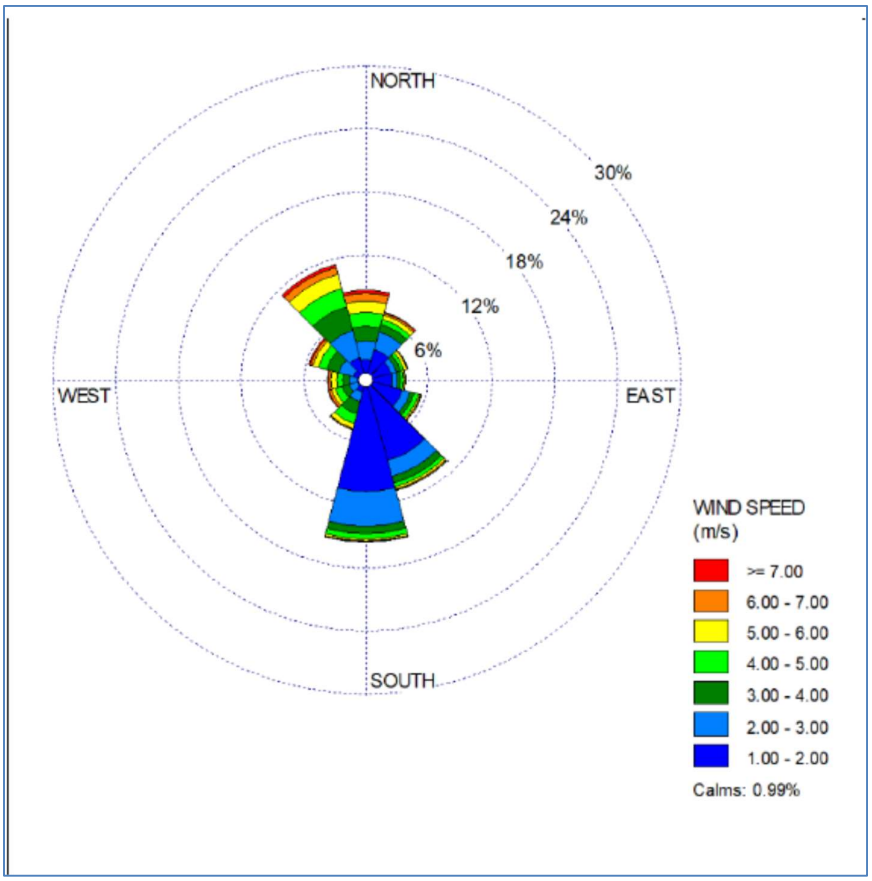
Minimum, maximum and mean temperatures for the project area, as obtained from on-site data, are shown in Table 8-1. Diurnal monthly average temperatures are shown in Figure 9-1. Maximum, minimum and average temperatures were 34°C, 5°C and 21°C, respectively. The month of July experienced the lowest temperature whereas the maximum temperature occurred in December. Temperatures reach a minimum just before sunrise and a maximum between midday and sunset.

TABLE 9-1: MONTHLY TEMPERATURE SUMMARY

Hourly Minimum, Hourly Maximum and Monthly Average Temperatures (°C)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Minimum	20	18	16	12	8	5	4	8	12	16	14	19
Maximum	34	35	31	28	27	22	22	27	29	35	32	36
Average	27	27	23	19	16	12	12	16	20	26	24	28

Source: Air Quality Impact Assessment (Airshed, June 2019)

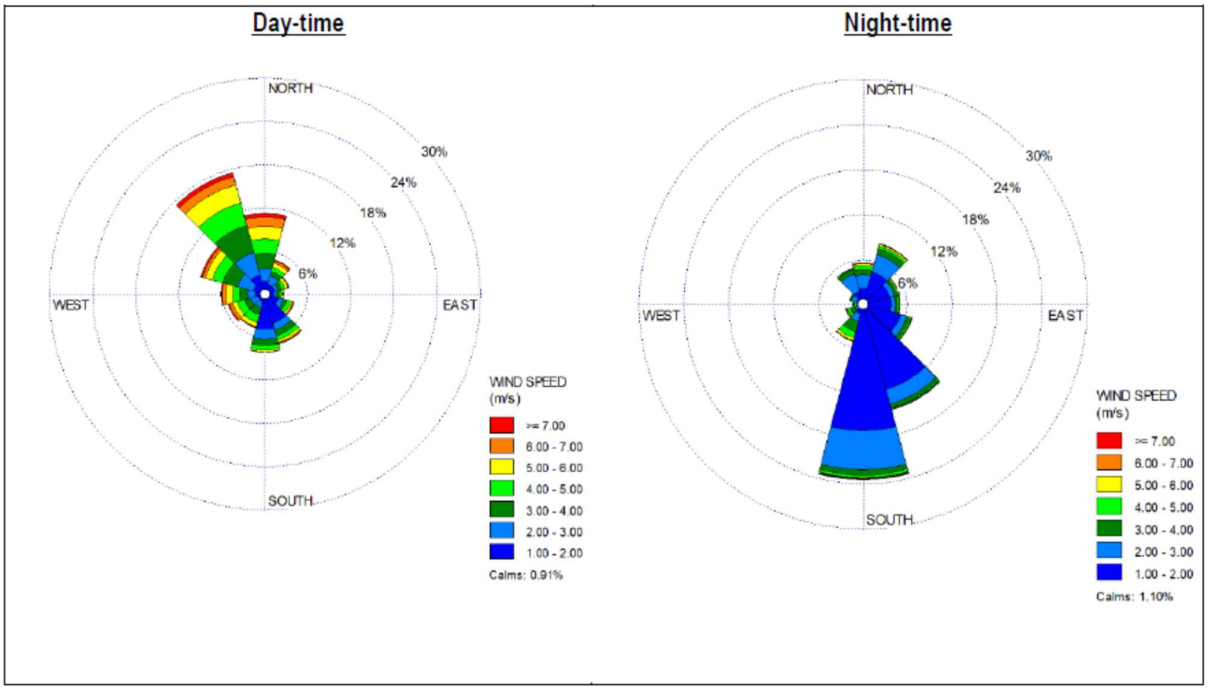
The regional wind direction and speeds are of importance as they provide an indication of the receptors areas that will experience the greatest impacts resulting from atmospheric emissions and dust. The wind rose for the period of July 2015 to June 2016 (as provided by Airshed, July 2019) is provided in Figure 9-2. 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, June 2019)

FIGURE 9-2: PERIOD AVERAGE WIND ROSE FOR SISHEN MINE JULY 2015 TO JUNE 2016

During the day, more frequent winds at higher wind speeds occurred from the north-westerly sector with 3% calm conditions. Night-time airflow had less frequent winds from the north-westerly sector and at lower wind speeds with winds mostly occurring from the south-easterly sector. The percentage calm conditions increased to 7%.



Source: Air Quality Impact Assessment (Airshed, July 2019)

FIGURE 9-3: DAY-TIME AND NIGHT-TIME WIND ROSES FOR SISHEN MINE 2017

9.2 Topography

The natural topography of the area is generally flat with isolated areas of undulation. The Sishen mining area elevation reaches 1 350 mamsl in the form of several hills towards the southeast of the Sishen mining areas. Locally, the existing waste rock dumps reach heights of 110 m and form prominent local landforms.

The Lylyveld mining areas are located amongst the hills located to the south east of the main Sishen Mine area (see Figure 9-3). Mining at Lylyveld North takes place on the eastern slopes of a small hill (height 1 280 mamsl) with the waste rock dumps and stockpile areas located on the flat areas to the east (1 225 mamsl). Lylyveld South is located between of a series of small hills (1 257 mamsl) to the west and the Gamagara River (1 208 mamsl) to the east. The top of the closest hill has been historically mined and this application includes an application for further mining in on the crest of the hill. The N14 and the Sishen Saldanha Iron Ore Export Rail Line run between the hills and the two mining areas along the Gamagara flood plain area.

The TSF upgrade project will occur within the main Sishen mining area and the area is generally flat where the TSF is located. The Trolley Assist infrastructure is to be located on the up ramps at some of the pits and waste rock dumps.

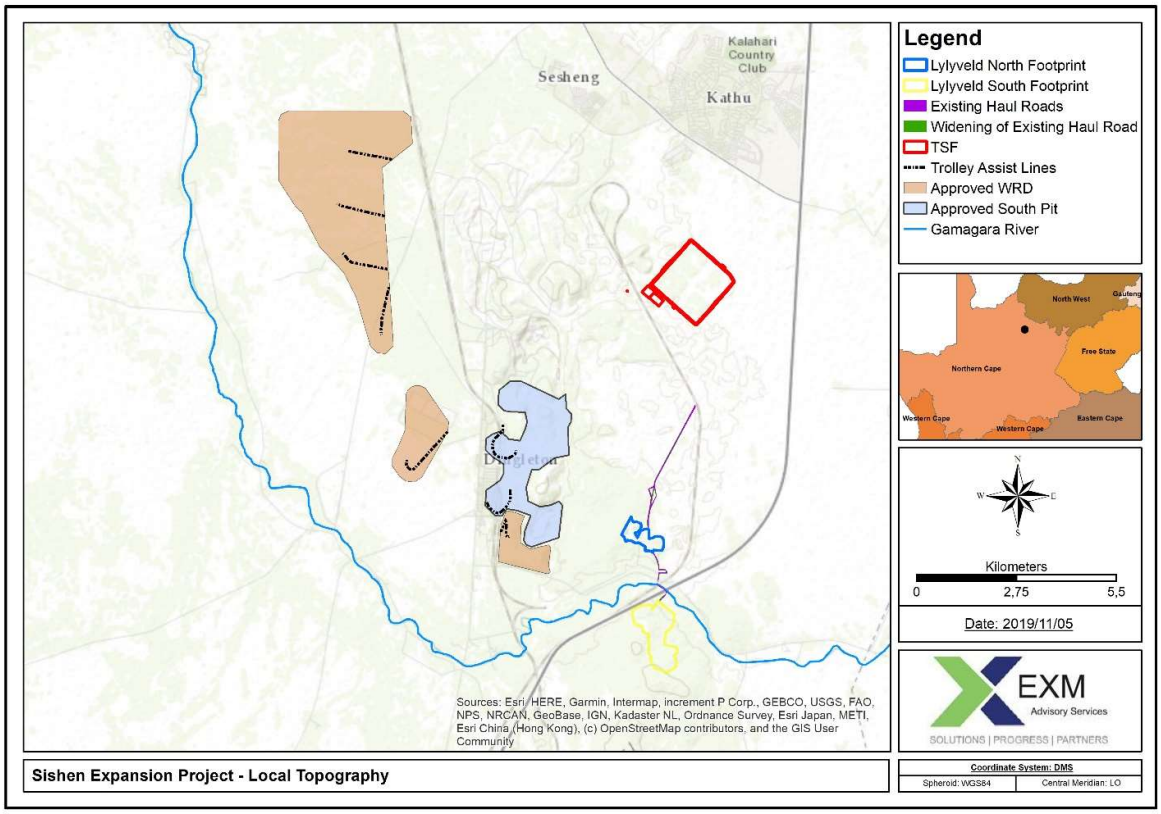


FIGURE 9-4: LOCAL TOPOGRAPHY

9.3 Soil and land capability

A soil and land capability specialist study (TerraSoil Science, March 2010) was originally undertaken as part of the EIA conducted for the Lylyveld operations. The study included the part where the proposed expansion will be undertaken. The study found that the soil in the study area is shallow and sandy with low intrinsic value. The study area is not suitable for crop cultivation and can be used for grazing, but only to a limited extent due to the low carrying capacity. The expansion activities will predominantly be conducted on previously disturbed areas with low land capability value, other than for mining purposes.

The upgrade of the TSF as well as the establishment of the Trolley Assist Infrastructure will be conducted on the existing mining footprint within existing disturbed areas.

9.4 Air Quality

The region is characterised as being a relatively dry, arid, and dusty environment. It is expected that various local and far-a-field sources contribute to suspended fine particulate ($PM_{2.5}$ and PM_{10}) concentrations in the region. Local sources include wind erosion from exposed areas,

The results of the 2016 & 2017 PM_{10} and $PM_{2.5}$ monitoring are shown in Table 9-2 and Table 9-3, respectively.

TABLE 9-2: SUMMARY OF PM10 CONCENTRATIONS FOR THE SISHEN MINE FOR 2016 & 2017

Receptor	Annual Average Conc. (µg/m3)	Days of Exceedance of 75 µg/m3	Days of Exceedance of 35 µg/m3	Data availability (%)
Dingleton 2016	39	**30**	**131**	78
Dingleton 2017*	20	**-**	**-**	-
Sesheng 2016	**47**	**35**	**227**	90
Sesheng 2017	39	**23**	**193**	96
Kathu 2016	28	2	**87**	84
Kathu 2017	33	**5**	**182**	85
NAAQS (Daily and annual)	**40**	**4**	**35 (EC)**	

* Dingleton station was decommissioned in March 2017

Source: Air Quality Impact Assessment (Airshed, June 2019)

TABLE 9-3: SUMMARY OF PM2.5 CONCENTRATIONS FOR THE SISHEN MINE FOR 2016 & 2017

Receptor	Annual Average Conc. (µg/m3)	Days of Exceedance of 40 µg/m3	Data availability (%)
Dingleton 2016	8.3	0	67
Dingleton 2017*	7.2	-	-
Sesheng 2016	13.4	1	86
Sesheng 2017	12.3	0	93
Kathu 2016	7.9	1	78
Kathu 2017	10.4	1	87
NAAQS (Daily and annual)	**20**	**4**	

* Dingleton station was decommissioned in March 2017

Source: Air Quality Impact Assessment (Airshed, June 2019)

The PM_{10} concentrations recorded around Sishen Mine are not in compliance with the NAAQS. The ambient air quality also does not meet the Anglo internal air quality target as it contributes more than 70% of the EC Limit Value (28 µg/m³ for annual and 35 µg/m³ for daily). The $PM_{2.5}$ concentrations at all three receptors (Dingleton, Sesheng, and Kathu) are, however, in compliance with NAAQS.

Dust fall also shows non-compliance with the national dust fallout limits. The location of the Sishen dust fallout monitoring points are shown in Figure 9-5. Results for the 2015 to 2016 monitoring campaign are shown in Figure 9-6 and Figure 9-7. Results for the 2017 campaign are shown in Figure 9-8 and 9-8.

Non-compliances with the National Dust Control Regulations during the monitoring campaigns are given in Table 9-4. The national dust fall limit for residential areas is 600 mg/m²/day, and for non-residential areas is 1 200 mg/m²/day.

TABLE 9-4: SUMMARY OF MONTHS DURING WHICH DUSTFALL EXCEED ACCEPTABLE LEVELS AS SPECIFIED IN THE NATIONAL DUST CONTROL REGULATIONS (JULY 2015-JUNE 2016 AND 2017)

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)	**Months of Non-Compliance**
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

Source: Air Quality Impact Assessment (Airshed, January 2018)

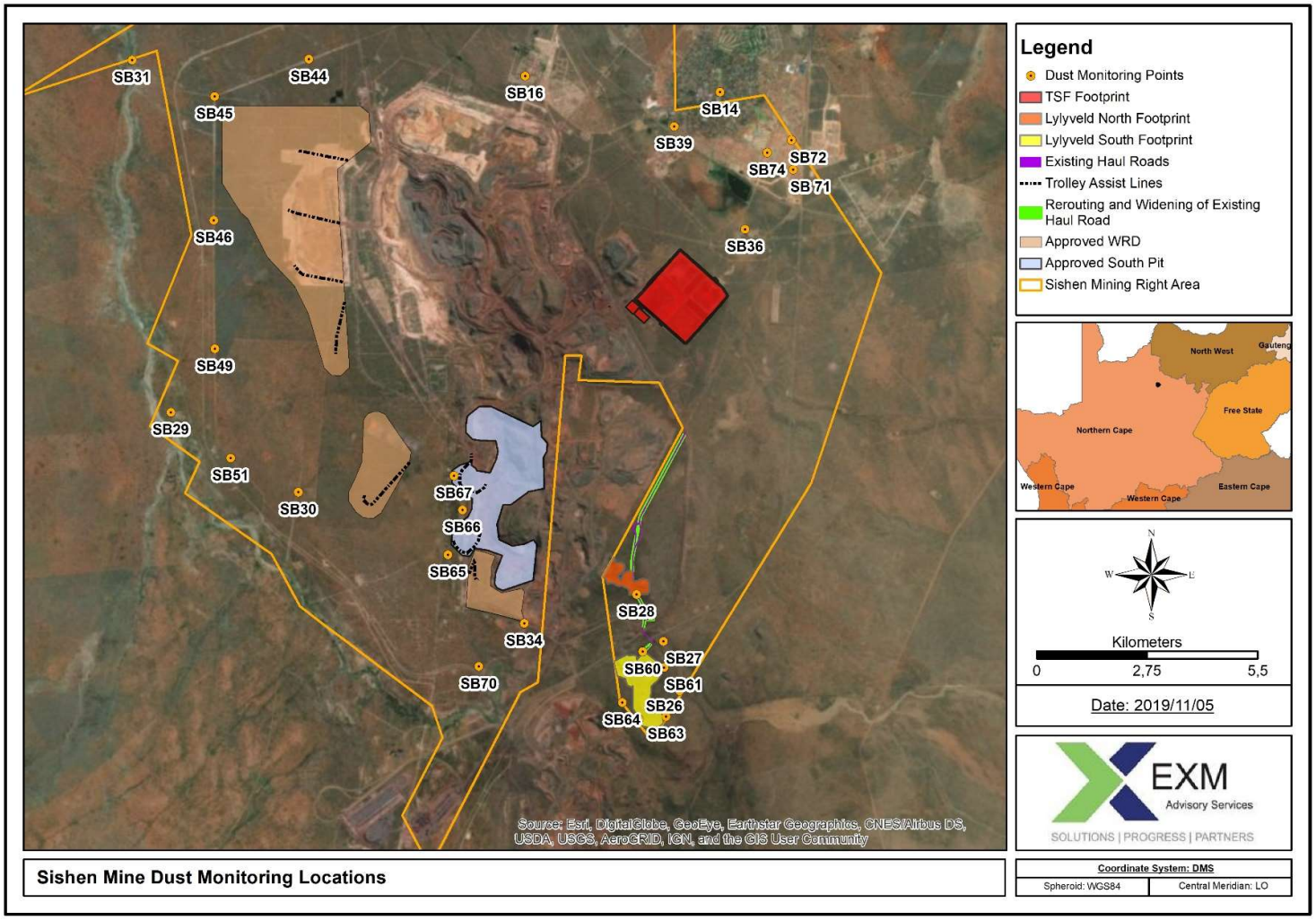
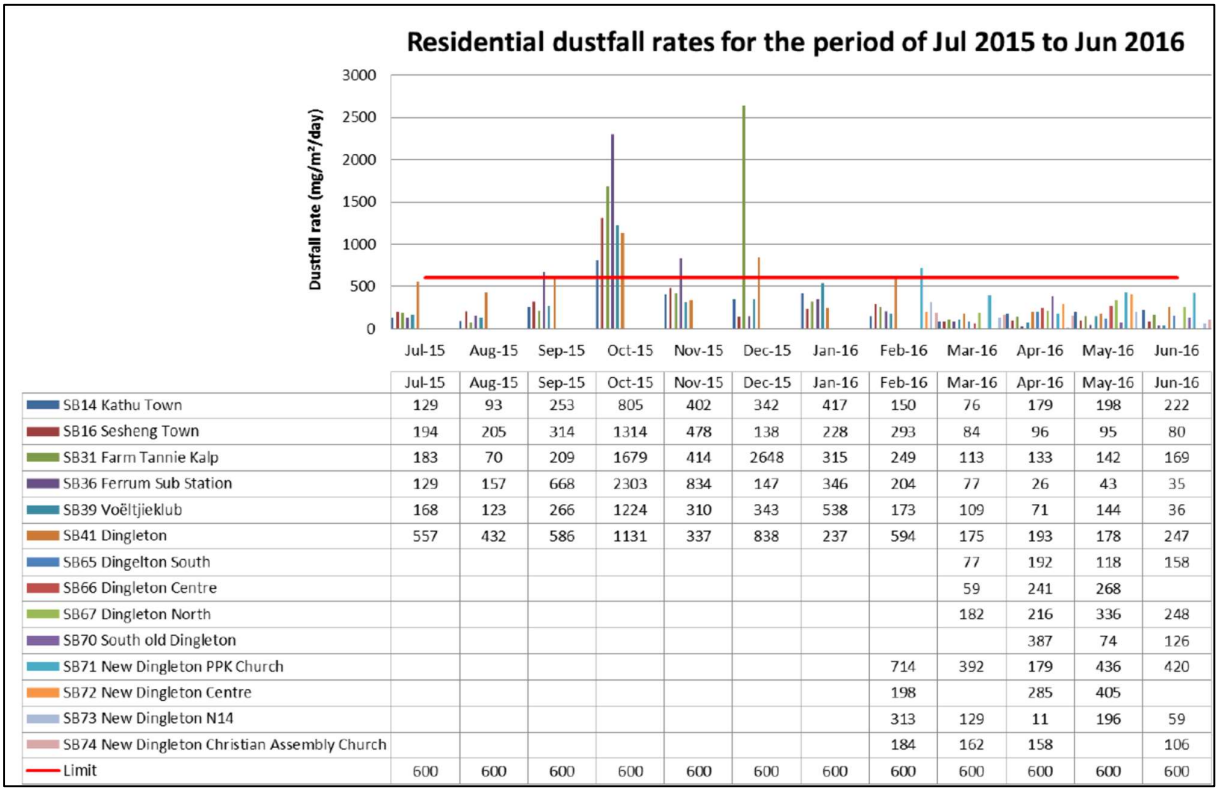


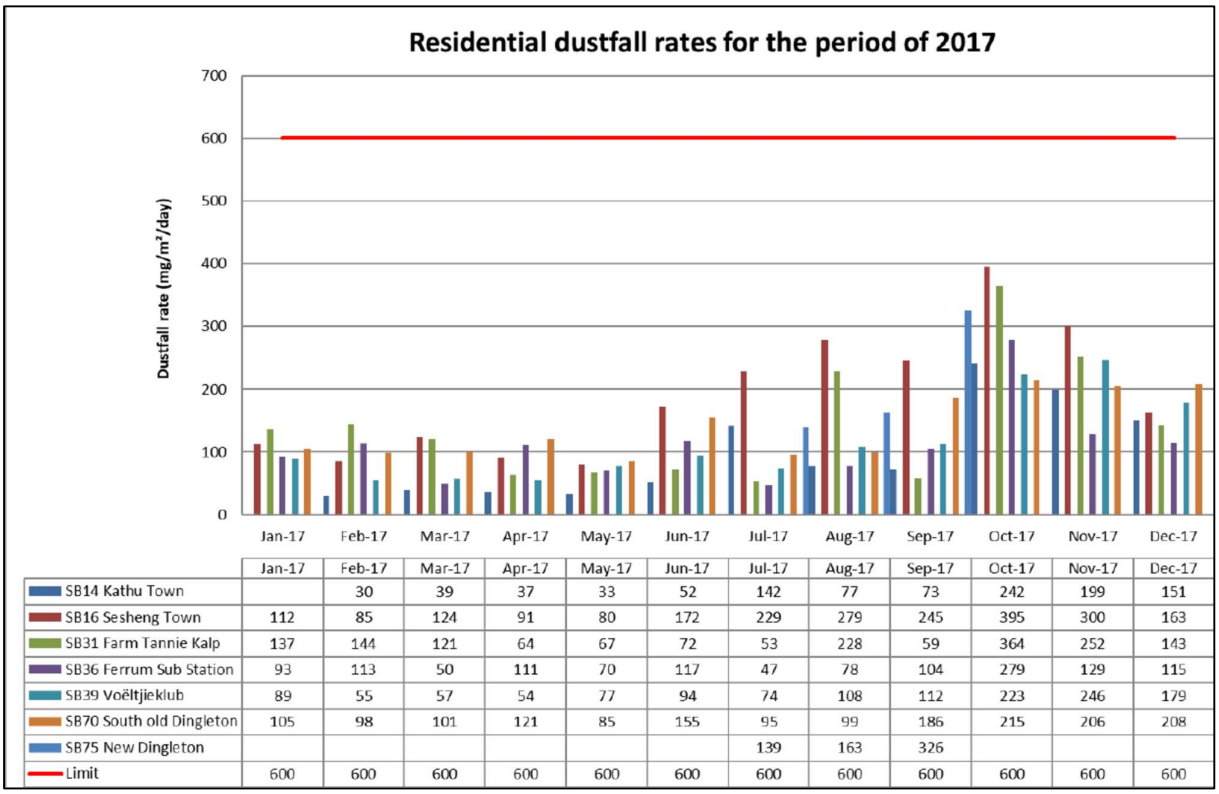
FIGURE 9-5: LOCATION OF DUST MONITORING STATIONS AND KEY RECEPTORS AT SISHEN MINE



	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16
SB14 Kathu Town	129	93	253	805	402	342	417	150	76	179	198	222
SB16 Sesheng Town	194	205	314	1314	478	138	228	293	84	96	95	80
SB31 Farm Tannie Kalp	183	70	209	1679	414	2648	315	249	113	133	142	169
SB36 Ferrum Sub Station	129	157	668	2303	834	147	346	204	77	26	43	35
SB39 Voëltjieklub	168	123	266	1224	310	343	538	173	109	71	144	36
SB41 Dingleton	557	432	586	1131	337	838	237	594	175	193	178	247
SB65 Dingelton South									77	192	118	158
SB66 Dingleton Centre									59	241	268	
SB67 Dingleton North									182	216	336	248
SB70 South old Dingleton										387	74	126
SB71 New Dingleton PPK Church								714	392	179	436	420
SB72 New Dingleton Centre								198		285	405	
SB73 New Dingleton N14								313	129	11	196	59
SB74 New Dingleton Christian Assembly Church								184	162	158		106
Limit	600	600	600	600	600	600	600	600	600	600	600	600

Source: Air Quality Impact Assessment (Airshed, June 2019)

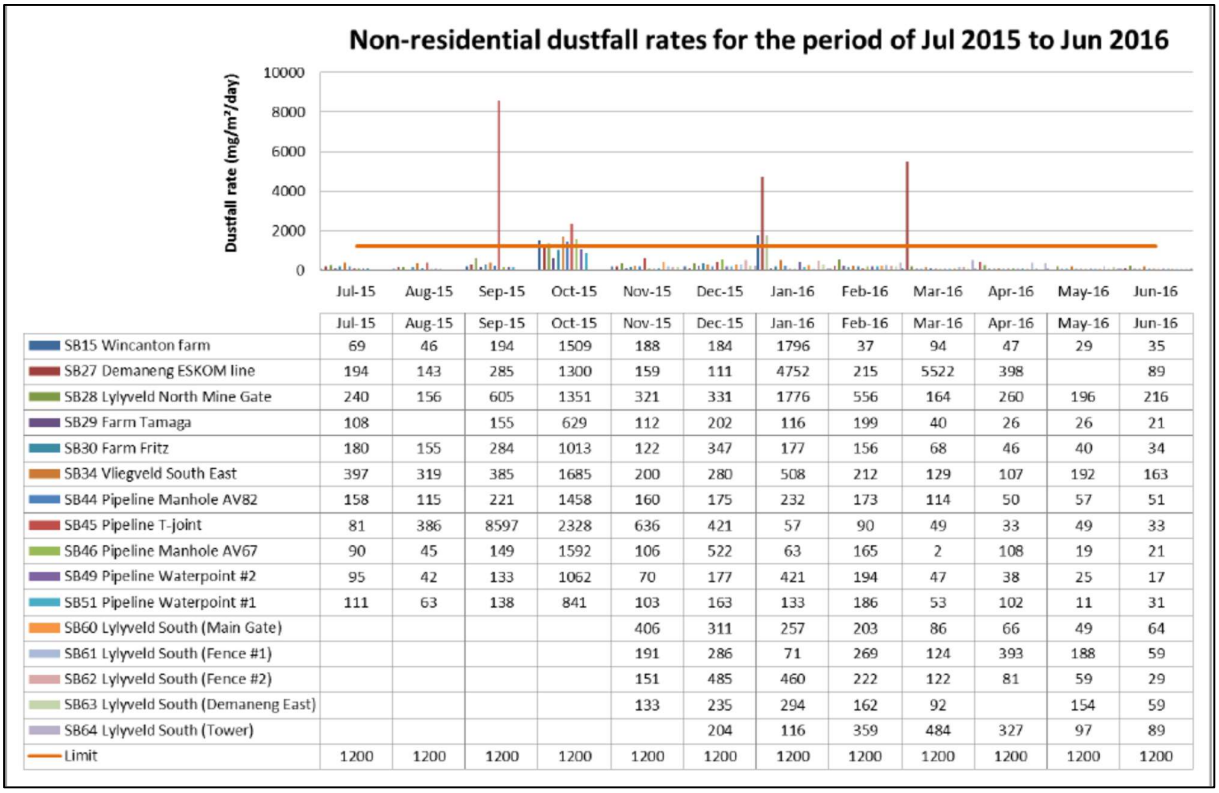
FIGURE 9-6: RESIDENTIAL DUST FALLOUT MONITORING FOR JULY 2015-JUNE 2016



	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17
SB14 Kathu Town		30	39	37	33	52	142	77	73	242	199	151
SB16 Sesheng Town	112	85	124	91	80	172	229	279	245	395	300	163
SB31 Farm Tannie Kalp	137	144	121	64	67	72	53	228	59	364	252	143
SB36 Ferrum Sub Station	93	113	50	111	70	117	47	78	104	279	129	115
SB39 Voëltjieklub	89	55	57	54	77	94	74	108	112	223	246	179
SB70 South old Dingleton	105	98	101	121	85	155	95	99	186	215	206	208
SB75 New Dingleton							139	163	326			
Limit	600	600	600	600	600	600	600	600	600	600	600	600

Source: Air Quality Impact Assessment (Airshed, June 2019)

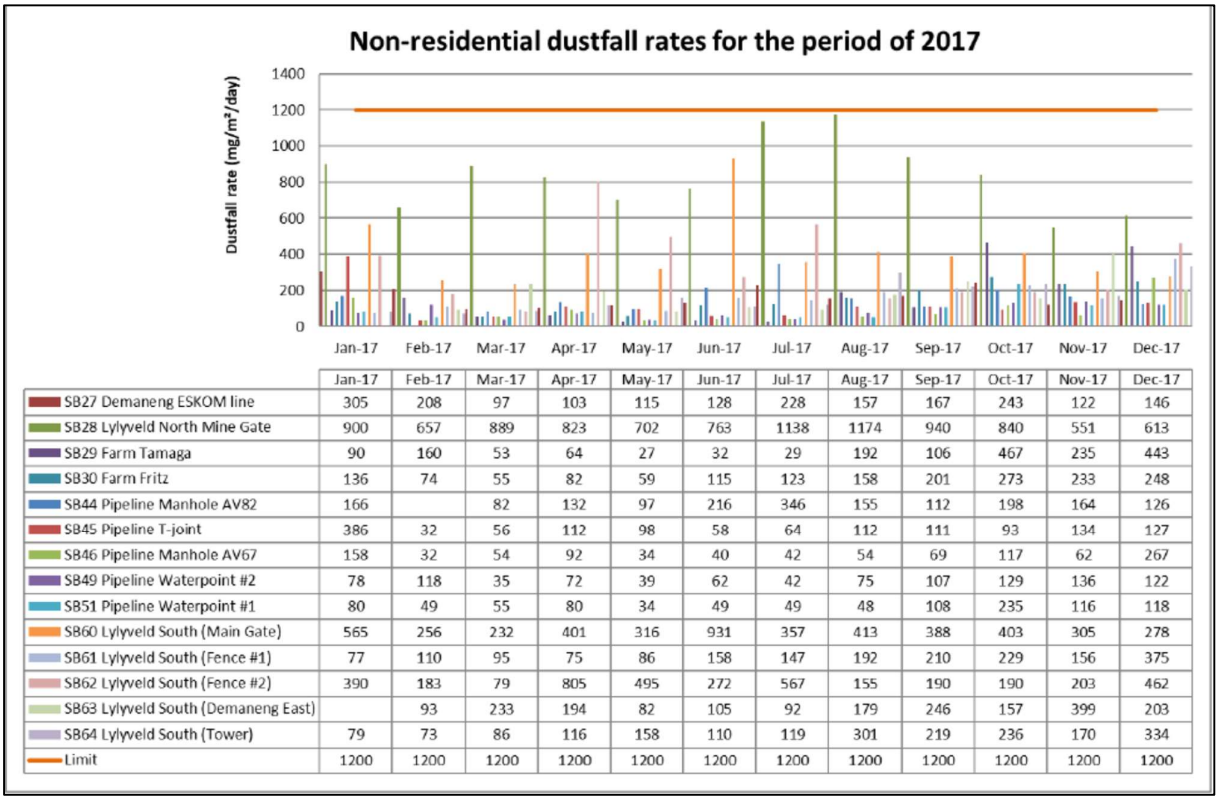
FIGURE 9-7: RESIDENTIAL DUST FALLOUT MONITORING FOR 2017



	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16
SB15 Wincanton farm	69	46	194	1509	188	184	1796	37	94	47	29	35
SB27 Demaneng ESKOM line	194	143	285	1300	159	111	4752	215	5522	398		89
SB28 Lylyveld North Mine Gate	240	156	605	1351	321	331	1776	556	164	260	196	216
SB29 Farm Tamaga	108		155	629	112	202	116	199	40	26	26	21
SB30 Farm Fritz	180	155	284	1013	122	347	177	156	68	46	40	34
SB34 Vliegveld South East	397	319	385	1685	200	280	508	212	129	107	192	163
SB44 Pipeline Manhole AV82	158	115	221	1458	160	175	232	173	114	50	57	51
SB45 Pipeline T-joint	81	386	8597	2328	636	421	57	90	49	33	49	33
SB46 Pipeline Manhole AV67	90	45	149	1592	106	522	63	165	2	108	19	21
SB49 Pipeline Waterpoint #2	95	42	133	1062	70	177	421	194	47	38	25	17
SB51 Pipeline Waterpoint #1	111	63	138	841	103	163	133	186	53	102	11	31
SB60 Lylyveld South (Main Gate)					406	311	257	203	86	66	49	64
SB61 Lylyveld South (Fence #1)					191	286	71	269	124	393	188	59
SB62 Lylyveld South (Fence #2)					151	485	460	222	122	81	59	29
SB63 Lylyveld South (Demaneng East)					133	235	294	162	92		154	59
SB64 Lylyveld South (Tower)						204	116	359	484	327	97	89
Limit	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200

Source: Air Quality Impact Assessment (Airshed, June 2019)

FIGURE 9-8: NON-RESIDENTIAL DUST FALLOUT MONITORING FOR JULY 2015-JUNE 2016



	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17
SB27 Demaneng ESKOM line	305	208	97	103	115	128	228	157	167	243	122	146
SB28 Lylyveld North Mine Gate	900	657	889	823	702	763	1138	1174	940	840	551	613
SB29 Farm Tamaga	90	160	53	64	27	32	29	192	106	467	235	443
SB30 Farm Fritz	136	74	55	82	59	115	123	158	201	273	233	248
SB44 Pipeline Manhole AV82	166		82	132	97	216	346	155	112	198	164	126
SB45 Pipeline T-joint	386	32	56	112	98	58	64	112	111	93	134	127
SB46 Pipeline Manhole AV67	158	32	54	92	34	40	42	54	69	117	62	267
SB49 Pipeline Waterpoint #2	78	118	35	72	39	62	42	75	107	129	136	122
SB51 Pipeline Waterpoint #1	80	49	55	80	34	49	49	48	108	235	116	118
SB60 Lylyveld South (Main Gate)	565	256	232	401	316	931	357	413	388	403	305	278
SB61 Lylyveld South (Fence #1)	77	110	95	75	86	158	147	192	210	229	156	375
SB62 Lylyveld South (Fence #2)	390	183	79	805	495	272	567	155	190	190	203	462
SB63 Lylyveld South (Demaneng East)		93	233	194	82	105	92	179	246	157	399	203
SB64 Lylyveld South (Tower)	79	73	86	116	158	110	119	301	219	236	170	334
Limit	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200

Source: Air Quality Impact Assessment (Airshed, June 2019)

FIGURE 9-9: NON-RESIDENTIAL DUST FALLOUT MONITORING FOR 2017

9.5 Noise

A noise survey was conducted by dBAcoustics during the winter (14 & 15 August) and summer (22 & 23 November) of 2017. The Environmental Health and Safety Guidelines for Noise are given in Table 9-5.

TABLE 9-5: ENVIRONMENTAL HEALTH AND SAFETY GUIDELINES FOR NOISE

Receptor	Either		Or
	Period		Where baseline exceeds IFC guideline
	Daytime (07h00 - 22h00)	Night time (22h00 – 7h00)	
Residential, institutional and educational	55.0dBA	45.0dBA	3dB increase over baseline
Industrial and commercial	70.0dBA	70.0dBA	

Source: Noise Impact Assessment (dBAcoustics, February 2018)

Noise sources in the area include: heavy vehicle hauling noise, traffic noise, industrial noise including mining activities and conveyors. Insects, birds and wind also contribute to ambient noise levels. Reverse signals, hooting of trains and blasting are clearly audible in the area surrounding the mine. The noise levels at the different locations recorded by dBAcoustics are given for the winter and summer periods in Table 8-6 and Table 8-7, respectively.

TABLE 9-6: ARITHMETIC PREVAILING NOISE LEVELS DURING THE WINTER

Location	Prevailing ambient noise levels in dBA	
	Prevailing ambient noise level - day	Prevailing ambient noise level – night
Sesheng	41.9	32.6
Western side of Kathu	47.1	37.7
Eastern side of Sishen mine	39.5	34.4
Kathu Agricultural Holdings	38.2	28.3
Dingleton	44.1	43.9
Farms to the west of Sishen mine	31.7	30.3

Source: Noise Impact Assessment (dBAcoustics, 2018)

TABLE 9-7: ARITHMETIC PREVAILING NOISE LEVELS DURING THE SUMMER

Location	Prevailing ambient noise levels in dBA	
	Prevailing ambient noise level - day	Prevailing ambient noise level – night
Sesheng	44.0	37.8
Western side of Kathu	47.3	39.6
Eastern side of Sishen Mine	40.4	37.8
Kathu Agricultural Holdings	37.0	35.1
Dingleton	47.3	47.3
Farms to the west of Sishen Mine	36.9	31.1

Source: Noise Impact Assessment (dBAcoustics, 2018)

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). The location of the noise monitoring points are provided in Figure 9-10.

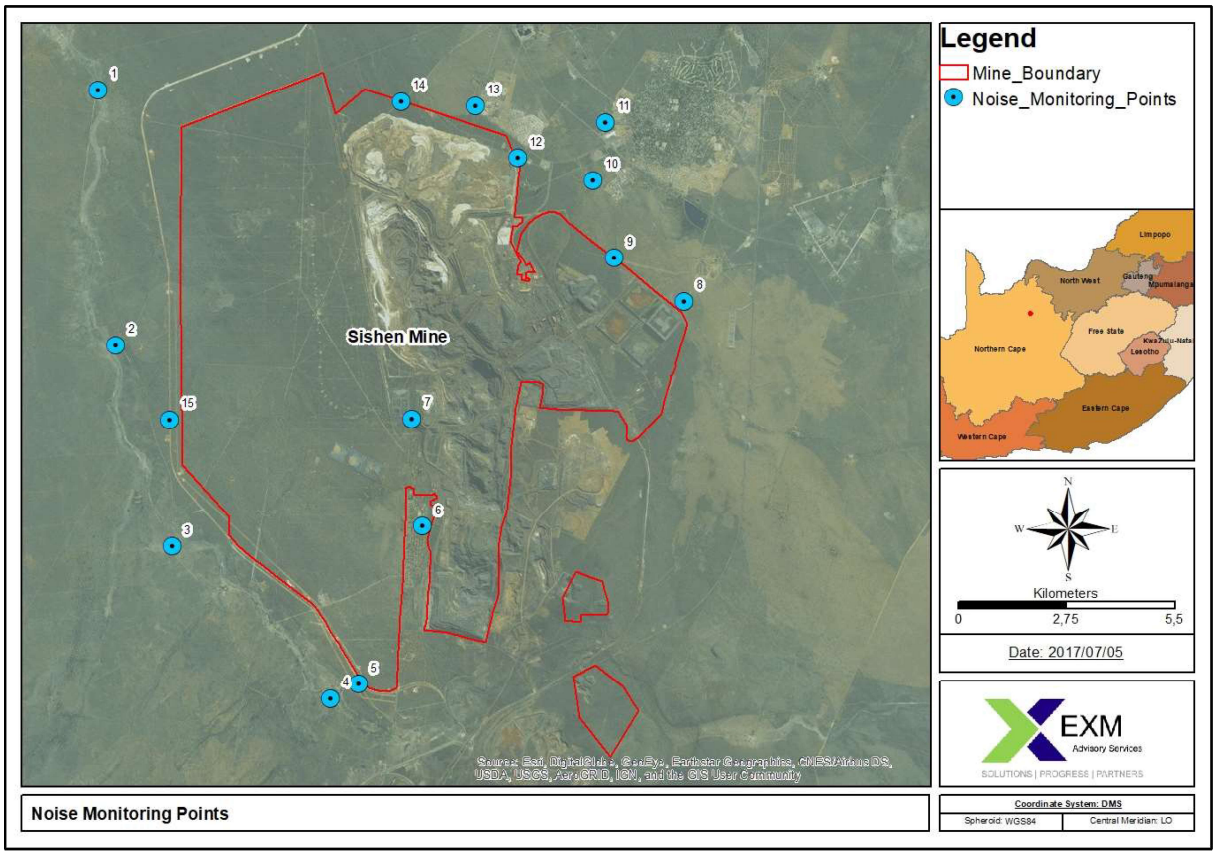


FIGURE 9-10: NOISE MONITORING POINTS

9.6 Biodiversity

9.6.1 Vegetation Types

There are three distinctive vegetation types in the Sishen Area, as defined by Mucina and Rutherford (2012), that occur on the land around Sishen:

- Kuruman Thornveld
- Kuruman Mountain Bushveld
- Kathu Bushveld, which is the predominant vegetation type.

The dominant vegetation types consist of Kuruman Mountain Bushveld and Kuruman Thornveld (Mucina & Rutherford, 2012). Kuruman Mountain Bushveld is prevalent on the hills at Lylyveld South, while Kuruman Thornveld occurs along the Gamagara River and also at Lylyveld North (see Figure 9-12).

The majority of Lylyveld South, the north-western portion of Lylyveld North, as well as the portions of the haul road immediately north of Lylyveld North and South fall within the Kuruman Mountain Bushveld vegetation type. The remaining portions of Lylyveld North and South, as well as two portions of the haul road fall within the Kuruman Thornveld Vegetation type. A small portion of the northern portion of the haul road fall within a Southern Kalahari Salt Pan, with the remaining northern most portion of the haul road situated within the Kathu Bushveld vegetation type.

The Biodiversity Impacts Assessment conducted by Scientific Terrestrial Services (STS, 2019) found that, due to active mining in the area, which has degraded the immediate surrounding vegetation, the species composition in areas where natural vegetation remains were similar, and no clear distinction between the vegetation types could be made. These areas were therefore considered as a single habitat unit, namely degraded bushveld.

PLATE 9-1: DEGRADED BUSHVELD

The Gamagara River flood plain is considered to be an Ecological Support Areas (ESAs).

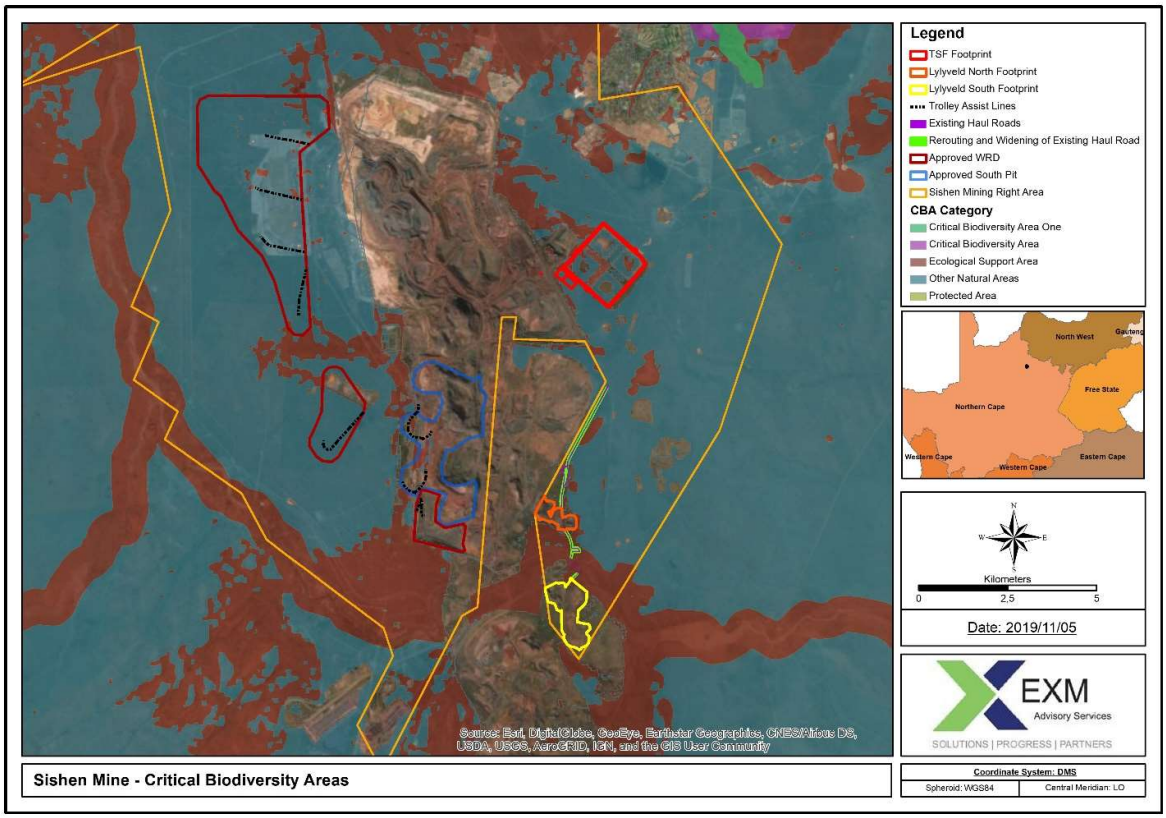
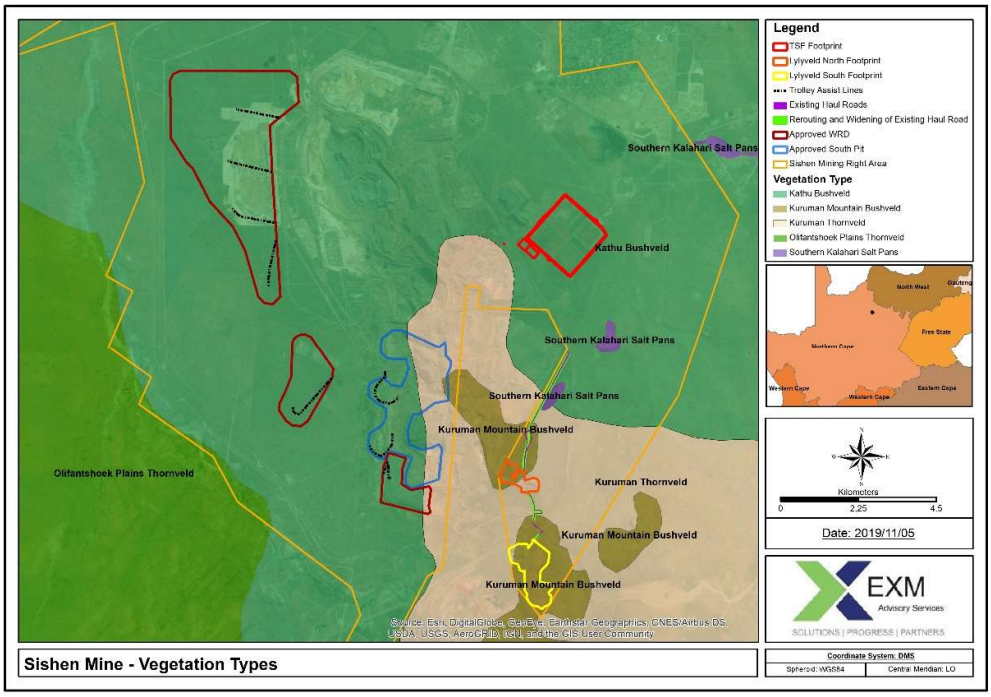


FIGURE 9-11: NORTHERN CAPE DEFINTED CRITICAL BIODIVERSITY AREAS



Source: Biodiversity Impact Assessment (Scientific Terrestrial Services, 2019)

FIGURE 9-12: VEGETATION TYPES AT LYLYVELD

STS further stated that the woody component of the study area is dominated by species indigenous to the Kuruman Thornveld and Kathu Bushveld, often associated with bush encroachment, such as *Senegalia mellifera* subsp. *detinens*, *Tarchonanthus camphoratus*, *Grewia flava* and *Ziziphus macronata*. The herbaceous layer was dominated by grass species such as *Fingerhurthia africana*, *Stipagrostis amabilis* and *Eragrostis lehmanniana* amongst others. Earthworks and edge effects associated with mining have degraded the habitat as was evident throughout the area due to severe bush encroachment. The habitat unit however did provide suitable habitat for a variety of floral species of conservation concern (SCC), such as *Vachellia erioloba, Vachellia haematoxylon, Boscia albitrunca, Hoodia gordonii* and Orbea lutea subsp. *lutea*, albeit in limited numbers.

The TSF Upgrade will take place in disturbed areas around the existing tailings dams as well as the existing processing plants. Some vegetation has established in these disturbed areas and will need to be removed as part of the upgrade activities. The existing vegetation coverage can however be regarded as significantly degraded. The disturbance area was thus checked for the occurrence of species of conservation concern (see Section 9.6.2).

The trolley assist infrastructure will not result in the disturbance of vegetation as these will be established on haul roads on waste rock dumps or pits.

9.6.2 Species of Conservation Concern

No floral Species of Conservation Concern (SCC) were observed during the site visit conducted by the biodiversity specialist within the expansion footprint areas of Lylyveld North and South, although individuals of SCC as indicated above were observed within the surrounding degraded bushveld habitat. A number of individuals of the protected trees V. erioloba and V. haematoxylon were located immediately adjacent to the existing haul road. Removal of these species during the widening of the haul road will be unavoidable. Although no individuals were observed within the expansion footprint areas of Lylyveld north and south, care should be taken not to harm/ destroy individuals within the surrounding area. The removal, relocation or protected trees will require permits as stipulated within the National Forest Act (1998), and as such expansion activities cannot commence until such permits are in place.

Two *V. erioloba* were observed in the footprint area of the TSF (see Figure 9-13). These trees will be removed during the upgrade activities at the TSF.

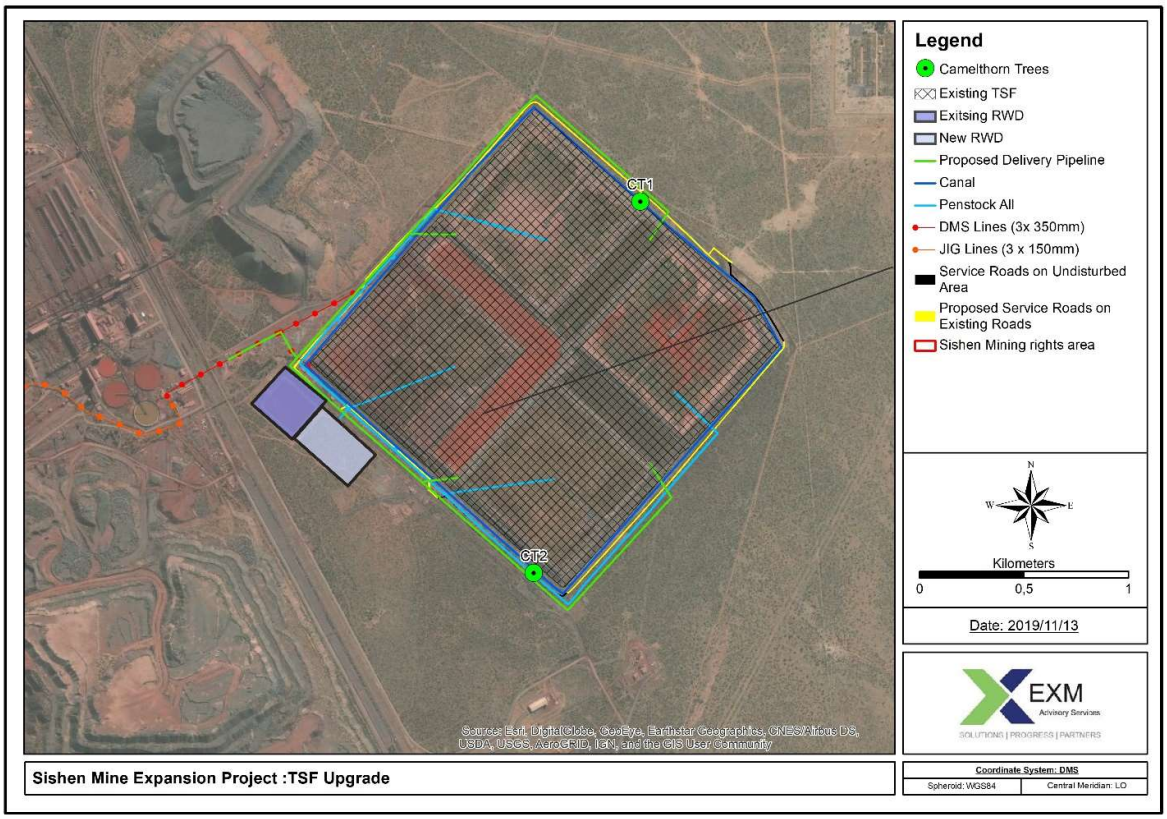


FIGURE 9-13: PROTECTED SPECIES OCCURING IN THE VICINITY OF THE TSF UPGRADES

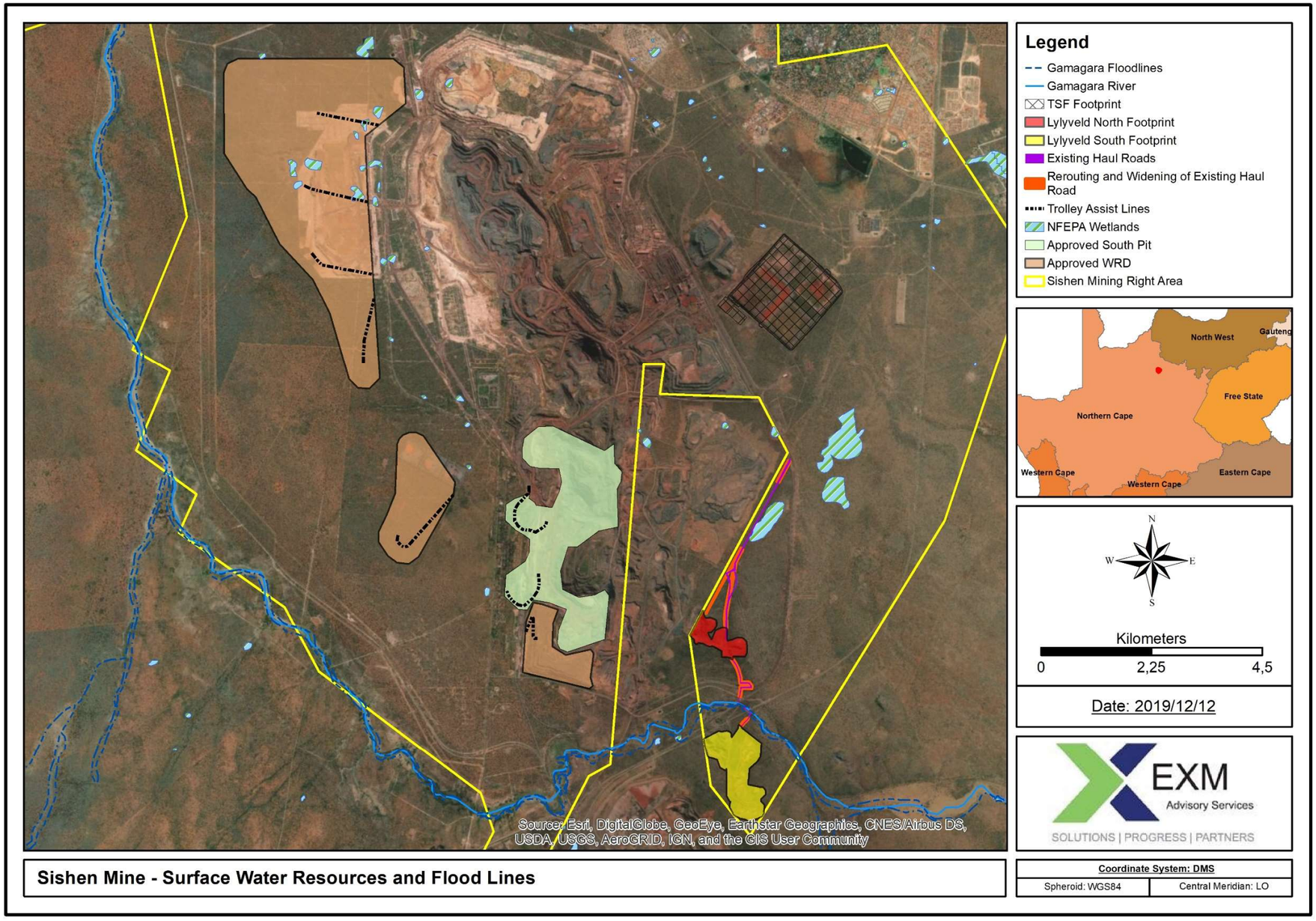
9.6.3 Faunal diversity

STS found that faunal diversity of the vicinity of Lylyveld is considered to be of intermediate levels with a variety of invertebrates, birds and mammals being either directly observed, or evidence of their presence being located (dung or spoor). The study area is dominated by insects and avifaunal species, and to a lesser degree by mammal species. Faunal diversity albeit of intermediate levels, were limited to widespread common species, often observed in the region. The likelihood of faunal SCC utilising the area permanently is highly unlikely due to the ongoing mining activities. Faunal species observed include species such as Streptopelia capicola (Cape turtledove), *Batis pririt* (Pririt Batis), *Cynictis penicillata* (Yellow Mongoose), *Sylvicapra grimmia* (Common Duiker), *Felis silvestris lybica* (African Wild Cat), *Danaus chrysippus* (African Monarch), and *Colotis euippe* (Smokey Orange Tip).

9.7 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 in the direction of the endorheic Gamagara River.

Refer to Figure 9-14 for the National Freshwater Ecosystem Priority Areas (NFEPA) (2011) map indicating the location of the Gamagara River and wetlands in the proximity of Sishen Mine.



Source: National Freshwater Ecosystem Priority Areas (NFEPA)

FIGURE 9-14: SURFACE WATER RESOURCES IN THE VICINITY OF SISHEN MINE

The Gamagara River flows between Lylyveld South and Lylyveld North with the haul road linking the 2 sections crosses the river below the N14 and the Transnet Iron Export line. Lylyveld North and South lie approximately 900 m north and 300 m south of the river flood plain, respectively.

As shown in Figure 9-14, there are several wetlands in the proximity of the Trolley Assist developments. However, it should be noted that these developments will take place once the approved waste rock developments have been developed in these areas and thus no additional disturbances resulting from the Trolley Assist power line developments.

Of importance is the location of wetlands in the proximity of the existing haul road from the Lylyveld mining area (see Figure 9-14). As indicated in Section 7.1.3. no widening of the haul road will take place within ta 500 m buffer of the wetland pans. The haul road will also not be widened where it crosses the Gamagara River 1 in 100-year food plain.

9.8 Stormwater Management

9.8.1 Lylyveld

According to GNR. 704 (June 1999) clean and dirty water areas must be defined and separated. Clean water is to be prevented from entering any dirty water area and dirty water run-off or seepage is to be contained and prevented from entering into the natural environment.
An Environmental Authorisation (EA) was received from the DMR on the 8th of November 2018 for the establishment of a clean stormwater cut-off system and Pollution Control Dam at Lylyveld (see Figure 9-15). The stormwater infrastructure will be designed for the diversion of potentially contaminated water to a PCD (still to be constructed). 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.

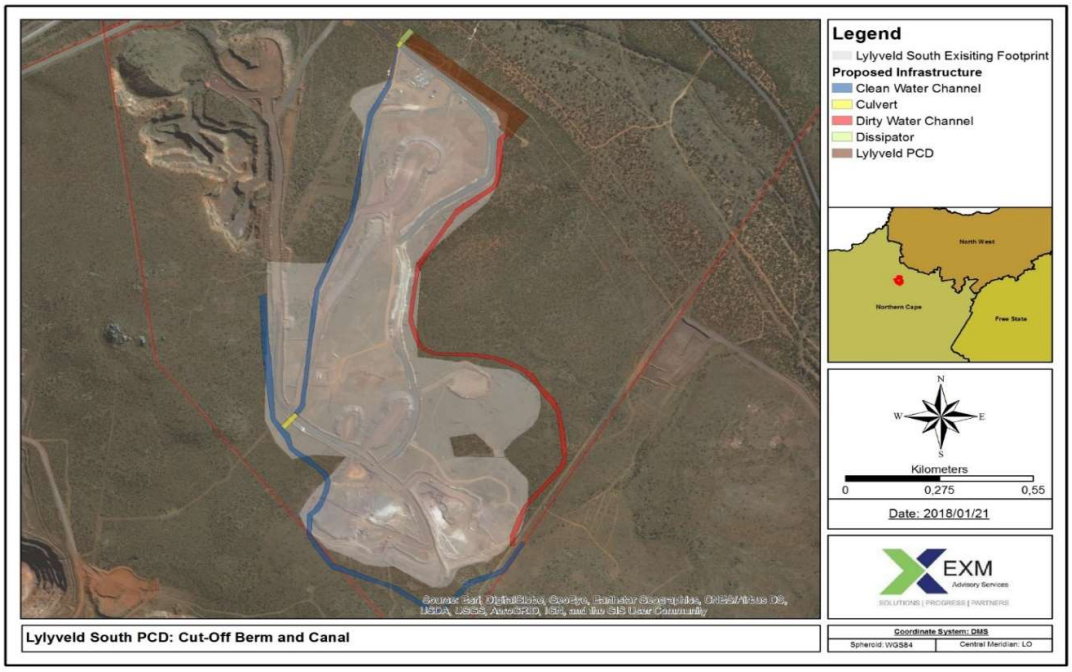


FIGURE 9-15: PROPOSED CUT-OFF BERM AND CANAL AT LYLYVELD SOUTH MINING AREA

There are currently no formal diversion berms, stormwater canals or pollution control dams at Lylyveld North.

9.8.2 Tailings Storage Facility

As indicated in Section 4.2.3, the solution trench at the toe of the tailings dam is non-functional and this trench will be reinstated and upgraded for the management of seepage and stormwater. The water will report to the existing sediment trap and will then enter the return water dam. Stormwater that cannot be managed by this system will either report to the area surrounding the tailings dam within the TSF or will overflow from the sediment trap and will make its way via the upgraded canal at the north west corner of the TSF and report to the Eastern Stormwater Management Canal at Sishen.

9.9 Groundwater

The information on the groundwater environment has been sourced from the Sishen Integrated Water and Waste Management Plan (IWWMP, Shangoni 2017). The structural geology of the region has an important influence on groundwater flow. The fault zones form preferential flow zones and the dykes form impermeable or semi-permeable boundaries. The area surrounding Sishen Mine has been divided into several compartments separated by dykes (see Figure 9-17). Lylyveld lies within the Sishen Mine Compartment.

The boundaries of this compartment are formed by an east-west dolerite dyke, two north-south diabase dykes, a northwest-southeast diabase dyke and a northeast-southwest diabase dyke. The latter dyke has been mined through and breached. This compartment is in constrained hydraulic connection with some of the neighbouring compartments. Constrained hydraulic connection means that there is no direct link across which groundwater can flow freely. The constrained flow is called leakage. The constrained hydraulic connection is because some dykes are younger than others, notably the dolerite dyke is much younger than the diabase dykes. The younger dykes cut through the older dykes. There are also faults that are inferred to cut through some of the dykes. The Sishen Compartment has been dewatered by mining activities.

The Gamagara River Alluvial Aquifer forms a groundwater zone along the Gamagara River. This aquifer has mainly hypoeiric flow below the alluvium. The vertical thickness of this aquifer varies between 10 m to 75 m. It has three sub zones. The first is the zone upstream of the Sishen Mine Compartment where the weathered/fractured aquifers (mainly BIF and dolomite) feed hypoeiric flow into the Gamagara Alluvial Aquifer. The upstream zone is inferred to have a minor impact due to leakage across and above the eastern diabase dyke boundary to the Sishen Compartment. The Gamagara Alluvial Aquifer overlies the diabase dykes as it is younger. The zone of the Gamagara Alluvial Aquifer in the Sishen Compartment is dewatered and does not exist in this area anymore, except during and after flood events when it can have a temporary existence. The downstream zone receives hypoeiric flow from the shallow calcrete aquifer and is not impacted directly by the dewatered Sishen Compartment.

The impact of dewatering at the main Sishen Mine pit is mainly on the deep BIF-Dolomite-Chert aquifer. Since the compartment is dewatered, no additional dewatering activities need to take place at Lylyveld.

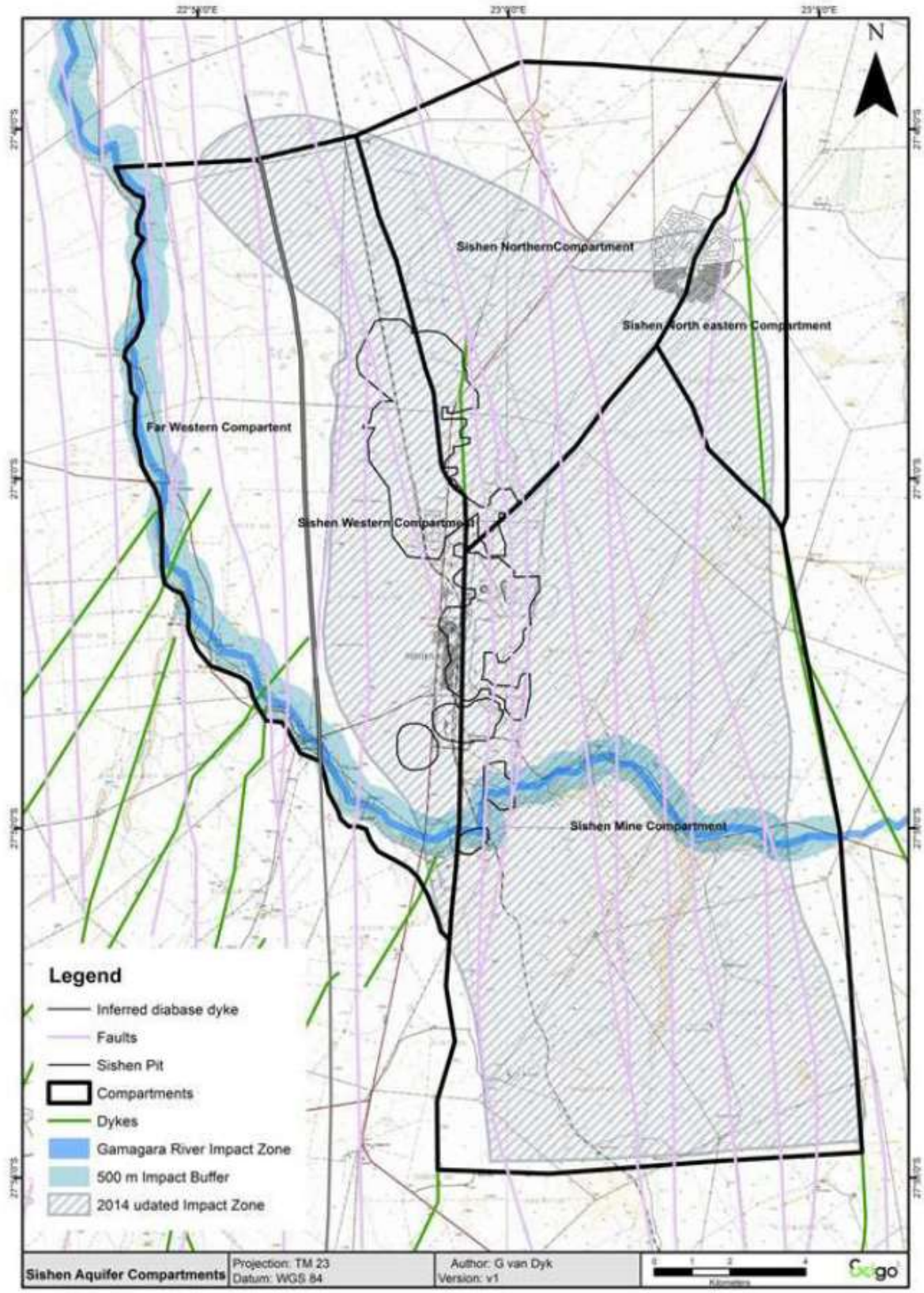


FIGURE 9-16: SISHEN COMPARTMENTS WITH GEOLOGICAL STRUCTURES AND CURRENT IMPACT ZONE (MEYER, 2009).

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There is an extensive groundwater monitoring network at Sishen Mine (see Figure 9-17). 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. Other contaminants detected in groundwater within the main Sishen Mine area include nitrate, ammonia, led and manganese.

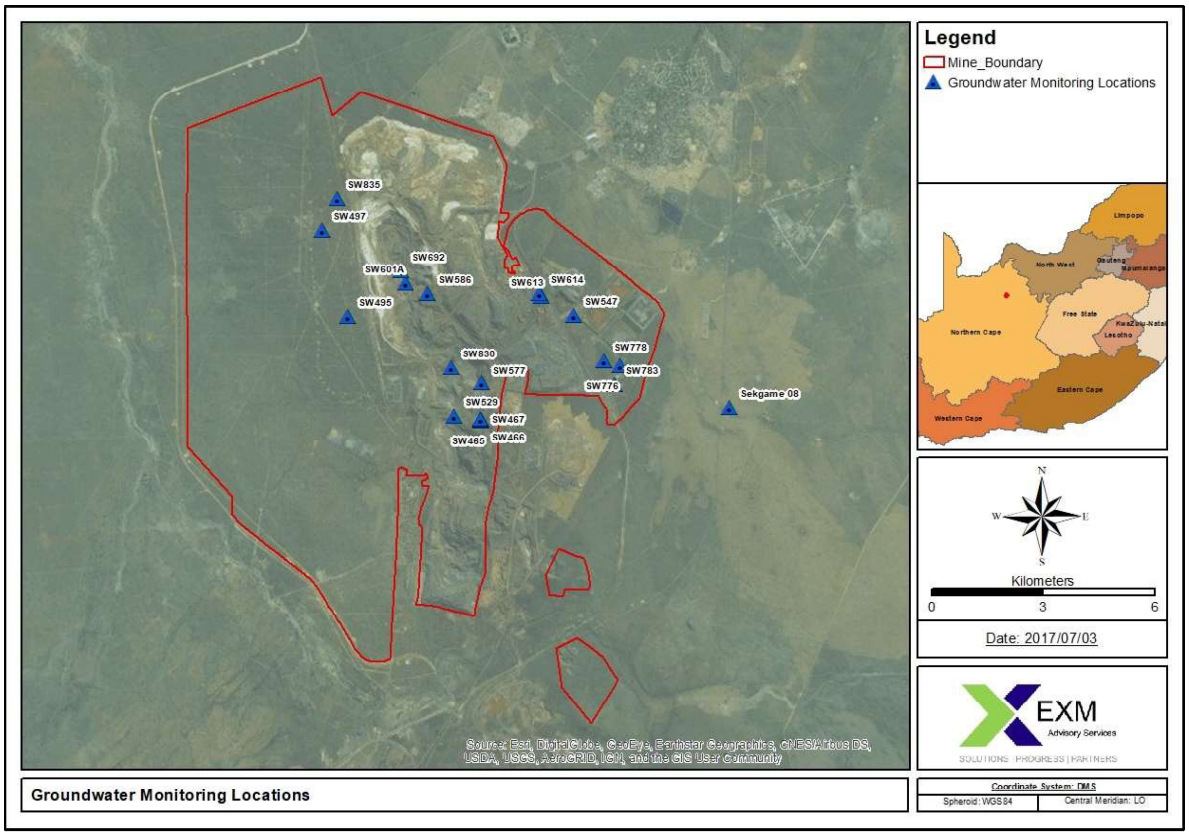


FIGURE 9-17: SISHEN COMPARTMENTS WITH GEOLOGICAL STRUCTURES AND CURRENT IMPACT ZONE

The Sishen Mine residue including the waste rock material has been classified as inert. Current and long-term contamination of groundwater and surface water from the material is shown to be unlikely (Exigo[3], November 2014). The risk of groundwater pollution as a result of waste rock dumps is thus considered to be low.

9.10 Land Tenure

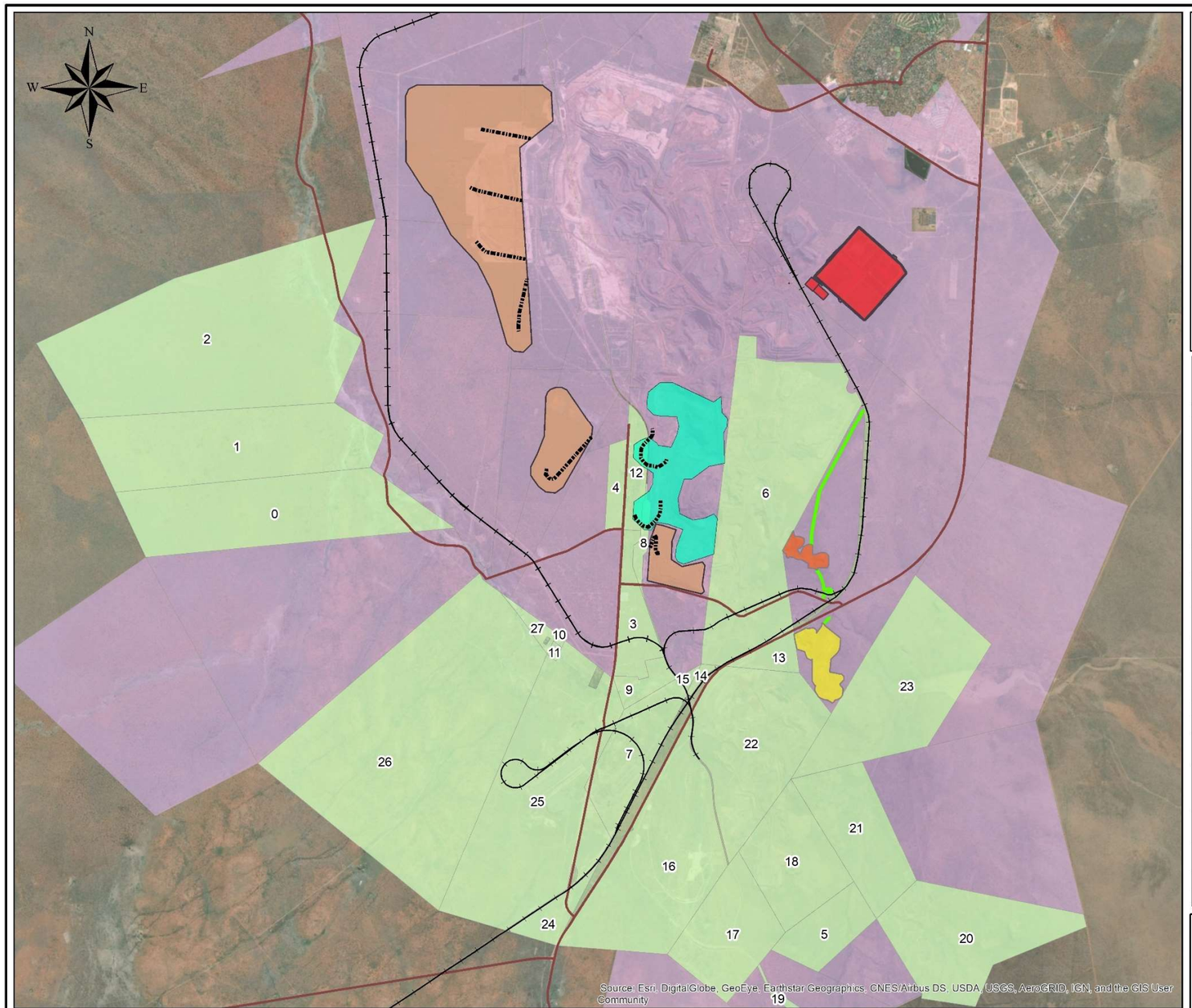
The Lylyveld Expansion, upgrade of the TSF and the establishment of the Trolley Assist Infrastructure will take place on properties owned by Sishen Iron Ore Company (Pty) Ltd and forms part of the Sishen Mine mining right area. The haul road, which is proposed to be realigned and widened does cross servitudes including that for the N14 (SANRAL), the Sishen Saldanha Iron Ore Rail Line (Transnet Freight Rail) and power lines to Sishen Mine (Eskom). Land tenure of affected and neighbouring properties is given in Figure 9-18.

9.11 Cultural Heritage

The landscape of the general area has a rich and diverse heritage. According to these reports historical findings in the region include an Earlier Stone Age sample from the Gamagara River and Earlier Stone Age plus Iron Age material from around pits on the hillside. The latter sites were destroyed by subsequent Iscor prospecting, as was another small Iron Age specularite working on a hill flanking the Gamagara River, on Demaneng 546, that they found in the same year. And from southern Lylyveld 545, is a small Later Stone Age collection made in 1987 from the slopes around a shallow overhang near a beacon, now mined away, at the north end of the ridge, directly south of the N14. Still intact is a low rise with many specularite pits on Mashwening 557, some 6 km to the south-east, where a test trench in 1989 yielded Ceramic Later Stone Age overlying sparse Acheulean, which included a cleaver.

About 6 km to the north-west, on the farms Sishen 543 and Bruce 544, there were many pecked engravings on off – white Gamagara Shale, of which some were saved and donated to the McGregor Museum in 1971. Further away, about 30 km to the north, on the eastern edge of Kathu, there is the Townlands site, an Acheulean quarry of 12 ha extent with about 0.7 billion artefacts, that was latterly declared a Provincial Heritage Site. About 3 km to the north-east of it, on the crest of Kathu Hill, is another Acheulean quarry of similar extent and richness that still remains to be mapped. And between those two localities, just east of the N14 and downslope of the cemetery, is the recently found Cobus Dreyer site, where hand axes are common and cleavers rare, with some bifaces being based on quartzite derived from the Langberg Mountains, 40 km and more to the west. Beaumont (November 2009) discovered 11 jasper artefacts ascribed to the Fauresmith – Acheulean timespan.

The survey of Lylyveld North concluded that the entire area demarcated for development was disturbed and largely devoid of archaeological occurrences. Old roadways and tillage heaps were present within this area, indicating that much of the property has already been altered by previous activities, possibly farming and/or mining.



Legend

- Railway Line
- Roads
- TSF Footprint
- Lylyveld North Footprint
- Lylyveld South Footprint
- Rerouting of Existing Haul Road
- Trolley Assist Lines
- Approved South Pit
- Approved WRD
- Surrounding Land Owners
- Sishen-Owned Property

No.	FARM NAME	FARM NO.	PORTION NO.	OWNER
0	WRIGHT	538	0	S. CORNELISSEN
1	WRIGHT	538	1	J. LOOCK
2	LANHAM	539	0	A. VAN ZYL
3	SISHEN	543	19	GAMAGARA MUNICIPALITY
4	GAMAGARA	541	12	UNKNOWN
5	MOKANING	560	2	ASSMANG LTD
6	BRUCE	544	0	ASSMANG LTD
7	PARSON	564	2	ASSMANG LTD
8	SISHEN	543	2	TRANSNET LTD
9	SISHEN	543	24	MORIA BOERDERY
10	PARSON	564	5	J. HOFFMAN
11	PARSON	564	4	A. HOFFMAN
12	SISHEN	543	16	UNKNOWN
13	BRUCE	544	0	ASSMANG LTD
14	KING	561	0	ASSMANG LTD
15	PARSON	564	2	ASSMANG LTD
16	KING	561	0	ASSMANG LTD
17	MOKANING	560	1	ASSMANG LTD
18	MOKANING	560	3	ASSMANG LTD
19	MOKANING	560	5	TRANSNET LTD
20	HELPEBIETJIE	738	0	NTSU TRADING 601 PTY LTD
21	MASHWENING	557	1	BURK MINING PTY LTD
22	KING	561	0	ASSMANG LTD
23	DEMANENG	546	2	DIRO IRON ORE PTY LTD
24	PARSON	564	0	ASSMANG LTD
25	PARSON	564	0	ASSMANG LTD
26	DINGLE	565	0	DINGLE TRUST
27	DINGLE	565	2	J. HOFFMAN

EXM Advisory Services
SOLUTIONS | PROGRESS | PARTNERS

Sishen Mine: Land Tenure | Date: 2019/11/05 | **Coordinate System: DMS** Spheroid: WGS84 Central Meridian: LO

FIGURE 9-18: SISHEN IRON ORE COMPANY LAND OWNERSHIP

However, one stone tool was located on Lylyveld North, which was a side scraper (formal tool type) made on a chert/chalcedony material (S 27°48'37.0"; E 023°01'41.8"). It was found on the surface of a road running parallel to the southern border of the Lylyveld North area. The scraper had clear signs of steep (~90°) retouch on one of its lateral margins and lacked platform preparation. The artefact was relatively fresh even though it was found on the surface. Based on this, the tool is likely associated with the LSA. Further survey of this area did not locate any other artefacts and thus it is likely a single occurrence. According to PGS Heritage (November 2019(a)) the lack of concentrated artefactual material, this single stone tool is of low significance.

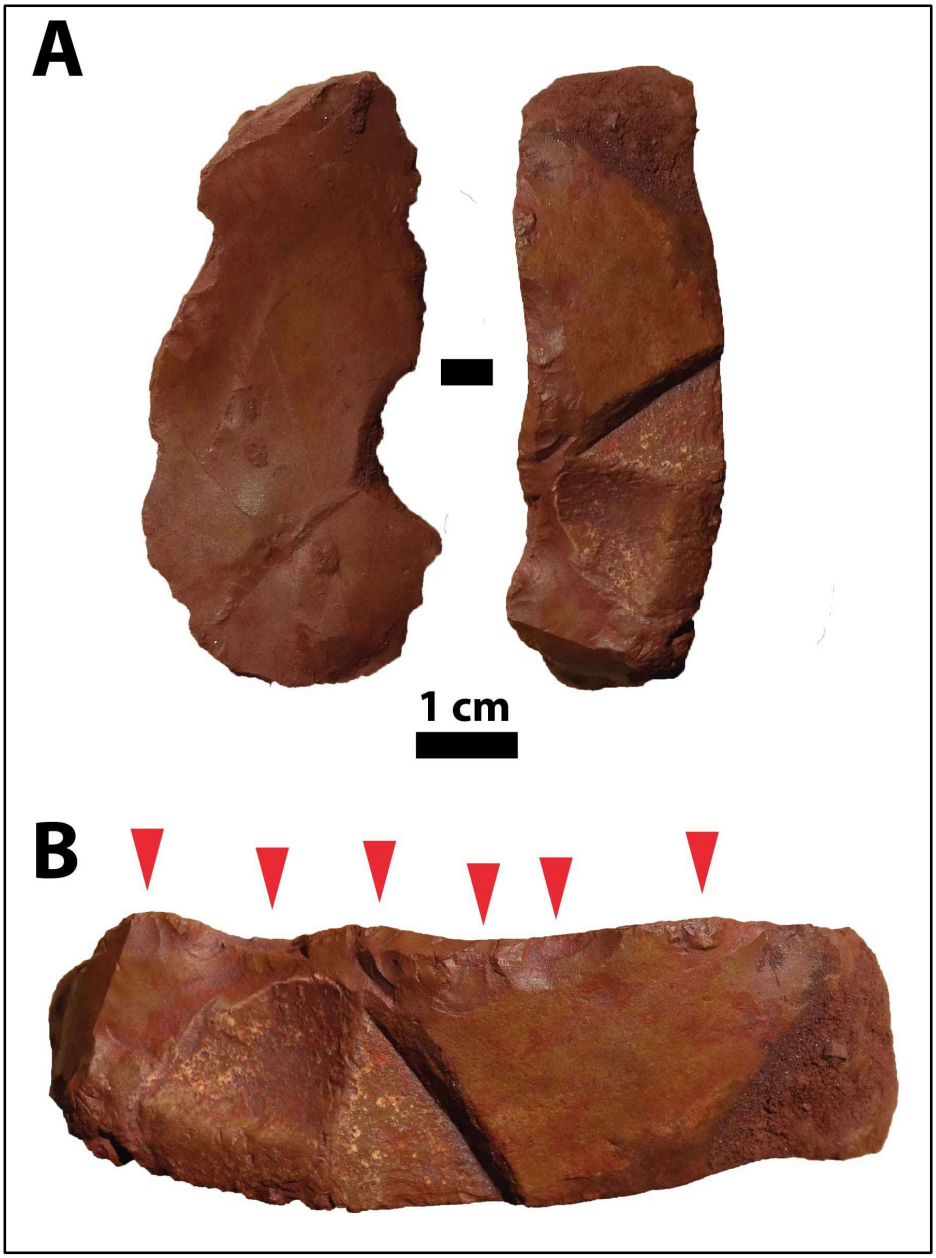


FIGURE 9-19: **STONE TOOL LOCATED DURING THE SURVEY OF LYLYVELD NORTH. A. DORSAL AND MEDIAL VIEW OF THE TOOL. B. RED ARROWS SHOWING THE LOCATION OF SCRAPER (STEEP) RETOUCH**

The survey of Lylyveld South also concluded that the entire area demarcated for development was disturbed and devoid of archaeological occurrences. Tillage heaps and previous coring activities were present within this area, indicating the presence of mining activities.

The haul road also has been heavily disturbed by mining activities and thus any archaeological materials would be limited in terms of their significance.

A paleontological desktop assessment (PGS Heritage, October 2018) of the area also indicated that activities at Lylyveld are unlikely to pose any threat to local fossil heritage. The geological formations in this area, the Ghaap Group (Transvaal Supergroup) and the Vryburg Formation (a sedimentary unit of the Ghaap Group) have not yielded valuable palaeontological finds within the area. Further, the study area is overlain by the Quaternary Kalahari Group sands at extensive depth.

A site visit to assess the TSF as well as Trolley Assist electrical lines alignments was conducted by PGS Heritage on 17 July 2019. It was found that the study area was totally transformed. No heritage resources were identified during the site visit. Based on the findings of the fieldwork and the study completed by PGS Heritage (November 2019(b)) It is evident from the nature of the mining activity and the total transformed landscape that no heritage resources will be impacted by the proposed activities.

9.12 Socio-Economic Environment

Sishen Mine plays a key role in the economy of the Northern Cape, especially in the John Taolo Gaetsewe (JTG) District. JTG comprises the Joe Morolong Local Municipality, Ga-Segonyana Local Municipality and the Gamagara Local Municipality in which Sishen Mine is located (see Figure 9-19).

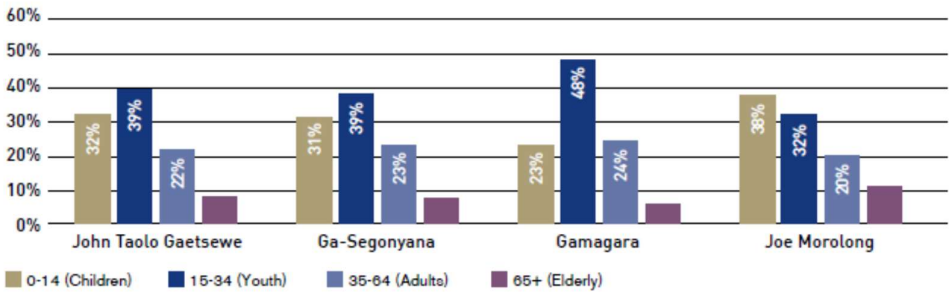
FIGURE 9-20: JOHN TAOLO GAETSEWE DISTRICT MUNICIPALITY

9.12.1 Social Profile

Only 30% of the population in the Gamagara Municipal area have Grade 12 or higher. Of the economically active population, 82.3% are employed and 17.7% are unemployed and 2/3 of the population earn less than R44 521 per annum.

Approximately 63% of the people living in the area rent their accommodation or live rent free (Demacon, 2019). Twenty-two percent of people reside in informal dwellings located in Debeng, Mapoteng and Olifantshoek.

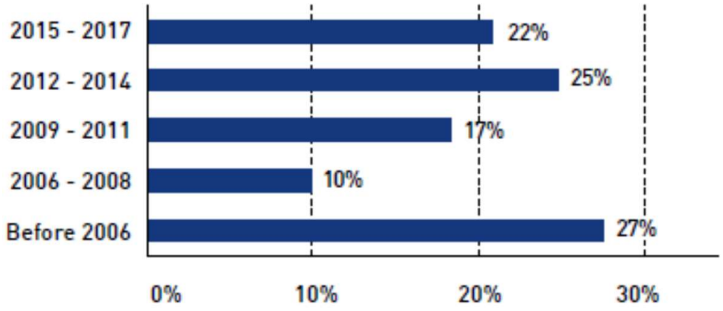
The district population is skewed towards the young with a high percentage of citizens younger than 30. Approximately half of the Gamagara population are between the ages of 15-34.



Source: Sishen SEAT Report 2017/2018

FIGURE 9-21: POPULATION AGE DISTRIBUTION IN JOHN TAOLO GAETSEWE MUNICIPALITY

According to the Sishen SEAT Report 2017/2018, 63% of people residing in Gamagara are not originally from the municipal area. According to the 2017 Gamagara Community Survey, 61% have come to the area in search of jobs and another 37% moved as either they or their partners have found employment in the areas. More than 35 000 have moved into Kathu and surrounds since 2001, with the majority (73%) arriving in the past 11 years (since 2006).



Source: Sishen SEAT Report 2017/2018

FIGURE 9-22: DATE OF ARRIVAL IN GAMGARA LOCAL MUNICIPALITY

While most the new arrivals into Gamagara settled in Kathu (43%), there has also been a significant increase in settlement in Mapoteng (29%).

The economically active segment increased by 6 330 people between 2007 and 2017 in the Gamagara Local which translates into an annual increase of 633 people within the Gamagara Local Economy. The employment sector is increasing with approximately 445 jobs per annum of which 327 is formal employment opportunities (Demacon, 2019).

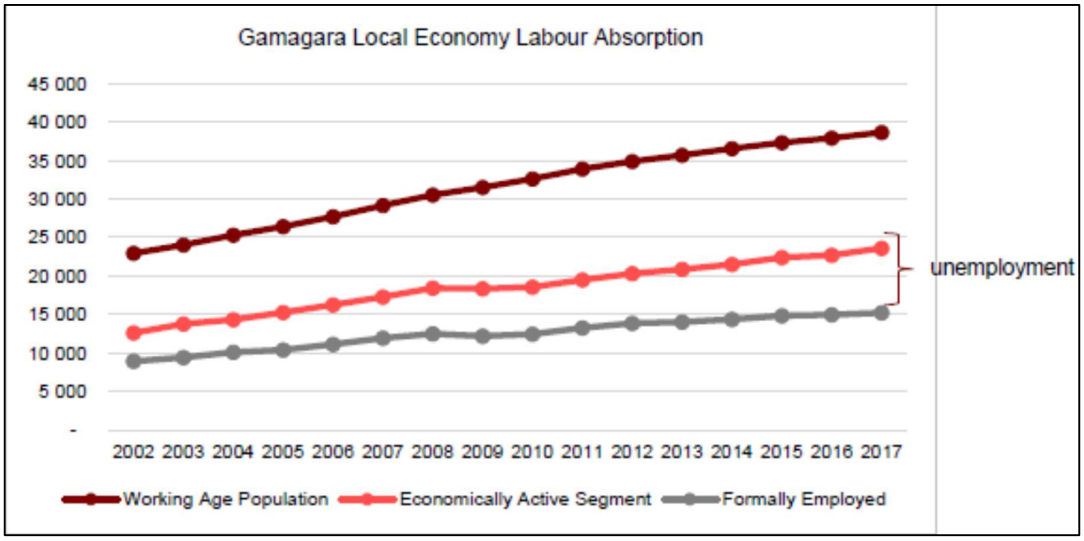
It is thus evident that the economically active segment is growing more rapidly than what the local economy can absorb.

TABLE 9-8: ECONOMICALLY ACTIVE POPULATION GROWTH, 2007-2017

	2007	2017	Net gain / loss	Average Gain / loss per annum
Working Age Population	29 156	38 658	9 503	950
Not economically active	11 873	15 045	3 173	317
Economically Active	17 283	23 613	6 330	633
Total Employment (formal & informal)	14 053	18 500	4 447	445
Unemployment	3 230	15 045	11 815	1 181

Source: Demacon (2019)

Figure 9-22 illustrates the widening gap between the expanding population (economically active segment) and the total employment from 2002 to 2017.

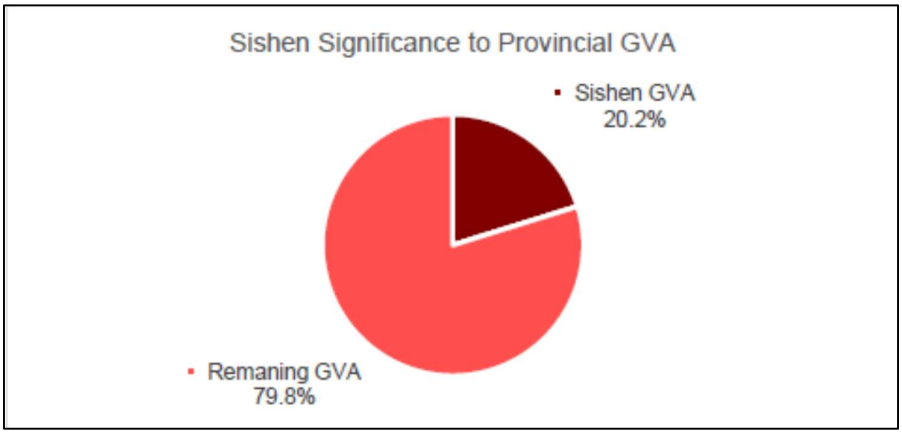


Source: Demacon (2019)

FIGURE 9-23: GAMAGARA LOCAL ECONOMY LABOUR ABSORPTION

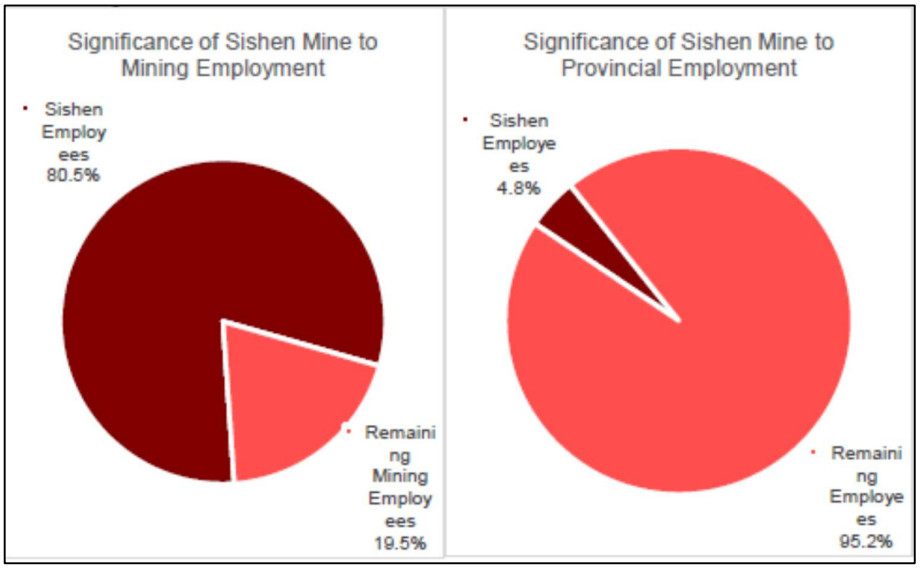
9.12.2 Economic Profile

Mining is the main economic driver in the Northern Cape and contributes 28.9% towards the provincial economy. The district and local economies, mining is even more pronounced with mining contributing 63.1% of the total GVA in the district and 70.4% of the total GVA in the local economy. Mine employees constitute approximately 6% of the provincial employment. 23.% of the district employment and 23.8% of local employment (Demacon, 2019). The contribution of Sishen Mine to the provincial economy and employment is shown in Figure 9-23 and 9-24.



Source: Demacon (2019)

FIGURE 9-24: SISHEN MINE SIGNIFICANCE IN THE PROVINCIAL ECONOMY (2018)



Source: Demacon (2019)

FIGURE 9-25: SISHEN MINE SIGNIFICANCE IN THE PROVINCIAL EMPLOYMENT (2018)

Sishen plays a significant role in the provincial economy, with 20% of the provincial production generated from Sishen Mine.

9.13 Description of current land use and services infrastructure

The land use in the area is dominated by mining activities. Activities at Lylyveld North and Lylyveld South take place within fenced off mining areas which form part of Sishen Mine. The proposed amendments and expansions at Lylyveld North and South, as well as the haul road will require the disturbance of wilderness areas. The new pit at Lylyveld South was however historically mined, although vegetation has established over the historically disturbed areas. The footprint of the expansion project has been reduced according to comments received from the DMR. A portion of the waste rock will be backfilled and only a small area will be converted for the expansion of existing WRD.

Neighbouring activities include stock farming (cattle farming) and mining activities. Land use activities are shown in Figure 9-26. The closest farming activities take place on the farm Demaneng (now owned by SIOC), with the homestead located approximately 3.4 km to the east of Lylyveld South. The house is currently leased to security contractors. The settlements closest to Lylyveld are Dingleton (4 km west), Sesheng (12 km north) and Kathu (12 km north east). The persons residing at Dingleton have largely been relocated to facilitate future mining activities at Sishen to the west.

The Trolley Assist Infrastructure will be established at the existing haul roads within the selected pits (Southern Pushback) and the Western WRDs and Vliegveld WRD at on the Sishen site and no new areas will be disturbed.

The upgrade of the TSF will occur at the current TSF facility with some new pipelines to the existing plant infrastructure. The establishment of the new service roads will require disturbance of small areas adjacent TSF. The new mixing tank will be developed within disturbed areas near the DMS processing plant.

9.14 Description of specific infrastructure on the site

External infrastructure to be affected by the proposed activities at Lylyveld include:

- Public Road to Dingleton

  Haul trucks from Lylyveld South to Lylyveld North will continue to cross the public road (DR3333) to Dingleton. This road is used by remaining residents at Dingleton, traffic to Assmang's Khumani Mine and farmers located to the west. Note that the Dingleton has recently been included in the Sishen Mine mining right. Sishen is in the final steps to relocate persons residing in Dingleton to facilitate future expansion of mining activities in that area. The upgrade of the TSF will not affect infrastructure.

FIGURE 9-26: DR3333 CROSSING

- Sishen Saldanha Iron Ore Export Rail

  The haul road passes underneath the rail line. No changes will be made to the road in this section. The new pit at Lylyveld South will be located within close proximity (~150 m) from the rail line.

- National Road N14

  The haul road passes underneath the N14. No changes will be made to the road in this section. The new pit at Lylyveld South will be located near the N14. The distance to the road has been reduced according to comments received from Transnet.

PLATE 9-2: N14 LOOKING EAST WITH THE OLD HISTORICCAL WORKINGS AT LYLYVELD SOUTH ON THE RIGHT OF THE PICTURE

- Eskom Powerline

  The realignment of the haul road will take place within an Eskom powerline servitude. Eskom has been engaged to provide input regarding the realignment.

No external infrastructure will be affected by the TSF Upgrade and the Trolley Assist developments.

9.14.1 Environmental and current land-use map

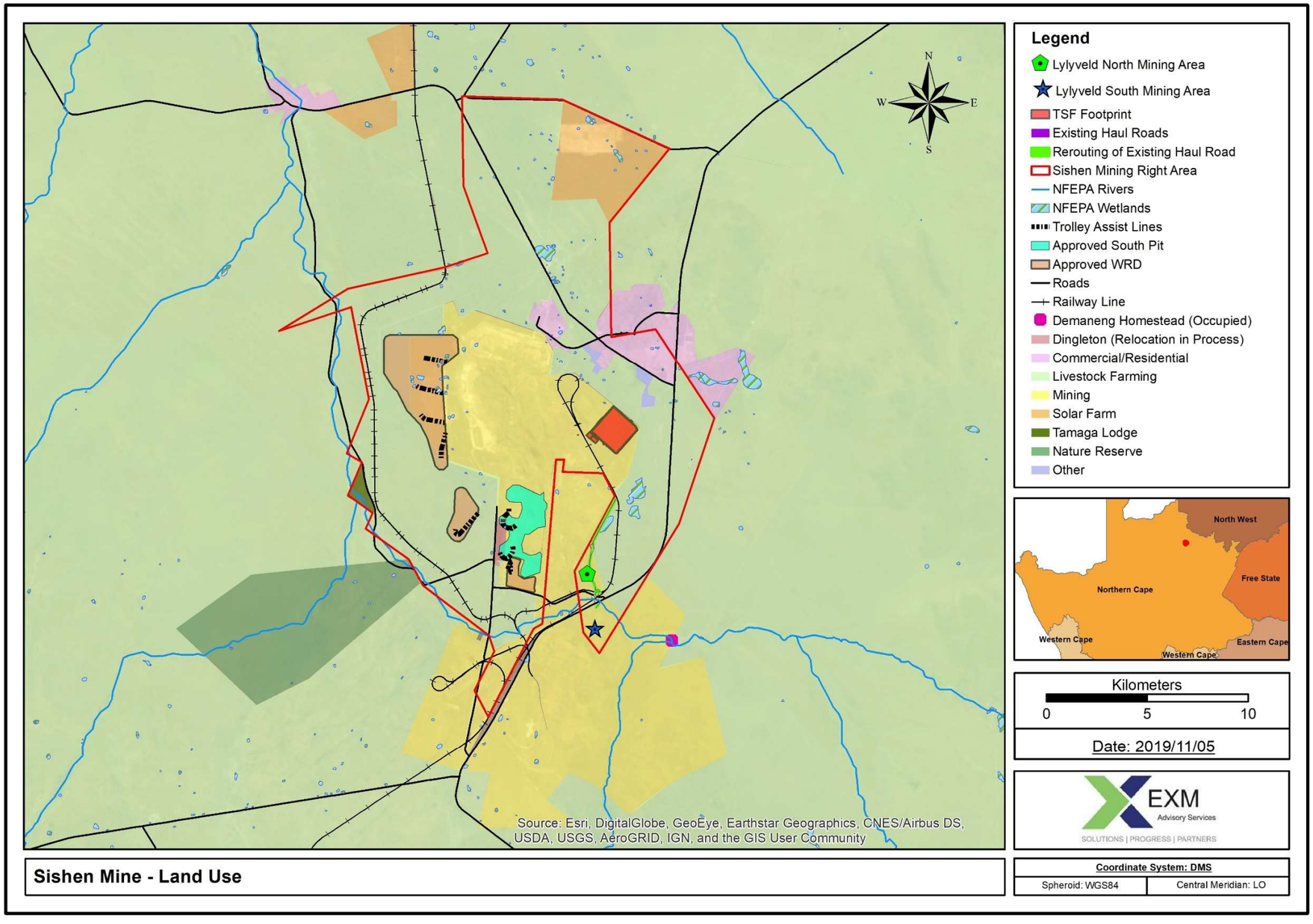


FIGURE 9-27: EXISTING LAND USE AND INFRASTRUCTURE MAP SHOWING LOCATION OF LYLYVELD NORTH AND SOUTH EXPANSION AREAS (APPROVED WRD FOOTPRINTS)

10. IMPACTS AND RISKS IDENTIFIED INCLUDING THE NATURE, SIGNIFICANCE, CONSEQUENCE, EXTENT, DURATION IN AND PROBABILITY OF THE IMPACTS, INCLUDING THE DEGREE TO WHICH THESE IMPACTS CAN BE REVERSED, AVOIDED, MANAGED, MITIGATED AND EXTENT TO WHICH THEY MAY CAUSE IRREPLACEABLE LOSS OF RESOURCES

10.1 Methodology used in determining the significance of environmental impacts

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 EIA.

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.

TABLE 10-1: SEVERITY CRITERIA FOR ASSESSING THE IMPACT SIGNIFICANCE

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	**1**
Short-term: impact lasts for a short time e.g. construction period	**2**
Medium-term: impact lasts for the for less than the life of operation.	**3**
Long-term: impact occurs over the operational life of the project	**4**
Residual: impact is permanent (remains after mine closure)	**5**
EXTENT = SPATIAL SCOPE OF IMPACT/FOOTPRINT AREA/NUMBER OF RECEPTORS	**RATING**
Limited: Impact only affects the mine site or part there of	**1**
Neighbours: Limited to the immediate surroundings;	**2**
Local: Affecting a larger area (beyond immediate surroundings or neighbours)	**3**
District: Affects entire district	**4**
Regional: Affects an entire region e.g. Province	**5**
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

10.2 The positive and negative impacts that the proposed activity will have on the environment and the community that may be affected

NOTE: A COMPREHENSIVE ASSESSMENT OF ALL IMPACTS IS GIVEN IN SECTION 10.5. A SHORT DESCRIPTION OF KEY IMPACTS IS PROVIDED BELOW.

10.2.1 Lylyveld Expansion Project

10.2.1.1 Soils and Land Capability

The expansion activities will predominantly be conducted on previously disturbed areas with low land capability value, other than for mining purposes.

Measures to contain spillages and protect soils from contamination due to spillages from HME are to be put in place. The HME workshop is no longer planned for the site.

10.2.1.2 Groundwater

The zone of the Gamagara Alluvial Aquifer in the Sishen Compartment is dewatered and does not exist in this area anymore, except during and after flood events when it can have a temporary existence. The impact of dewatering at the main Sishen Mine pit is mainly on the deep BIF-Dolomite-Chert aquifer. Since the compartment is dewatered and no groundwater is present, no additional dewatering activities take place at Lylyveld (IWWMP, Shangoni 2017). The Lylyveld expansion project will not result in dewatering and the project will therefore not affect groundwater levels.

The mineral waste streams (rock discard) produced and disposed at Lylyveld were assessed in terms of the National Norms and Standards for the Assessment of Waste for Landfill Disposal (GNR. 635 of 23 August 2013). These regulations consider the leachable concentrations (LC) and total concentrations (TC) of potential contaminants compared to legislated limits. The wastes are then defined as types based on the risk to the environment (groundwater). The containment barriers required to protect the environment from the different waste types are defined in the National Norms and Standards for Disposal of Waste to Landfill (GNR. 636 of 23 August 2013).

Samples of the waste rock produced and disposed at the Lylyveld North and South WRD were collected and assessed according to the abovementioned norms and standards (Exigo[3], November 2014). The results of the waste assessment indicated that the waste rock is a Type 3 waste. However, due to the absence of leachable contaminants it is considered inert as medium- and long-term contamination of the groundwater and surface water from this material is unlikely.

10.2.1.3 Surface Water Resources

The Gamagara River flows between Lylyveld South and Lylyveld North with the haul road linking the 2 sections crosses the river below the N14 and the Transnet Iron Export line. The river will not be directly disturbed by the expansion project.

Sishen proposes to implement a system to divert potentially contaminated runoff from this area to a PCD to prevent potential contamination. The PCD is to be implemented as a matter of urgency. The current proposed clean water diversion does not include the future expanded dumps and mining areas. The diversion is to be expanded prior to the commencement of the expansion of the mining activities.

There is no formal stormwater management infrastructure at Lylyveld North. The stormwater management requirements for this area re to be reviewed in accordance with GNR. 704.

As indicated in Section 7.1.3 thee are two depression wetlands east of the northern portion of the haul road where expansion is proposed. In order to prevent further impacts on these wetlands, no further widening is to take place within the 500 m buffer zone of these wetlands.

10.2.1.4 Air Quality

A comprehensive Air Quality Impact Assessment (AQIA) was conducted by Airshed in 2017 which was used as a baseline to determine the additional impact associated with the proposed Lylyveld expansion project. This section will firstly elaborate on the results of the original AQIA to provide context for the impacts associated with the project.

Because the production rates stay the same, the following sources of emissions will not change: handling of waste and ore in the open pit and at the waste dumps; drilling and blasting, transport of waste and ore (although the roads might change slightly). The open pit activities may move to new pit areas; however, the emissions will stay the same.

The sources that are expected to show an increase in emissions will be windblown dust from the waste dumps as these will increase in size.

Additional sources of emission and associated pollutants considered in the emissions inventory included:

- Windblown dust from the Lylyveld North waste dumps, the expanded stockpile area has relevance – PM2.5, PM10 and TSP.
- Windblown dust from the Lylyveld South waste dumps, the expanded WRD area has relevance – PM2.5, PM10 and TSP.

All emissions were determined through the application of ADDAS (an Airshed in-house emission from windblown dust model). Estimated annual average emissions, per source group, are presented in Table 10-3. The increase in emissions due to the Sishen Lylyveld expansion project are shown in Table 10-4. The increase in Sishen emissions due to the project is **less than 0.3%.**

TABLE 10-2: ESTIMATED ANNUAL AVERAGE EMISSION RATES FOR THE ADDITIONAL SOURCES FOR THE PROPOSED SISHEN LYLYVELD EXPANSION PROJECT

Source group	Total Suspended Particulates (TPA)	PM 10 (TPA)	PM2.5 (TPA)
Windblown dust from Lylyveld North proposed new and expanded waste dumps	9	5	1.5
Windblown dust from Lylyveld South proposed new and expanded waste dumps	21	11	3.5
Total Emissions	**30**	**16**	**5**

Source: Air Quality Impact Assessment (Airshed, July 2019)

TABLE 10-3: ESTIMATED INCREASE IN ANNUAL AVERAGE EMISSION RATES DUE TO THE PROPOSED SISHEN LYLYVELD EXPANSION PROJECT

Source group	Total Suspended Particulates (TPA)	PM 10 (TPA)	PM2.5 (TPA)
Additional sources due to proposed Sishen Lyylveld expansion project	30	16	5

Total increase in emissions (%)	**0.23**	**0.33**	**0.28**

Source: Air Quality Impact Assessment (Airshed, July 2019)

Although the proposed Lylyveld expansion project has a low significance ranking, the current and therefore the cumulative significance ranking is high, so the mine in general needs to mitigate to reduce to a moderate or low significance ranking. Due to the already elevated baseline levels, mitigation should be included at the proposed Lylyveld expansion project to ensure particulate matter levels are as low as possible.

10.2.1.5 Noise Impacts

The extension of the life of Lylyveld will not result in a change in the current noise levels as activities will simply continue for an extended period of time. However, current noise levels at Sishen Mine are considered acceptable (see Section 9.5) and the extensions a Lylyveld will not result in a significant change to such impacts. It is however recommended that future noise monitoring include monitoring in the vicinity of the Lylyveld mining activities.

10.2.1.6 Neighbouring Land Use

The expansion project has the potential to impact on service infrastructure such as roads, railway line and power supply lines. The expansion activities (establishment of new pit area) at Lylyveld South will be conducted relatively close to the N14 national route. The original project layout has been amended in order to establish an appropriate buffer of 100 m, according to legal requirements to prevent impacts on the N14. A safety risk assessment in terms of the Mine Health & Safety Act should blasting take place within 500 m of the N14.

The realignment of the existing haul road will pass underneath Eskom power lines. It should be taken into consideration that the existing haul roads already passes underneath the powerlines. A wayleave must be obtained from Eskom for the realignment of the haul roads.

The expansion of the WRD will allow a 30m zone for rehabilitation purposes, not for additional waste rock disposal.

Activities at Lylyveld South take place in close proximity to an Eskom servitude. The layout planning has been changed wot ensure that WRDs do not encroach on such servitudes.

10.2.1.7 Terrestrial Biodiversity

The study area and surrounding degraded bushveld habitat does provide suitable habitat for a variety of floral species of conservation concern (Scientific Terrestrial Services, 2019). It is recommended that a detailed survey be undertaken prior to the clearance of any vegetation to identify such species and the necessary permits/licences obtained, if required.

One of the most significant impacts on the terrestrial ecology is dust generation from mining activities, which accumulate on the leaves of floral species, thereby reducing the photosynthetic ability of plants. The vegetation of the study area is however considered to be of moderately low ecological sensitivity. Current dust generation by the existing mine is high, and as such the additional impact on the terrestrial ecology from the expansion activities is considered to be low, relative to the existing Sishen mine.

Prior to the implementation of mitigation measures, the impact on the terrestrial ecology the expansion activities at Lylyveld North and South is considered moderate. With mitigation fully implemented impacts can be reduced to low significance.

10.2.1.8 Heritage

As indicated in Section 9.11 there are no sites of heritage significance in the areas to be disturbed by the Lylyveld Extension. Therefore no archaeological or heritage mitigation is needed for the proposed development activities as assessed to continue. However, the following general recommendations are required:

- A Chance-Find Procedure must be developed that must include:
    - If a deposit is identified a controlled sampling of the material found should be done;
    - 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;
    - These test excavations and sampling must be done after a permit has been granted under Section 35 of the NHRA to a qualified and experienced Stone Age archaeologist;
    - A close out report must be submitted to SAHRA
    - In the event that substantive material is uncovered, it is recommended that a display is considered in a convenient location.

As per the palaeontological desktop assessment (PGS, October 2018) the proposed development is unlikely to pose any substantial threat to local fossil heritage and developments should go forward. However, should fossil remains be discovered during any phase of construction, either on the surface or exposed by fresh excavations, 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 (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.

10.2.1.9 Traffic

A traffic assessment was conducted in 2015 to obtain a wayleave for the Lylyveld haul road/ DR3333 crossing. The recent traffic impact assessment (JG Afrika, July 2019) found that the future traffic volumes predicted in the 2015 study has not changed substantially. The most significant risk identified is the creation of dust from trucks traveling on the haul road which is blown onto the crossing, causing poor visibility and poses a risk to traffic crossing the intersection. The dust at the intersection is also due to inadequate dust suppression on the haul roads. The steeper gradient of the gravel haul road north of the intersection and the relatively flat crossing area may result in gravel being washed onto the road during rainstorms.

FIGURE 10-1: HAUL ROAD AND DR3333 CROSSING – LOOSE MATERIAL ON SURFCE

Immediate mitigation should be to increase dust suppression and regular mechanical sweeping to the clean the surfaced area. It is recommended that a dust suppressant be applied at least 10 m before and after the crossing as a minimum. Depending on the life of the crossing, it may be warranted to construct a proper intersection and to surface the approaches at least 40 m long. The length is recommended so dust and gravel can be deposited before the crossing.

The road signs are not adequate for a 4-way stop and do not comply with the relevant regulations. It is also recommended that the stop sign sizes be increased.

Mining activities (such as blasting) at the new Lylyveld South pit will pose a safety risk to road users on the N14. Blasting poses a risk to persons including road users within 500 m. No blasting is to be undertaken within 500 m unless the safety risk assessment is completed and in accordance with the Mine Health & Safety Act. The widening of the road will facilitate the safe passing of haul trucks and thus will improve the safety at the Lylyveld operations.

10.2.1.10 Visual Impacts

The Lylyveld Project will be visually intrusive to receptors travelling on the N14. However, the area is dominated by existing mining activities and the visual intrusion of the expansion activities will be insignificant compared to the extent of the current mining footprint in the area.

The natural topography will shield most of the proposed expansion activities at Lylyveld South for vehicles travelling from Postmasburg/Olifantshoek in a north eastern direction. The expansion activities at Lylyveld North will be visible from this point, but the activities will form part of the current footprint and therefore reduce the visibility thereof.

The proposed expansion activities at Lylyveld South and North will be visible from the N14 and DR3333 intersection. The visual footprint of the current mining activities is however the most prominent at this point and the proposed expansion activities will be absorbed by the current activities, to a large extent.

The proposed expansion activities at Lylyveld South and North will be visible for vehicles travelling to Postmasburg/Olifantshoek in a south western direction. Vegetation provides some cover and will reduce the visibility of the proposed expansion activities. The current footprint of existing mining activities will also provide a buffer for the visual footprint of the expansion activities.

The southern section of Lylyveld South in the area where the pits will be expanded is visible a homestead to the east. The area falls within the existing disturbed footprint of Lylyveld south and the pits will not cause significant additional visual intrusion. Lylyveld north is not visible from this receptor point due to the natural topography of the area.

In summary the visual impacts associated with the proposed expansion activities at Lylyveld South will have a moderate significance rating prior to the application of the proposed mitigation measures and the significance rating will be low after the application of the mitigation measures. The visual impacts associated with the proposed expansion activities at Lylyveld North will have a low significance rating prior to the application of the proposed mitigation measures and the significance rating will be very low after the application of the mitigation measures.

The following mitigation is proposed to reduce the visual impacts:

- Optimise the backfilling/infilling of pits with waste rock to minimise the footprint of the waste rock dumps. Backfilling/infilling must be viewed as the first option.
- Concurrent rehabilitation must be conducted in terms of the Sishen Mine rehabilitation plan.
- The footprint of the expansion activities must be limited to the mitigated/revised layout

10.2.1.11 Socio-Economics

The ROM extracted at the Lylyveld operations will remain the same and therefore no additional full-time jobs will be created, except for technical support at the HME workshop. Currently the operations contribute approximately 1 million tonnes per annum (Mtpa) Run of Mine (ROM) to the Sishen Mine production, which amount to approximately 3% of the total ROM of Sishen. There are currently two contractors responsible for the load and haul operations at Lylyveld North and South combined, employing 132 people, operating in 2 shifts. The proposed expansion project will increase the life of operations at Lylyveld from 2022 to 2032 which will ensure that the current employment at the operations remain for an additional 10 years. The indirect socio-economic contribution such as salary expenditure at local business and associated benefits for the local economy will also remain intact for an additional 8 years. Some temporary jobs (approximately 10 persons) will be created during the construction phase of the expansion activities.

The increased LOM of the Lylyveld operations will sustain the contribution of the operations to the national GDP and local economy for an additional 12 years. Sishen Mine, has, through its community development programmes, improved the lives of local people and households.

As for all projects at Sishen Mine, there is a risk of unmet expectations by local service providers and job seekers. Effective engagement with stakeholders and communities as to planning is thus required. The Lylyveld personnel are to provide support to Sishen Public Affairs Department in this regard.

10.2.2 TSF Upgrade Project

10.2.2.1 Soil and Land Capability

The upgrade of the TSF will be conducted on the existing TSF footprint which is significantly disturbed and degraded. Any soil removed during the construction phase is to be stockpiled for use in the rehabilitation of construction disturbance. The greatest risk to soils is during the construction phase. Care needs to be taken to ensure that soils are protected from contamination to leaks and spillages for chemical substances including hydrocarbons during this phase. Stringent requirements are to be placed on contractors to adhere to Sishen's hydrocarbon and spill management procedures.

10.2.2.2 Groundwater

The project allows for the improvement of water management at the facility. The drain pipes at the base of the tailings dams will be extended to ensure that should any seepage from the tailings occur in the future this will enter the solution trench.

10.2.2.3 Water Consumption

The proposed upgrades also provide for water saving measures by improving on the current operational densities of approximately 1.3 t/m^3, to a new operating range between 1.5 and 1.7 t/m^3 to a maximum of 1.9 t/m^3. The solution trench will be reinstated and upgraded to carry both seepage (if it occurs) as well as stormwater to the existing sediment trap, thus allowing water to be returned to the return water dam and back to the process.

10.2.2.4 Surface Water Resources

The solution trench will serve to channel some stormwater into the system via the existing sediment trap. Overflow from this system will be directed to the stormwater management infrastructure at Sishen Mine. The sediment trap and the solution trench need to be maintained and cleaned regularly to ensure that the capacity of this system is kept to a maximum. Of importance is the instatement of the planned cleaned water diversion at Sishen to intercept stormwater entering into the area.

10.2.2.5 Air Quality

Earthworks and construction activities may result in an increase in dust levels at the site and surrounds. Given the existing dust levels in the area, any activities that could contribute to a cumulative impact in dust must be managed. Dust suppression at areas of work and on roads used by construction traffic is imperative to minimise any additional dust as a result of the project.

10.2.2.6 Noise

It is not expected that the project will result in a significant increase in noise levels. However, all equipment should be kept in a high level of maintenance to ensure that noise levels are kept to a minimum.

10.2.2.7 Biodiversity

As indicated in Section 9.6.2, two specimens of V. erioloba have established in the existing disturbed footprint of the TSF and will be impacted on by the upgrade. These trees are to be clearly demarcated and avoided if possible. As indicated in Section 5.5 a licence is to be obtained from DAFF prior to the removal of these trees.

Care should also be taken to minimise the disturbance of vegetation that has established in the TSF, as this serves to control the entrainment of dust and also provides a biodiversity habitat within the area with a view to moving towards the closure objectives of the mine.

10.2.2.8 Cultural Heritage

As indicated in Section 9.11, no artefacts of heritage significance are known to occur on the area to be disturbed by the project. The following recommendations are however made (PGS Heritage (November 2019a)):

- A Chance finds procedure must be developed that must include:
    - If a deposit is identified a controlled sampling of the material found should be done;
    - 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;
    - 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;
    - A close out report must be submitted to SAHRA
    - In the event that substantive material is uncovered, it is recommended that a display is considered in a convenient location;

- In the unlikely event of any unmarked human burials, burial pits, potsherds or stone tools being uncovered during earthworks for the proposed development, these must be reported immediately to the South African Heritage Resources Agency – Burials and Graves Unit (Mrs Thinghangwi Thivhase - 012 320 8490 / 4968).

10.2.2.9 Visual Environment

The proposed upgrade of the TSF will not result in any significance change in the scenic quality or visual intrusion of the facility.

10.2.2.10 Socio-Economics

The project provides the opportunity for short-term local procurement and employment during the construction phase. Of importance is the adherence of contractors to Sishen's targets in terms of maximising local employment and use of local services to ensure the maximum benefit to the local economy. Projects increase the risk of human rights abuses particularly through contractors not providing adequate living conditions to their employees. Compliance to Sishen's standards is to be reported on and audited during the construction phase.

The project team is to work with and provide the necessary support to Sishen's Public Affairs personnel to ensure that details on the project, including procurement and employment opportunities are communicated with stakeholders and the communities to ensure that potential impacts associated with influx and also expectations are planned for and managed.

10.2.3 Trolley Assist Infrastructure

The Trolley Assist infrastructure will be instated within pits and WRDs at Sishen Mine. There will thus be no disturbances resulting from the developments. Impacts on the physical environment are thus generally considered to be insignificant. The project has a positive impact in that tail pipe emissions from haul trucks will be reduced due a significant decrease in diesel consumption. The implementation of the infrastructure can be expected to result in some short-term procurement and employment opportunities. It is however anticipated that the bulk of the expenditure will be with specialised service providers for the type of infrastructure although some civils type works will be required and can be sourced locally. As indicated for both the Lylyveld Extension Project and the TSF Upgrade Project, stakeholder engagement is imperative to manage public perceptions and expectations.

10.3 The possible mitigation measures that could be applied and the level of residual risk

The mitigation measures for each of the identified impacts are included in Tables 10-5, 10-6 and 10-7 in Section 10.7 and also described in Section 10.2. Mitigation of key impacts and risks are also discussed in detail in Part B: Environmental Management Programme.

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.

Mitigation Confidence Negative Impacts

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

Enhancement Confidence Positive Impacts

1	Very High Risk (no confidence)	Measures are very difficult or expensive to implement or are not expected to be effective in enhancing the impact.
1.2	High Risk (low confidence)	Measures are difficult or expensive to implement or are expected to have limited effectiveness in enhancing the impact (20% Confidence)
1.5	Moderate Risk (moderate confidence)	Measures can be implemented with some effort and cost and/or the measures can be effective in enhancing the impact if implemented (50% Confidence)
1.8	Low Risk (high confidence)	There is high confidence that mitigation measures can be implemented and can be effective in enhancing the impact (80% Confidence)

10.4 Motivation where no alternative sites were considered

Not applicable as alternatives layouts have been considered based on the mitigation of impacts. Alternatives considered are described in Section 7.

10.5 Statement motivating the alternative development location within the overall site

The project alternatives and the motivation for the selection of the preferred alternative is provided in Section 7. The preferred layout alternatives are provided in:

Figure 4-1 (Lylyveld North)

Figure 4-2 (Lylyveld South)

Figure 4-3 (Lylyveld Haul Road Widening)

Figure 4-4 (TSF Upgrade)

Figure 4-10 (Trolley Assist Infrastructure).

10.6 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 10.1 for the methodology used in the ranking of impacts. Please refer to Section 10.3 for the methodology used for the application of a mitigation confidence ranking to the impact ranking.

10.7 Assessment of each identified potentially significant impact risk

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.

TABLE 10-4: LYLYVELD EXTENSION - IMPACT RISK ASSESSMENT

IMPACT CATEGORY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Soils	Loss of available soils due to improper handling during stripping of footprint areas.	C	2	5	3.5	1	2.25	0.8	1.8	Minimise footprint of disturbance to that needed for development of infrastructure. Strip available topsoil for use in rehabilitation. Protect stockpiles from erosion.	0.5	0.9
Soils	Soil contamination due leaking of hydrocarbons from HME used on site.	C&O	3	4	3.5	2	2.75	0.6	1.65	Drip trays are to be provided where mobile equipment has the potential to drip oil. Such machinery is removed from site for repair at designated facilities. No informal maintenance is to take place at site. Implement spill prevention and emergency response procedure. Implement good housekeeping practices.	0.5	0.8

IMPACT CATEGORY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Groundwater	Contamination of underlying aquifers due potential leaks or spillages from HME used on site	C&O	3	4	3.5	2	2.75	0.6	1.65		0.5	0.825
Groundwater	Dewatering impacts	O	5	5	5	3	4	0.2	0.8	No additional dewatering is requires as existing dewatering has lowered the groundwater levels in the area.		
Groundwater	Contamination of underlying aquifers as a result of seepage from waste rock dumps.	O	3	5	4	3	3.5	0.4	1.4	Expand Groundwater Monitoring Network to include additional borehole/s in Lylyveld area.	0.8	1.12
Surface Water Resources	Contamination of surface water resources due to contaminated run-off due to leaks or spillages from HME used on site,	C&O	2	4	3	3	3	0.6	1.8	Implement above measures for the protection of soil and groundwater resources. Implement measures for the containment of dirty water stormwater (approved PCD) and protection of Gamagara River. Monthly monitoring of water quality within the PCD.	0.8	1.44

IMPACT CATEGORY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Surface Water Resources	Contamination of surface water resources due to contaminated run-off from mining, stockpile and WRD areas.	O	5	4	4.5	3	3.75	0.8	3	Expand surface water management infrastructure for the containment of dirty water run-off and the diversion of clean water to incorporate new mining and disposal areas at Lylyveld South. Review stormwater management requirements for Lylveld North and implement in accordance with GNR. 704.	0.8	2.4
Surface Water Resources	Disturbance of wetlands due to haul road widening	C	3	5	4	3	3.5	0.8	2.8	Implement revised layout plan with no widening to take place within the 500 m buffer of the wetland.	0.5	1.4
Air Quality	Increased dust emissions due to increased footprint of the expansion activities	O	2	4	3	3	3	0.8	2.4	Implement Sishen Mine Dust Management Plan. Enforce speed limit. Conduct dust suppression on unpaved road, i.e. wet suppression or chemical stabilisation. Continue to implement complaints management procedure. Proper maintenance of	0.5	1.2

IMPACT CATEGORY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
										dust monitoring equipment. Monitor effectiveness of dust control measures and revise dust management plans in response. Limit footprint of exposed areas during development of expansion activities. Manage tipping heights. Rehabilitation of disturbed areas as per rehabilitation plan.		
Noise	Increase in noise levels due to expansion activities	O	1	4	2.5	1	1.75	0.4	0.7	Equipment is to be kept in a high level of maintenance. Noise complaints will continue to be monitored and managed through the Sishen External Complaints Procedure.	0.2	0.14
Neighbouring Land Use	Damage to powerlines due to rehabilitation of eastern WRD at Lylyveld South.	O	5	5	5	3	4	0.4	1.6	Maintain buffer from WRD to Eskom servitude to prevent damage to Eskom infrastructure.	0.5	0.8

IMPACT CATEGORY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Neighbouring Land Use	Damage to powerlines due to rehabilitation of eastern WRD at Lylyveld South.	O	5	5	5	3	4	0.4	1.6	Future mining activities to not encroach on the existing Eskom Servitude without the necessary consultations and approval from Eskom.	0.5	0.8
Neighbouring Land Use	Disturbance of power line servitude for the realignment of the haul road.	C	3	4	3.5	3	3.25	1	3.25	Obtain the necessary permissions from Eskom of crossing of the servitude and adhere to the conditions of the wayleave.	0.5	1.625
Neighbouring Land Use	Damage to the N14 road due to blasting.	O	5	4	4.5	3	3.75	0.8	3	Implement revised layout to ensure that pit does not encroach on 100 m from infrastructure. Sishen to comply with legal requirements in terms of the Mine Health and Safety Act. This will include a safety risk assessment.	0.8	2.4
Neighbouring Land Use	Damage to railway infrastructure.	O	5	4	4.5	3	3.75	0.8	3		0.8	2.4
Biodiversity	Disturbance of vegetation and habitats for the development of lay down areas, HME maintenance area, expanded WRD and pit areas	C	4	5	4.5	2	3.25	0.8	2.6	Mark all individuals of Species of Conservation Concern Obtain relevant permits for the removal of SCC. Restrict vehicles to travelling only on designated roadways to limit the ecological footprint of the	0.5	1.3

IMPACT CATEGORY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
										expansion activities; No uncontrolled fires whatsoever should be allowed; No collection of firewood, floral SCC or medicinal floral species must be allowed by construction or mining personnel; Restrict footprint of expansion to the predetermined extent. No trapping or hunting of any faunal species is to take place Conduct rehabilitation according to the Sishen rehabilitation plan		
Cultural Heritage	Disturbance of archaeological deposits due to the development of the HME maintenance area, expanded WRD and additional pit area.	C	4	4	4	2	3	0.2	1.2	Implement Chance --Finds Procedure	0.5	0.6

IMPACT CATEGORY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Cultural Heritage	Disturbance of palaeontological deposits due to the development of the HME maintenance area, expanded WRD and additional pit area.	C	4	4	4	2	3	0.2	1.2		0.8	0.96
Traffic impacts	Safety risk due to haul trucks crossing DR 3333	C&O	4	4	4	3	3.5	1	3.5	Adequate dust suppression must be conducted on the haul road. Apply chemical dust suppression on haul road 100 meters from the intersection. Conduct sweeping at the intersection to get rid of loose particles. Adequate signage must be placed at the intersection. Consider surfacing the intersection for 40 m on either side to allow loose material to be overloaded prior to the intersection.	0.8	2.8

IMPACT CATEGORY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Traffic impacts	Risk of blasting at Lylyveld South to vehicle travelling on the N14	O	5	4	4.5	3	3.75	0.6	2.25	Implement revised layout plan with 100 m buffer from N14. Sishen to comply with legal requirements in terms of the Mine Health and Safety Act. This will include a safety risk assessment.	0.8	1.8
Visual Environment	Increased visual intrusion and loss of scenic quality (Lylyveld South).	O	3	5	4	3	3.5	0.8	2.8	Optimise the backfilling/infilling of pits with waste rock to minimise the footprint of the waste rock dumps. Backfilling/infilling must be viewed as the first option. Concurrent rehabilitation must be conducted in terms of the Sishen Mine rehabilitation plan. The footprint of the expansion activities must be limited to the mitigated/revised layout	0.4	1.12
Visual Environment	Increased visual intrusion and loss of scenic quality (Lylyveld North)	O	2	5	3.5	3	3.25	0.6	1.95		0.4	0.78
SOCIO-ECONOMICS	Continued opportunity for local procurement for haulage of ore due to the extension of the life of operations.	C	2	4	3	3	3	0.8	2.4	Preferential procurement plan for local service providers.	1	2.4

IMPACT CATEGORY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
	Continued opportunity for local employment due to extension of life of operations.	C	1	4	2.5	3	2.75	0.8	2.2	Contractors to adhere to preferential local employment in line with Sishen Mine targets and commitments.	1.2	2.64
	Local employment of persons involved directly or indirectly in construction of the HME workshop.	C	1	1	1	3	2	0.8	1.6	Contractors to adhere to preferential local employment in line with Sishen Mine targets and commitments.	1.2	1.92
	Strained relationships with selected stakeholders due to unmet expectations of economic benefits from the mine	C	4	2	3	4	3.5	0.8	2.8	Engagement plan to ensure that stakeholders are being kept up to date with the project and the opportunities for local community members – management of expectations. Project to align with Sishen's Public Affairs Department and provide support where required. Effective engagement with key stakeholders.	0.8	2.24

TABLE 10-5: UPGRADE OF TAILINGS STORAGE FACILITY - IMPACT RISK ASSESSMENT

IMPACT CATEGORY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Soils	Loss of available soils due to improper handling during construction.	C	1	4	2.5	1	1.75	0.4	0.7	Minimise footprint of disturbance to that needed for development of infrastructure. Protect stripped soils for use in rehabilitation of areas disturbed during construction.	0.4	0.28
Soils	Soil contamination due to storage and handling of potential pollutants at the laydown areas and areas of work.	C	2	2	2	3	2.5	0.8	2	Hazardous substances must be stored in bunded areas and handled on impervious surfaces. Waste to be stored in allocated areas in line with regulatory requirements. Additional	0.5	1

IMPACT CATEGORY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Groundwater	Contamination of underlying aquifers due to storage and handling of potential pollutants at laydown areas	C	3	2	2.5	2	2.25	0.8	1.8	temporary toilets and ablutions are to be provided in laydown areas and in areas of work where there are no existing facilities. Equipment which has the potential to leak oil or other chemicals are to be stored on impervious surfaces within bunded areas. Drip trays are to be provided where mobile equipment has the potential to drip oil. Implement spill prevention and emergency response procedure. Implement good housekeeping practices.	0.5	0.9
Groundwater	Contamination of underlying aquifers as a result of seepage from TSF.	O	2	4	3	2	2.5	0.6	1.5	The Upgrade of the TSF allows for better management and monitoring of underdrains.	0.5	0.75
Water Consumption	Improvement in operations efficiency resulting in water saving and increased return water for use in processing.	O	4	4	4	2	3	1	3	Optimise the capacity of infrastructure to allow for water to be returned for use in the process.	1	3

IMPACT CATEGORY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Surface Water Resources	Contamination of surface water resources due to overflow of stormwater management infrastructure.	O	3	4	3.5	3	3.25	0.8	2.6	Run-off is to be directed to stormwater management infrastructure (in the process of being upgraded). Clean water to be prevented from entering TSF. Maintain water management infrastructure to ensure operation at maximum capacity.	0.8	2.08
Surface Water Resources	Contamination of surface water resources due to storage and handling of potential pollutants at laydown areas	C	3	3	3	3	3	0.8	2.4	Implement measure for the protection of soil and groundwater. Implement spill prevention and emergency response procedure. Laydown areas to be incorporated within Sishen Mine's existing dirty stormwater management areas.	0.5	1.2
Air Quality	Increased dust levels due to earthworks and replacement of infrastructure.	C	2	2	2	3	2.5	0.6	1.5	Dust suppression to be implemented at laydown areas and new roads associated with access to laydown areas and areas of work, as required. Sishen Mine to maintain roads including chemical suppression in existing areas with consideration given to additional	0.5	0.75

IMPACT CATEGORY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
										wearing of surfaces as a result of the project.		
Noise	Increase in noise levels due to upgrade activities	C	1	2	1.5	1	1.25	0.4	0.5	Equipment is to be kept in a high level of maintenance.Noise complaints will continue to be monitored and managed through the Sishen External Complaints Procedure.	0.5	0.25
Biodiversity	Site clearance for upgrade of infrastructure.	C	2	5	3.5	1	2.25	1	2.25	Mark all individuals of Species of Conservation Concern (SCC) Obtain relevant licences for the removal of SCC. Restrict footprint of expansion to the predetermined extent.	0.5	1.125
Cultural Heritage	Disturbance of heritage sites due to the development of laydown areas or earthmoving activities for the upgrade of the TSF.	C	2	5	3.5	1	2.25	0.2	0.45	Implement Chance-Find Procedure		
Visual Environment	Increased visual intrusion and loss of scenic quality due to upgraded infrastructure.	C&O	1	2	1.5	2	1.75	0.2	0.35	Upgrade of the TSF and associated infrastructure is within the mine and will not change the visual environment. No additional mitigation required as a result of the project.		

IMPACT CATEGORY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
SOCIO-ECONOMICS	Increased demand for local products and services i.e. local procurement opportunities.	C	3	2	2.5	4	3.25	0.6	1.95	Maximise local Procurement to be implemented in line with Sishen's Local Procurement Strategy.	1.8	3.51
	Short-term local employment opportunities.	C	3	2	2.5	4	3.25	0.6	1.95	Resourcing Plan to be developed and aligned with Sishen's commitments for preferential local employment. Contractors to comply with preferential local employment targets in line with Sishen's employment targets. Local employment to be reported on, on a monthly basis and audited.	1.8	3.51
	Added value to the economy due to construction expenditure	C	3	2	2.5	4	3.25	0.6	1.95	Preferential procurement and employment to enhance benefits to local economy.	1.8	3.51

IMPACT CATEGORY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
	Influx of job-seekers into the area.	C	2	2	2	4	3	0.6	1.8	Stakeholder engagement to ensure stakeholders are informed on employment opportunities and requirements. Alignment with Sishen's Public Affairs Department and project to provide support where required. Collaboration through existing mechanism for local employment (e.g. local labour desk). Contractors to comply with Sishen's local employment requirements.	1	1.8
	Potential for infringement of human rights.	C	3	2	2.5	3	2.75	0.8	2.2	Contractors to adhere to SIOC's requirements on housing of personnel. ER plan to be in place for the project and to be adhered to by contractors.	0.5	1.1
	Increased exposure of vulnerable groups (especially the youth and persons living in informal settlements.)	C	3	2	2.5	3	2.75	0.6	1.65	Influx management through the prioritisation of employment of local persons.	0.5	0.825

IMPACT CATEGORY	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
	Increase pressure on local services and infrastructure due to influx of persons.	C	2	2	2	3	2.5	0.6	1.5	Influx management through the prioritisation of employment of local persons.	0.8	1.2
	Strained relationships with selected stakeholders due to unmet expectations of economic benefits from the mine	C	4	2	3	4	3.5	0.8	2.8	Engagement plan to ensure that stakeholders are being kept up to date with the project and the opportunities for local community members – management of expectations. Project to align with Sishen's Public Affairs Department and provide support where required. Effective engagement with key stakeholders.	0.8	2.24

TABLE 10-6: TROLLEY ASSIST INFRASTRUCTURE - IMPACT RISK ASSESSMENT

ASPECT	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Groundwater	Contamination of groundwater due to the storage and handling of potential pollutants at laydown areas and areas of work.	C	1	2	1.5	2	1.75	0.2	0.35	Hazardous substances must be stored in bunded areas and handled on impervious surfaces. Waste to be stored in allocated areas in line with regulatory requirements. Equipment which has the potential to leak oil or other chemicals are to be stored on impervious surfaces within bunded areas. Drip trays are to be provided where mobile equipment has the potential to drip oil. Implement spill prevention and emergency response procedure.	0.5	0.175
Surface Water Resources	Contamination of surface water resources due to contaminated run-off originating from laydown areas and areas of work.	C	2	2	2	2	2	0.4	0.8		0.5	0.4
Soils	Contamination of soils due to the storage and handling of pollutants at laydown areas and areas of work.	O	3	2	2.5	1	1.75	0.6	0.4		0.5	0.2
Air quality	Increased dust emissions due to the entrainment from construction activities.	C	1	2	1.5	2	1.75	0.4	0.7	None required.		

ASPECT	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
Climate change	Reduced diesel consumption and associated emissions.	C	2	4	3	2	2.5	0.6	1.5	Maximise opportunity for implementation of trolley assist at Sishen Mine.	1	1.5
Noise	Increase in noise levels due to construction activities	C	1	2	1.5	1	1.25	0.2	0.25	None required.		
Biodiversity	Disturbance of vegetation	C	1	1	1	1	1	0.2	0.2	None required		
Cultural Heritage	Disturbance of heritage sites- established on existing footprint	C	1	1	1	1	1	0.2	0.2	None required.	1	0.2
Visual Environment	Increased visual intrusion and loss of scenic quality due to trolley assist infrastructure.	O	2	4	3	3	3	0.2	0.6	None required	1	0.6
Socio-economic	Increased demand for local products and services.	C	1	2	1.5	4	2.75	0.4	1.1	Maximise local Procurement to be implemented in line with Sishen's Local Procurement Strategy.	1.2	1.32
Socio-economic	Short-term local employment opportunities.	C	1	2	1.5	4	2.75	0.4	1.1	Resourcing Plan to be developed and aligned with Sishen's commitments for preferential local employment. Contractors to comply with preferential local employment targets in line with Sishen's employment	1.2	1.32

ASPECT	POTENTIAL IMPACT	PHASE	INTENSITY	DURATION	CONSEQUENCE	EXTENT	SEVERITY	PROBABILITY	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	MITIGATION CONFIDENCE	SIGNIFICANCE WITH MITIGATION
										targets. Local employment to be reported on, on a monthly basis and audited.		

11.SUMMARY OF SPECIALIST REPORTS

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
LYLYVELD EXTENSION			
Air Quality Specialist Study (Airshed Planning Professionals, February 2018)	Ongoing development and implementation of dust management plans. Restricting or ceasing activities during unfavourable weather conditions. Conducting local area visual checks to direct application of necessary dust controls. Properly maintaining dust-control equipment to ensure mitigation measures are available and effective. Monitoring the effectiveness of the mitigation measures implemented and feeding this information into regular reviews of dust management procedures. Ensure that ambient dust-monitoring equipment is calibrated and maintained. Ensuring staff are aware of – and implement – dust management procedures in day-to-day mining operations. Limiting exposed areas throughout all stages of mine operations.	Implement Sishen Mine Dust Management Plan. Enforce speed limit. Conduct dust suppression on unpaved road, i.e. wet suppression or chemical stabilisation. Continue to implement complaints management procedure. Proper maintenance of dust monitoring equipment. Monitor effectiveness of dust control measures and revise dust management plans in response. Limit footprint of exposed areas during development of expansion activities. Manage tipping heights. Rehabilitation of disturbed areas as per rehabilitation plan.	Table 10-4 Part B – Section 5
Heritage Impact Assessment (PGS Heritage, November 2019)	A Chance finds procedure must be developed that must include: If a deposit is identified a controlled sampling of the material found should be done; This work must be done in such a way as to augment the current research questions and	As per specialist recommendation.	Section 12.1.9 Table 10-4, 10-5 & 10-6. Part B – Section 5

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	field work such as the excavations at the Kathu Townlands Site and Kathu Pan; 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; A close out report must be submitted to SAHRA In the event that substantive material is uncovered, it is recommended that a display is considered in a convenient location;		
Palaeontological Desktop Study (PGS Heritage, October 2018)	Should fossil remains be discovered during any phase of construction, either on the surface or exposed by fresh excavations, 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.	As per specialist recommendation.	Section 12.1.9 Table 10-4, 10-5 & 10-6 Part B – Section 5

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
Terrestrial Ecological Assessment (Scientific Terrestrial Services, July 2019)	A walkdown of the expansion footprint is to be undertaken prior to the commencement of expansion activities in order mark all individuals of floral SCC identified in this report; The necessary permits need to be acquired pertaining to the removal of floral SCC that are located within the study area prior to the expansion and haul road widening activities, and the following should be ensured: Where feasible, effective relocation of individuals to suitable similar habitat in the vicinity of the study area, especially with regards to *Hoodia gordonii* and *Orbea lutea* subsp. *lutea*, where these individuals are situated in close proximity to the expansion footprint area; A suitable floral rescue and relocation plan should be developed and overseen by a suitably qualified specialist or nominated mine personnel in order to ensure that species loss during the expansion activities is kept to a minimum. It is recommended that where feasible vegetation clearance and expansion activities take place in a phased manner, in a uniform direction from the existing mining area outwards, so as to ensure that as far as possible faunal species can naturally disperse out of the area ahead of activities;	Mark all individuals of Species of Conservation Concern Obtain relevant permits for the removal of SCC. Restrict vehicles to travelling only on designated roadways to limit the ecological footprint of the expansion activities; No uncontrolled fires whatsoever should be allowed; No collection of firewood, floral SCC or medicinal floral species must be allowed by construction or mining personnel; Restrict footprint of expansion to the predetermined extent. No trapping or hunting of any faunal species is to take place Conduct rehabilitation according to the Sishen rehabilitation plan	Section 12.1.6 Table 10-4 Part B- Section 5.

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	Smaller species such as scorpions and reptiles are likely to be less mobile during the colder period, as such should any be observed in the expansion footprint during vegetation clearing and operational activities, they are to be carefully and safely moved to an area of similar habitat outside of the expansion footprint. Construction personnel are to be educated about these species and the need for their conservation. Smaller scorpion species and harmless reptiles should be carefully relocated by a suitably nominated construction person or nominated mine official. For larger venomous snakes, a suitably trained mine official or suitable qualified specialist6 should be contacted to oversee the relocation of the species, should it not move off on its own; The expansion and haul road widening footprint must be kept as small as possible in order to minimise impacts on the surrounding natural environment. In this regard, the expansion footprint should be demarcated to prevent excessive clearing and footprint creep into sensitive surrounding habitat; A dust suppression control plan should be designed in line with best practice guidelines and implemented throughout the operation of the mining activities, to minimise the impact of dust accumulation on the surrounding natural habitat;		

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	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 management of bush encroachment; Restrict vehicles to travelling only on designated roadways to limit the ecological footprint of the expansion activities; No uncontrolled fires whatsoever should be allowed; No collection of firewood, floral SCC or medicinal floral species must be allowed by construction or mining personnel; No dumping of waste should take place. If any spills occur, they should be immediately cleaned up;		
Wetland Verification Report (Scientific Aquatic Services, July 2019)	Although the two depression wetlands have been significantly modified, the ecoservice provision and hydrological function thereof is still deemed important. Thus, as much protection of the wetlands as possible should be afforded during all planning phases of any potential future expansion in the mining area, to ensure that these ecoservices are protected in the receiving environment;	No widening of the haul road to take place within the 500 m buffer of the wetland pans identified.	Section 12.1.5 Table 10-4 Part B- Section 5.

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	Listed activities in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA) EIA Regulations as amended in April 2017 must be taken into consideration if any infrastructure is to be placed within the applicable zone of regulation. This must be determined by the EAP in consultation with the relevant authorities; In accordance with Notice 509 of 2016 as it relates to the NWA, a regulated area of a watercourse for section 21c and 21i of the NWA, 1998 is defined as: the outer edge of the 1 in 100-year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; in the absence of a determined 1 in 100-year flood line or riparian area the area within 100m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or a 500 m radius from the delineated boundary (extent) of any wetland or pan.		

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	If activities are planned within the wetlands or its 32m area, from an enviro-legal viewpoint, the project will face some challenges and the relevant environmental authorisation process will need to be followed. Also, since the expansion of the haul road is located within the 500m Zone of Regulation in terms of Notice 509 of the wetlands, if any future development is to be investigated, such development may also require authorisation by the Department of Water and Sanitation (DWS) in terms of section 21 (c) and (i) of the NWA, 1998 (Act 36 of 1998); Should detailed information pertaining to the Present Ecological State (PES), the Ecological & socio-cultural service provision (ES) as well as the Ecological Importance and Sensitivity (EIS) of the wetlands be required, further studies will need to be undertaken. These studies will be required in support of any application to the Department: Environment and Nature Conservation (DENC), Northern Cape Province and the DWS to develop the site as well as to obtain water use authorisation for the development of the site; and It is recommended that proceeding forward, the proponent should obtain guidance from the relevant regulating authorities with regards to the development process within the associated regulated zone (NWA), and that the relevant environmental		

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	authorisations and water use authorisation processes are followed.		
Traffic Impact Assessment (JG Afrika, July 2019)	The biggest risk identified is poor visibility due to dust. The immediate mitigation should be to increase dust suppression and regular mechanical sweeping to clean the surfaced area. Water alone may not be sufficient, and the recommendation is to apply a dust suppressant at least 100m before and after the crossing as a minimum. Depending on the remaining life of the crossing, it may be warranted to construct a proper intersection and to surface the approaches at least 40m long. This length is recommended so dust and gravel can be deposited before the crossing. The road signs are not adequate for a 4-way stop and do not comply with the relevant regulations. It is also recommended that the stop sign sizes be increased. This is relatively inexpensive and quick to fix. Road authority approval was obtained for a haul road crossing for a period of 6 years from 2015. It is recommended that the change in use to an intersection be formalised with the road authority and that the duration be reviewed.	Adequate dust suppression must be conducted on the haul road. Apply chemical dust suppression on haul road 100 meters before and after the intersection. Conduct regular sweeping at the intersection to get rid of loose particles. Adequate signage must be placed at the intersection. Consideration must be given to construct a proper intersection and to surface the approaches at least 40m long.	Included as mitigation in Table 10-4 Part B- Section 5.
Visual Impact Assessment (EXM, November 2019)	Optimise the backfilling/infilling of pits with waste rock to minimise the footprint of the waste rock dumps. Backfilling/infilling must be viewed as the first option.	As per specialist recommendation.	Included as mitigation in Table 10-4 Part B- Section 5.

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	Concurrent rehabilitation must be conducted in terms of the Sishen Mine rehabilitation plan. The footprint of the expansion activities must be limited to the mitigated/revised layout.		
TSF UPGRADE			
Socio-economic impact assessment (Demacon, November 2019)	None	Resourcing Plan to be developed and aligned with Sishen's commitments for preferential local employment. Contractors to comply with preferential local employment targets in line with Sishen's employment targets. Local employment to be reported on, on a monthly basis and audited. Preferential procurement and employment to enhance benefits to local economy. Preferential procurement and employment to enhance benefits to local economy. Contractors to adhere to SIOC's requirements on housing of personnel. ER plan to be in place for the project and to be adhered to by contractors. Influx management through the prioritisation of employment of local persons.	Included as mitigation in Table 10-5 Part B- Section 5.

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
		Engagement plan to ensure that stakeholders are being kept up to date with the project and the opportunities for local community members – management of expectations. Project to align with Sishen's Public Affairs Department and provide support where required. Effective engagement with key stakeholders	
Heritage Screening Assessment	The following general recommendations are required: A Chance finds procedure must be developed that must include: If a deposit is identified a controlled sampling of the material found should be done; 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; 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; A close out report must be submitted to SAHRA In the event that substantive material is uncovered, it is recommended that a display is considered in a convenient location; In the unlikely event of any unmarked human burials, burial pits, potsherds or stone tools being uncovered during earthworks for the	As per specialist recommendations.	Included as mitigation in Section 10.2.2.8 and Table 10-5. Part B- Section 5.

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	proposed development, these must be reported immediately to the South African Heritage Resources Agency – Burials and Graves Unit (Mrs Thinghangwi Thivhase - 012 320 8490 / 4968).		

12.ENVIRONMENTAL IMPACT STATEMENT

12.1 SUMMARY OF KEY FINDINGS OF THE ENVIRONMENTAL IMPACT ASSESSMENT

The following have been identified as the key findings of the impact assessment:

12.1.1 Employment, Local Procurement and Economic Development

- The construction phase of the TSF upgrade project will provide approximately 125-150 temporary jobs.
- 90% of services required for the TSF Upgrade will be sourced locally.
- The Lylyveld expansion project will not result in additional permanent employment.
- The proposed expansion project will however increase the life of operations at Lylyveld from 2022 to 2032 which will ensure that the current employment of 132 persons and local procurement associated with the operations remain for an additional 10 years.

12.1.2 Unmet Community Expectations

- Given high unemployment levels in the region, all project at Sishen will be subjected to high expectations of communities of employment. The details of the project, supply chain and employment requirements are to be communicated clearly with stakeholders in an attempt to manage such expectations.

12.1.3 Poor Contractor Management

- Contractors are to adhere to Sishen's requirements with respect to housing of workers, local employment, use of local suppliers and employee relations. Compliance is to be monitored to ensure the maximisation of local economic benefits and protection of workers' rights.

12.1.4 Increased atmospheric emissions

- The contribution of the expansion of the Lylyveld operations and the TSF Upgrade to dust levels in the area will be low. However, the cumulative impact of the Sishen Mining operations on dust levels is high. Mitigation of any additional impact sources that will contribute to dust levels.

12.1.5 Surface water resources

- Spillages and leaks of hydrocarbons from HME used at Lylyveld are to be managed to ensure that soils, surface water and groundwater resources are protected. This includes the use of drip trays under machinery that has the potential to leak. HME that does leak is to be removed from site and repaired as soon as possible. No informal maintenance is to take place at the site.
- The Lylyveld PCD (already authorised) is to be developed to ensure protection of the Gamagara River.
- Laydown areas will also be established for the assembly of equipment and general contractor work during the construction phase of the TSF upgrade and Lylyveld expansion. Spillages associated with the laydown areas has the potential to cause surface water pollution.
- The TSF Upgrade Project will improve stormwater management due to the reinstatement and upgrading of the solution trench. Such water will be recycled for use in the process. Where such water cannot be accommodated the surplus water is to be directed to Sishen's existing stormwater management system. The implementation of the clean water diversion in the area is to be prioritised.
- The haul from Lylyveld to the Sishen process plant area passes in close proximity to 2 wetland pans. No widening is to take place within a buffer of 500 m of these pans.

12.1.6 Loss of Sensitive Biodiversity

- The Lylyveld area and adjacent natural areas have been disturbed by existing mining activities. The expansion activities will therefore not result in significant biodiversity impacts.
- Species of conservation concern (particular protected trees) occur both in the Lylyveld and the TSF Upgrade area. Licences/permits must be obtained for the removal of Species of Conservation Concern.

12.1.7 GHG Emissions

- The implementation of the Trolley Assist System will reduce the use of diesel on site and reduce dependency on fossil fuel. Therefore, greenhouse gas emissions will be reduced as a result of the project.

12.1.8 Surrounding Land Use

- The expansion activities at Lylyveld South will be conducted relatively close to the N14 national route. The original project layout has been amended in order to establish a

buffer of 100 m from the N14. No blasting is to take place within 500 m without compliance with the requirements of the Mine Health & Safety Act and the necessary consultation with SANRAL and Transnet.

- The realignment of the existing haul road will pass underneath Eskom power lines. It should be taken into consideration that the existing haul roads already passes underneath the powerlines, in the same area. A wayleave must be obtained from Eskom for the realignment of the haul roads.
- The expansion of the WRD at Lylyveld North will be in (relatively) close proximity to Eskom powerline servitude. The original layout plan was amended and the expansion of the WRD will only allow a 30m zone for rehabilitation purposes and no further envcroachment on the power line servitude will take place.

12.1.9 Heritage resources

- Insignificant heritage and paleontological resources are present on the areas in which the Lylyveld expansion activities will be undertaken.
- The TSF upgrade will be undertaken on the existing mining footprint and will not result in impacts of heritage resources.

12.1.10 Traffic impacts

- Traffic impacts due to dust generation from the Haul Road and DR3333 crossing has the potential to cause visibility problems and a high risk of accidents. The deposition of small particles on the haul road also contributes to dust generation.
- The expansion of the pit area at Lylyveld South and associated blasting may result in a risk to vehicles travelling on the N14. No mining activities will take place within 100 m of the road.

12.1.11 Visual Impacts

- Although the Lylyveld activities are surrounded by other mining operations, the activities at Lylyveld South will still be visually intrusive and will result in a loss of scenic quality for users of the N14. Measures, such as maximisation of backfilling opportunities and ongoing rehabilitation are recommended to reduce the impact.

12.2 Final site map

The final site layout maps (Mitigated Scenario) as provided in

- Figure 4-1 (Lylyveld North)
- Figure 4-2 (Lylyveld South)

- Figure 4-3 (Lylyveld Haul Road Widening)
- Figure 4-4 (TSF Upgrade)
- Figure 4-10 (Trolley Assist Infrastructure).

12.3 Summary of the positive and negative implications and risks of the proposed activity and identified alternatives

TABLE 12-1: SUMMARY OF KEY POSITIVE AND NEGATIVE IMPACTS IDENTIFIED FOR THE MITIGATED AND UNMITIGATED SCENARIOS

IMPACT CATEGORY	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
LYLYVELD EXTENSION				
Surface Water Resources	Contamination of surface water resources due to contaminated run-off from mining, stockpile and WRD areas.	Moderate	Expand surface water management infrastructure for the containment of dirty water run-off and the diversion of clean water to incorporate new mining and disposal areas at Lylyveld South. Review stormwater management requirements for Lylyveld North and implement in accordance with GNR. 704.	Low
Surface Water Resources	Disturbance of wetlands due to haul road widening	Moderate	Implement revised layout plan with no widening to take place within the 500 m buffer of the wetland.	Low
Air Quality	Increased dust emissions due to increased footprint of the expansion activities	Moderate	Implement Sishen Mine Dust Management Plan. Enforce speed limit. Conduct dust suppression on unpaved road, i.e. wet suppression or chemical stabilisation. Continue to implement complaints management procedure. Proper maintenance of dust monitoring equipment. Monitor effectiveness of dust control measures and revise dust management plans in response. Limit footprint of exposed areas during development of expansion activities. Manage tipping heights.	Low

IMPACT CATEGORY	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
			Rehabilitation of disturbed areas as per rehabilitation plan.	
Neighbouring Land Use	Disturbance of power line servitude for the realignment of the haul road.	High	Obtain the necessary permissions from Eskom of crossing of the servitude and adhere to the conditions of the wayleave.	Low
Neighbouring Land Use	Damage to the N14 road due to blasting.	Moderate	Implement revised layout to ensure that pit does not encroach on 100 m from infrastructure. Sishen to comply with legal requirements in terms of the Mine Health and Safety Act. This will include a safety risk assessment.	Moderate
Neighbouring Land Use	Damage to railway infrastructure.			
Biodiversity	Disturbance of vegetation and habitats for the development of lay down areas, HME maintenance area, expanded WRD and pit areas	Moderate	Mark all individuals of Species of Conservation Concern Obtain relevant permits for the removal of SCC. Restrict vehicles to travelling only on designated roadways to limit the ecological footprint of the expansion activities; No uncontrolled fires whatsoever should be allowed; No collection of firewood, floral SCC or medicinal floral species must be allowed by construction or mining personnel; Restrict footprint of expansion to the predetermined extent. No trapping or hunting of any faunal species is to take place Conduct rehabilitation according to the Sishen rehabilitation plan	Low

IMPACT CATEGORY	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
Traffic impacts	Safety risk due to haul trucks crossing DR 3333	High	Adequate dust suppression must be conducted on the haul road. Apply chemical dust suppression on haul road 100 meters from the intersection. Conduct sweeping at the intersection to get rid of loose particles. Adequate signage must be placed at the intersection. Consider surfacing the intersection for 40 m on either side to allow loose material to be overloaded prior to the intersection.	Moderate
Traffic impacts	Risk of blasting at Lylyveld South to vehicle travelling on the N14	Moderate	Implement revised layout plan with 100 m buffer from N14. Sishen to comply with legal requirements in terms of the Mine Health and Safety Act. This will include a safety risk assessment.	Low
Visual Environment	Increased visual intrusion and loss of scenic quality (Lylyveld South).	Moderate	Optimise the backfilling/infilling of pits with waste rock to minimise the footprint of the waste rock dumps. Backfilling/infilling must be viewed as the first option. Concurrent rehabilitation must be conducted in terms of the Sishen Mine rehabilitation plan. The footprint of the expansion activities must be limited to the mitigated/revised layout	Low
SOCIO-ECONOMICS	Continued opportunity for local procurement for haulage of ore due to the extension of the life of operations.	Moderate Positive	Preferential procurement plan for local service providers.	Moderate Positive

IMPACT CATEGORY	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
	Continued opportunity for local employment due to extension of life of operations.	Moderate Positive	Contractors to adhere to preferential local employment in line with Sishen Mine targets and commitments.	Moderate Positive
	Strained relationships with selected stakeholders due to unmet expectations of economic benefits from the mine	Moderate	Engagement plan to ensure that stakeholders are being kept up to date with the project and the opportunities for local community members – management of expectations. Project to align with Sishen's Public Affairs Department and provide support where required. Effective engagement with key stakeholders.	Moderate
TSF UPGRADE				
Water Consumption	Improvement in operations efficiency resulting in water saving and increased return water for use in processing.	Moderate Positive	Optimise the capacity of infrastructure to allow for water to be returned for use in the process.	Moderate Positive
Surface Water Resources	Contamination of surface water resources due to overflow of stormwater management infrastructure.	Moderate	Run-off is to be directed to stormwater management infrastructure (in the process of being upgraded). Clean water to be prevented from entering TSF. Maintain water management infrastructure to ensure operation at maximum capacity.	Moderate

IMPACT CATEGORY	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
Surface Water Resources	Contamination of surface water resources due to storage and handling of potential pollutants at laydown areas	Moderate	Implement measure for the protection of soil and groundwater. Implement spill prevention and emergency response procedure. Laydown areas to be incorporated within Sishen Mine's existing dirty stormwater management areas.	Low
Biodiversity	Site clearance for upgrade of infrastructure.	Moderate	Mark all individuals of Species of Conservation Concern (SCC) Obtain relevant licences for the removal of SCC. Restrict footprint of expansion to the predetermined extent.	Low
SOCIO-ECONOMICS	Increased demand for local products and services i.e. local procurement opportunities.	Low Positive	Maximise local Procurement to be implemented in line with Sishen's Local Procurement Strategy.	High Positive
	Short-term local employment opportunities.	Low Positive	Resourcing Plan to be developed and aligned with Sishen's commitments for preferential local employment. Contractors to comply with preferential local employment targets in line with Sishen's employment targets. Local employment to be reported on, on a monthly basis and audited.	High Positive
	Added value to the economy due to construction expenditure	Low Positive	Preferential procurement and employment to enhance benefits to local economy.	High Positive

IMPACT CATEGORY	POTENTIAL IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION	SIGNIFICANCE WITH MITIGATION
	Potential for infringement of human rights.	Moderate	Contractors to adhere to SIOC's requirements on housing of personnel. ER plan to be in place for the project and to be adhered to by contractors.	Low
	Strained relationships with selected stakeholders due to unmet expectations of economic benefits from the mine	Moderate	Engagement plan to ensure that stakeholders are being kept up to date with the project and the opportunities for local community members – management of expectations. Project to align with Sishen's Public Affairs Department and provide support where required. Effective engagement with key stakeholders.	Low
TROLLEY ASSIST INFRASTRUCTURE				
No significant impacts				

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

The key mitigation measures to be included in the EMPr are as follows:

12.4.1 Lylyveld Extension

- Implementation of project layout as per Mitigated Scenario.
- No widening of the haul road to be allowed within the 500 m buffer zone in the vicinity for the identified wetland pans.
- Adequate dust suppression measures must be implemented at the intersection of the haul road and DR 3333 regional road. Chemical suppressants must be applied 100 meters from the intersection. The intersection must be swept by mechanical sweeping to ensure that loose particles are cleared. Signage sizes are to be increased at the intersection.
- No blasting is to be undertaken within 500 m of the N14 or Transnet Railway Line unless the safety risk assessment is completed and in accordance with the Mine Health & Safety Act. The widening of the road will facilitate the safe passing of haul trucks and thus will improve the safety at the Lylyveld operations.
- The implementation of the approved Lylyveld PCD is to be prioritised to ensure the protection of the Gamagara River.
- Adequate stormwater management measures must be implemented. Clean water is to be diverted around any potentially polluting area including workshop areas, processing areas, ore stockpile areas, and residue stockpiles/dumps.
- Necessary permission to be obtained from Eskom the realignment of the haul road in the powerline servitude and requirements must be adhered to.
- Dust suppression to be conducted on exposed areas and haul roads.
- Licences/Permits must be obtained for the removal of Species of Conservation Concern.
- Opportunities for backfilling and ongoing rehabilitation of waste rock dumps are to be maximized.
- Implement Chance-Find Procedure for protection of heritage resources.

12.4.2 TSF Upgrade

- Maximise opportunity for local procurement and local employment through the enforcement of Sishen targets and requirements on contractors.
- Management community expectations through effective stakeholder engagement.
- Implement dust suppression in all laydown areas and areas of work as required to prevent entrainment of dust.
- Implement measure for the protection of soil and groundwater, including spill prevention and emergency response procedure. Laydown areas to be incorporated within Sishen Mine's existing dirty stormwater management.
- Licences/permits must be obtained for the removal of Species of Conservation Concern.
- Stormwater is to be directed to Sishen's existing stormwater management system. The implementation of the clean water diversion in the area is to be prioritised. Water management systems are to be maintained to ensure they operate at maximum capacity at all time.
- Groundwater monitoring to be expanded to include Lylyveld impacts.
- Implement Chance-Find Procedure for protection of heritage resources.

12.4.3 Trolley Assist Infrastructure

- Maximise opportunities for local procurement.
- Maximise opportunities for local employment.

12.5 Final proposed alternatives

See Section 7. The final proposed layout alternatives are provided in:

Figure 4-1 (Lylyveld North)

Figure 4-2 (Lylyveld South)

Figure 4-3 (Lylyveld Haul Road Widening)

Figure 4-4 (TSF Upgrade)

Figure 4-10 (Trolley Assist Infrastructure).

12.6 Aspects for inclusion as conditions in the authorisation

The authorisation is subject to the implementation of the Mitigated Layout Plan which is required to reduce negative impacts to acceptable levels. The authorisation is also subject to the recommendations contained in the EMPr (Part B). Key conditions to be included are the implementation of a stormwater management system at Lylyveld South and the implementation of appropriate dust management measures at the haul road crossing to prevent traffic impacts due to visibility problems.

12.7 Description of any assumptions, uncertainties and gaps in knowledge

The outcomes of this EIA Report are based on the following assumptions, uncertainties and knowledge gaps:

- The impacts are associated with the project description provided by the Sishen Iron Ore Company and as described in Section 4.
- The proposed layout of project as provided in and Figures 11-1 to 11-4 are conceptual. Detailed design of such infrastructure is still to be undertaken. The final layout may differ slightly from the conceptual layout plan. The principles as specified in the outcomes of the EIA Report will however be adhered to during final design.
- The EIA was done at a specific time frame according to current environmental legislation which may change over time.
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked by the biodiversity study. It is, however, expected that most floral and faunal communities have been accurately assessed and considered.
- The wetland verification study was initiated as a desktop assessment and as such, the information gathered must be considered with caution, as inaccuracies and data capturing errors are often present within national and provincial databases;
- Only a qualitative AQIA study was done for this Project, as a detailed AQIA was completed for the mine in 2017 and 2018 and the expansions are expected to have no significant impacts.
- Sishen Mine's available budget to implement management and mitigation measures to enhance positive social impacts and mitigate negative environmental impacts, are dependent on economic conditions.

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

It is the opinion of the EAP that the activities associated with the expansion of the Lylyveld operations, upgrade of the TSF and the establishment of the Trolley Assist Infrastructure be authorised based on the following reasons:

- The expansion activities will extend the LOM of the Lylyveld operations and therefore the socio-economic benefits (employment and local spending) of the operations will remain intact for the rest of the Sishen LOM (currently 2032).
- The upgrade of the existing TSF will extend the life of the facility which will prevent the establishment of a new TSF and therefore prevent associated environment impacts. The upgrade project will result in positive environmental impacts such as reduced water consumption and improved stormwater management. The upgrade of the TSF will not result in any significant environmental impacts.
- The Trolley Assist Infrastructure will provide an adequate alternative for the use of diesel in the haul trucks at the WRD areas. The Trolley Assist Infrastructure will be established on the authorised footprint of the Western WRD and will not result in additional environmental impacts.
- The negative impacts on water resources, biodiversity, heritage resources and infrastructure can be successfully mitigated to acceptable levels by the implementation of the Mitigated Layout Plan and the implementation of the proposed management measures.

12.9 Rehabilitation Objectives

Rehabilitation will be undertaken in accordance with the overall rehabilitation objectives for the mine. The final land use at Sishen Mine is envisaged to include a combination of wilderness areas, agricultural and small industrial use. In order to achieve the final land-use plan the following rehabilitation objectives have been set for the mine:

- All rehabilitated land is to be safe and useable, excluding the open pits and potentially the pit-facing slopes of waste rock dumps which will be wilderness;
- All rubble from plant decommissioning and related areas must not cause long term degradation or safety hazards;
- All waste dumps must be closed and rehabilitated as per legislative requirements;
- Land is to be physically and chemically stable;
- Rehabilitated areas must be used in a sustainable manner;
- Ground and surface water will not be polluted once the mine is closed; and

- Stakeholders will be engaged on final land use planning.

In order to meet the above objectives, provision has been made for:

- Removal of infrastructure associated with the Lylyveld Extension Project;
- Removal of infrastructure (pipelines, canals and roads) associated with the TSF Upgrade Project;
- Removal of infrastructure associated with the Trolley Assist Project;
- Remediation of landforms in line with final land use;
- Ripping of roads to allow for the establishment of vegetation;
- Removal or rubble and disposal of waste in accordance with legislative requirements;
- Remediation of the footprint area to a state that is free of contaminants and suitable for the establishment of sustainable vegetation;
- Implementation of stormwater management at contaminated areas (if required);
- Establishment of suitable indigenous vegetation on rehabilitated footprint areas;
- Maintenance and monitoring of revegetated areas to self-sustaining state.

12.10 Period for which the environmental authorisation is required

The authorisation is required for the Sishen LOM (currently until 2032)

13.FINANCIAL PROVISION

13.1 Derivation of quantum

13.1.1 Annual (Premature) Closure Provision

The closure liability costing associated with the Lylyveld expansion, TSF upgrade and Trolley Assist Infrastructure amount to **R 4,935,517.03** (premature closure) and **R 32,966,672.41** at LOM (Table 13-1).

TABLE 13-1: ADDITIONALL CLOSURE COSTS FOR THE LYLYVELD EXPANSION, TSF UPGRADE AND TROLLEY ASSIST INFRASTRUCTURE

Item	PREMATURE CLOSURE LIABILITY	LOM CLOSURE LIABILITY
LYLYVELD EXTENSION		
Waste Rock Dump		18,763,093.26
Opencast Pit		9,268,062.12
Stockpile area	3,172,606.63	3,172,606.63
Overland Infrastructure	82,435.00	82,435.00
Total	**3,255,041.63**	**31,286,197.01**

Item	PREMATURE CLOSURE LIABILITY	LOM CLOSURE LIAIBILITY
TSF UPGRADE		
Overland Infrastructure	1,150,551.71	1,150,551.71
Total	**1,150,551.71**	**1,150,551.71**

Item	PREMATURE CLOSURE LIABILITY	LOM CLOSURE LIABILITY
Trolley Assist Infrastructure		
Overland Infrastructure	529,923.68	529,923.68
Total	**529,923.68**	**529,923.68**
GRAND TOTAL	**4,935,517.03**	**32,966,672.41**

13.2 Amount to be provided for from operating expenditure

Sishen Mine carries out ongoing rehabilitation of the WRDs as part of the operations. The rehabilitation of the waste rock dumps forms the bulk of the rehabilitation costs. The costs of dust management are incorporated into the running costs of the mine.

14.DEVIATIONS FROM THE APPROVED SCOPING REPORT AND PLAN OF STUDY

14.1 Deviations from the methodology used in determining the significance of the potential environmental impacts and risks

Not applicable

14.2 Motivation for deviation

Not applicable

15.OTHER INFORMATION REQUIRED BY COMPETENT AUTHORITY

Not applicable

16.OTHER MATTERS REQUIRED IN TERMS OF SCETIONS 24(4)(A) AND (B) ON NEMA

Not applicable

17.UNDERTAKING

I, Kerry Colleen Fairley, the Environmental Assessment Practitioner responsible for compiling this report, undertake that:

- the information provided herein is correct;
- the comments and inputs from stakeholders and I&APs have been correctly recorded;
- information and responses provided to stakeholders and I&APs by the EAP is correct; and
- the level of agreement with I&APs and stakeholders has been correctly recorded and reported.

Report Sign-Off			
Name	**Designation**	**Signature**	**Date**
Kerry Fairley	EAP Director Pr. Sci.Nat		2019/12/12

18.REFERENCES

Airshed Planning Professionals, July 2019. Air Quality Assessment for the Sishen Lylyveld Expansion Project. Report No. 19EXM01.

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PGS Heritage, November 2019(a). Heritage Impact Assessment for the Proposed Expansion of Mining Activities and the Widening of a Haul Road on the Farm Lylyveld 545, near Kathu, Northern Cape Province.

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JG Afrika, July 2019. Traffic Impact Assessment for the Lylyveld Expansion Project.

Scientific Terrestrial Services, July 2019**.** Watercourse Verification as part of the Environmental Authorisation Process for the Proposed Expansion of the Opencast Iron Ore Mining Operations at the Lylyveld South and North Pit, Kathu, Northern Cape. Report Reference: STS 190035

Scientific Terrestrial Services, July 2019**.** Terrestrial Ecological Habitat Integrity Investigation as Part of the Environmental Authorisation Process for the Proposed Expansion of the Opencast Iron Ore Mining Operations at the Lylyveld South and North Pit, Kathu, Northern Cape. Report Reference: STS 190035

TerraSoil Science, March 2010**.** EIA / EMP Phase Soil, Land Use, Land Capability and Agricultural Potential Survey: Lylyveld South Project (Kumba Resources)