

# ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PROGRAMME FOR THE CHANGES TO INFRASTRUCTURE LAYOUT AND ACTIVITIES AT THE MAMATWAN MINE

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| Project Manager       | Sharon Meyer   |
| Project Manager Email | smeyer@slrconsulting.com   |
| Author                | Sharon Meyer; Edwynn Louw  |
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## REPORT SIGN OFF AND APPROVALS



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**Sharon Meyer**  
(Project Manager)



-----  
**Edward Perry**  
(Reviewer)

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## EXECUTIVE SUMMARY

### Project background

Hotazel Manganese Mines (Pty) Ltd (HMM) is the holder of a Mining Right (MR) for the opencast manganese mine known as Mamatwan Manganese Mine (MMT). The MMT is operated by South32 Limited (South32), a globally diversified mining and metals company producing bauxite, alumina, aluminium, energy and metallurgical coal, manganese, nickel, silver, lead and zinc in Australia, Southern Africa and South America. The MMT is located approximately 25 km to the south of the town Hotazel, in the John Taolo Gaetsewe District Municipality (JTGDM) and Joe Morolong Local Municipality (JMLM) of the Northern Cape Province of South Africa. The MMT is bordered by the Tshipi Borwa Mine (operated by Tshipi é Ntle Manganese Mining (Pty) Ltd [Tshipi]) to the West and by the United Manganese of Kalahari (Pty) Ltd (UMK) Mine, to the North.

MMT is making an application to the Department of Mineral Resources and Energy (DMRE) for an integrated Environmental Authorisation (EA) (including Waste Management License) and update of the mine's current Environmental Management Programme report (EMPr) to address several layout and activity changes that have already taken place at the MMT, as well as proposed layout and activity changes.

A list of layout and/or activity changes that have already taken place include:

- Expansion of the north and south- eastern WRDs;
- Changes to the rehabilitation criteria of WRDs;
- Expansion of the product stockyard;
- Establishment of potable and process water storage facilities; and
- Expansion of an existing road.

A list of the proposed layout and/or activity changes include:

- Establishment of a top-cut stockpile and associated mobile crushing and screening plant;
- Establishment of stormwater management infrastructure including a Pollution Control Dam (PCD) and evaporation channels;
- Change in height of the WRD (this excludes rehabilitated WRD's);
- Establishment of a pipeline to transfer water abstracted from the decommissioned Middelplaats Mine to MMT;
- Upgrading the railway line and the railway loadout station;
- Sale of waste rock as aggregate; and
- Re-processing of material located in Adams Pit .

In addition to the above, MMT also proposes to amend specific management commitments in the approved EMPr which are no longer relevant to the operation.

SLR Consulting (South Africa) (Pty) Ltd (SLR), an independent firm of environmental assessment practitioners (EAPs), has been appointed to manage the environmental authorisation process.



## Summary of authorisation requirements

The proposed layout and activity changes will require an integrated EA and amendment of MMT's current EMPR. The project includes activities listed under the National Environmental Management Act (No. 108 of 1998) (NEMA) and waste management activities listed under the National Environmental Management: Waste Act (No. 59 of 2008) (NEM: WA). Under both NEMA and NEM: WA, listed activities are prohibited from commencing until written authorisation is obtained from the competent authority, which in this case is the Northern Cape office of the DMRE.

The project requires approval of an integrated EA (including Waste Management License) in terms of Section 24 of NEMA and Section 45 of NEM: WA from the Northern Cape DMRE. In terms of Section 102 of the Mineral and Petroleum Resources Development Act (No. 59 of 2002) (MPRDA), an EMPR may not be amended or varied without the written consent of the Minister of Mineral Resources.

The MPRDA, NEMA and NEM: WA requires that an applicant submit the relevant environmental reports required in terms of NEMA. The Environmental Impact Assessment (EIA) Regulations, 2014 (published under Government Notice Regulation (GNR) 982 of 4 December 2014, as amended), promulgated in terms of NEMA set out the assessment process and reporting requirements where authorisation is required. For the purpose of this project, an integrated EIA process will be undertaken and will meet the requirements of:

- Regulation 31 (Part 2: substantive amendment process) to cater for changes to the approved 2005 EMPR in terms of the EIA Regulations (GNR 982 of 2014), as amended; and
- Regulation 21 and 23 (Scoping and Environmental Impact Assessment (S&EIA) process) to cater for listed activities in terms of the EIA Regulations (GNR 982 of 2014), as amended. Listed activities triggered as a result of the project are outlined in Section 4.1.

In addition, the project also requires authorisation from the Department of Water and Sanitation (DWS) for specific water uses listed under Section 21 of the National Water Act (No. 36 of 1998) (NWA). This Report does not address the requirements of a water use licensing process. This will be handled as part of a separate process with the DWS.

This EIA and EMPR process does not cover occupational health and safety legislation requirements.

## Purpose of this report

An Environmental Impact Assessment (EIA) is conducted in two phases. The first is the Scoping Phase and the second is the EIA Phase. The final Scoping Report was submitted to the DMRE on 26 March 2021 and was accepted on 26 October 2021. The objectives of the Scoping Phase were in line with Chapter 4, Part 3 of the EIA Regulations (GNR 982 of 2014), as amended. The terms of reference as identified in the Scoping Report for further assessment during the EIA phase enables the meaningful assessment of all relevant biophysical and socio-economic issues.

This EIA and EMPR provides a description of the proposed project and the affected environment; summarises the EIA process followed to date; identifies and assesses the key project impacts and presents management and mitigation measures that are recommended to enhance positive and limit negative impacts.

## Summary of the public participation process

The public participation process commenced prior to the submission of the EIA and EMPr and will continue throughout the EIA and EMPr process. To date, commenting authorities and Interested and Affected Parties (I&APs) have been given the opportunity to review the Background Information Document (BID), to attend a public meeting, to review the Scoping Report and to submit questions and comments to the project team. The EIA and EMPr was made available for public review and comment between 22 November 2021 and 06 January 2022. This report has been updated to include any comments received during the public review period of the EIA and EMPr.

## Impacts and management actions

The table below provides a summary of the key impacts and management actions identified throughout the process.

### KEY IMPACTS AND MANAGEMENT ACTIONS ASSOCIATED WITH THE PROPOSED PROJECT

| Impact  | Possible Management Measure   | Impact rating      |                 |
|---|---|--------------------|-----------------|
|   |   | Without Mitigation | With Mitigation |
| Loss of soil and Land Capability through physical disturbance | <ul style="list-style-type: none"> <li>• Soil erosion management.</li> <li>• Soil compaction management.</li> <li>• Waste Management.</li> <li>• Soil Loss and Stockpile Management.</li> <li>• Revegetation immediate to rehabilitation of footprint.</li> </ul>   | Medium to Low      | Very Low        |
| Loss of soil and land capability through contamination        | <ul style="list-style-type: none"> <li>• Hazardous materials to be stored in bunded, lined areas.</li> <li>• Maintenance of vehicles and use of drip trays.</li> <li>• Waste stored on lined surface.</li> <li>• Spill kits available and used on site.</li> <li>• Awareness training.</li> <li>• Post rehabilitation audits.</li> </ul>      | Medium             | Low             |
| Reduced floral habitat and diversity                          | <ul style="list-style-type: none"> <li>• Demarcation and fencing of working footprint to limit loss of indigenous vegetation.</li> <li>• Designs should include precautions to prevent spills/leaks.</li> <li>• Alien Invasives Plants Management and Control Plan.</li> <li>• Comprehensive rehabilitation and revegetation plan.</li> </ul> | Medium             | Low             |
| Impact on floral species of conservation concern              | <ul style="list-style-type: none"> <li>• Walkdown of the green-fields areas within the project footprint and all protected species to be marked.</li> <li>• A rescue and relocation plan for protected floral species.</li> <li>• Permitting for the removal of protected species must be obtained.</li> </ul>                                | Medium             | Low             |

| Impact   | Possible Management Measure  | Impact rating      |                 |
|--|--|--------------------|-----------------|
|  |  | Without Mitigation | With Mitigation |
|  | <ul style="list-style-type: none"> <li>Rehabilitation plan to be implemented effectively and as soon as possible.</li> <li>Rehabilitation to continue for at least 5 years after decommissioning and closure.</li> </ul>   |                    |                 |
| Loss of faunal habitat and diversity   | <ul style="list-style-type: none"> <li>Proposed top-cut to be fenced off and clearly demarcated.</li> <li>Access roads on existing roads.</li> <li>Consider sensitive habitats throughout planning and execution.</li> <li>Alien invasive species control plan.</li> <li>Fire management and erosion plan.</li> <li>NO clearing outside of the development footprint.</li> </ul>   | Medium             | Low             |
| Impact on Important faunal species of conservation concern                             | <ul style="list-style-type: none"> <li>Proposed top-cut to be fenced off and clearly demarcated.</li> <li>Access roads on existing roads.</li> <li>Consider sensitive habitats throughout planning and execution.</li> <li>Rehabilitation plan should be developed for implementation throughout the development phase.</li> <li>Fire management and erosion plan.</li> <li>Design should prevent potential leaks and spills.</li> </ul> | Medium             | Very Low        |
| Contamination of surface water resources affecting third party use                     | <ul style="list-style-type: none"> <li>Drip trays should be placed under all standing machinery.</li> <li>Oil recovered from any vehicle or equipment on site must be collected, stored and disposed of by accredited vendors for recycling.</li> <li>A water quality monitoring plan must be formulated before construction.</li> </ul>   | Medium             | Low             |
| Erosion and Sedimentation  | <ul style="list-style-type: none"> <li>Construction must be undertaken in the dry season.</li> <li>Concurrent rehabilitation of disturbed land and revegetation should be carried out to minimise the period that bare soils are exposed to erosion.</li> <li>A service and maintenance plan must be compiled and implemented.</li> </ul>  | Medium             | Low             |
| Alteration of natural drainage patterns affecting flow of water in downstream systems. | <ul style="list-style-type: none"> <li>Development of stormwater infrastructure for pollution control.</li> <li>Clean water to be released into the environment to minimise alteration of natural drainage flow.</li> <li>Reuse of water from the PCDs must be prioritised as well as use of water from Middelplaats Shaft.</li> </ul>   | Medium             | Low             |

| Impact   | Possible Management Measure  | Impact rating      |                 |
|--|--|--------------------|-----------------|
|  |  | Without Mitigation | With Mitigation |
| Contamination of groundwater affecting third part use.                   | <ul style="list-style-type: none"> <li>Ongoing monitoring in order to address contamination timeously.</li> </ul>  | Medium             | Low             |
| Development of the drawdown due to mining.                               | <ul style="list-style-type: none"> <li>Ongoing monitoring in order to identify any issues for address.</li> </ul>  | Medium             | Low             |
| Increase in ambient air concentrations.                                  | <ul style="list-style-type: none"> <li>Limit speed of haul trucks to a maximum of 40 km/h.</li> <li>Limit unnecessary travel of vehicles on unpaved roads.</li> <li>Apply water sprays / dust suppressant on regularly travelled sections of roads.</li> <li>Vehicles should be cleaned of all mud and material to be transported must be covered before travelling on public roads.</li> <li>Access road to the sinter plant needs to be kept clean to minimise carry-on of mud to public roads.</li> <li>Controlled blasting techniques to be used to minimise dust generation.</li> <li>Blasting to be conducted on cloudless days only, if possible.</li> <li>Chemical surfactants added to water sprays to lower water surface tension and increase binding properties.</li> <li>Increase in-pit material moisture content.</li> <li>Drop the height from excavator into haul trucks through water sprays.</li> <li>Water sprays at mobile crushers.</li> </ul> | Medium             | Low             |
| Increase in disturbing noise levels affecting potential human receptors. | <ul style="list-style-type: none"> <li>Temporary noise barriers and use low noise equipment for construction phase.</li> <li>Alternatives to audible reversing alarms or configure to maximise forward movements of mobile plant and vehicles.</li> <li>Selection and management of low noise equipment and vehicles.</li> <li>Maintain road surfaces.</li> <li>Activities to be limited to daytime hours.</li> <li>Grievance procedure should be available for receptors to report noise disturbance.</li> </ul>  | Low                | Very Low        |
| Loss or damage to heritage and/or palaeontological resources.            | <ul style="list-style-type: none"> <li>Chance finds protocol to be implemented.</li> </ul>   | Low                | Very Low        |
| Disturbance to third party road users by project related traffic.        | <ul style="list-style-type: none"> <li>Chance finds protocol to be implemented.</li> </ul>   | Low                | Very Low        |
| Positive socio-economic impact.  | <ul style="list-style-type: none"> <li>Optimise the use of rail for the transport of materials to reduce the requirement for trucking and impact to road users.</li> </ul>   | Very Low           | Low             |

| Impact   | Possible Management Measure  | Impact rating      |                 |
|--|--|--------------------|-----------------|
|  |  | Without Mitigation | With Mitigation |
|  | <ul style="list-style-type: none"> <li>Optimise as possible the use of local labour.</li> </ul>  |                    |                 |
| Negative Socio-economic Impact   | <ul style="list-style-type: none"> <li>Influx of migrant workers should be managed as far as possible.</li> <li>Impacts to sensitive receptors should be minimised through implementation of the EMPR and mitigation measures, particularly within the construction phase.</li> </ul>  | Low                | Very Low        |
| Hazardous Excavations and infrastructure that pose a safety risk to third parties and animals. | <ul style="list-style-type: none"> <li>Excavations and infrastructure should be limited to within the working footprint.</li> <li>Access to the site should be limited as it is within the mining right area.</li> <li>Fencing, or demarcation of dangerous areas should be implemented.</li> <li>Monitoring of excavations should be carried out daily to ensure that no animal has become trapped within these areas.</li> </ul> | Low                | Very Low        |
| Sterilisation of mineral resources.  | <ul style="list-style-type: none"> <li>All of the proposed activities will be taking place within the existing mine surface infrastructure area. Therefore, it is not anticipated that any additional mineral resources will be sterilized.</li> </ul>   | N/A                | N/A             |
| Change in current land use.  | <ul style="list-style-type: none"> <li>The current land use is mining and this will remain the land use post authorisation of the proposed activities.</li> </ul>  | N/A                | N/A             |

## Environmental Impact Statement

The assessment of the proposed project presents the potential for negative impacts to occur (in an unmitigated scenario) on the biophysical environments both on the project footprint and in the surrounding area. With the implementation of management actions, these potential impacts can be prevented or reduced to acceptable levels.

It follows that provided the EMPR is effectively implemented, there is no biophysical, cultural heritage or socio-economic reason why the proposed project should not proceed.

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## ACRONYMS AND ABBREVIATIONS

| Acronym / Abbreviation | Definition  |
|------------------------|---|
| ABA                    | Acid Base Accounting  |
| AEL                    | Air Emissions License   |
| AIP                    | Alien and Invasive Plant  |
| AQIA                   | Air Quality Impact Assessment                                   |
| ASTM                   | American Standard Testing Method                                |
| BID                    | Background Information Document                                 |
| BIF                    | Banded Iron Formation   |
| BPG                    | Best Practice Guidelines  |
| Ca                     | Calcium   |
| CBA                    | Critical Biodiversity Area                                      |
| Cl                     | Chlorine  |
| CO                     | Carbon Monoxide   |
| CO <sub>2</sub>        | Carbon Dioxide  |
| CRR                    | Comments and Response Report                                    |
| DEA                    | Department of Environmental Affairs                             |
| DEFF                   | Department of Environment, Fisheries and Forestry               |
| DENC                   | Northern Cape Department of Environment and Nature Conservation |
| DME                    | Department of Minerals and Energy                               |
| DMRE                   | Department of Mineral Resources and Energy                      |
| DMS                    | Dense Medium Separator  |
| DRDLR                  | Department of Rural Development and Land Reform                 |
| DWS                    | Department of Water and Sanitation                              |
| EA                     | Environmental Authorisation                                     |
| EAP                    | Environmental Assessment Practitioner                           |
| EC                     | Electrical Conductivity   |
| EIA                    | Environmental Impact Assessment                                 |
| EIAR                   | Environmental Impact Report                                     |
| EMF                    | Environmental Management Framework                              |
| EMPR                   | Environmental Management Plan Report                            |
| EPCM                   | Engineering, Procurement and Construction Management            |
| ESA                    | Early Stone Age   |
| ESDD                   | Environmental and Social Due Diligence                          |
| ESIA                   | Environmental and Social Impact Assessment                      |
| F                      | Fluoride  |
| FOE                    | Frequency of Exceedance   |
| GDP                    | Gross Domestic Product  |
| GNR                    | General Notice Regulation                                       |

| Acronym / Abbreviation | Definition   |
|------------------------|--|
| HDSAs                  | Historically Disadvantaged South Africans  |
| HHM                    | Hotazel Manganese Mines (Pty) Ltd  |
| HIA                    | Heritage Impact Assessment   |
| I&AP                   | Interested and Affected Party  |
| IBA                    | Important Bird Area  |
| IDP                    | Integrated Development Plan  |
| IEM                    | Integrated Environmental Management  |
| IFC                    | International Finance Corporation  |
| IUCN                   | International Union for Conservation of Nature                                   |
| IWUL                   | Integrated Water Use Licence   |
| JMLM                   | Joe Morolong Local Municipality  |
| JTGDM                  | John Taolo Gaetsewe District Municipality  |
| KMF                    | Kalahari Manganese Field   |
| LC                     | Leachable Concentration  |
| LMO                    | Lower Manganese Ore Body   |
| LOM                    | Life of Mine   |
| LoS                    | Load-Out station   |
| LSA                    | Late Stone Age   |
| MECA                   | Manganese Export Capacity Allocation   |
| Mg                     | Magnesium  |
| MMO                    | Middle Manganese Ore Body  |
| MMT                    | Mamatwan Manganese Mine  |
| MPRDA                  | Minerals and Petroleum Resources Development Act (Act 28 of 2002, as amended)    |
| MR                     | Mining Right   |
| MSA                    | Middle Stone Age   |
| Mt                     | Million tonnes   |
| N                      | Nitrogen   |
| Na                     | Sodium   |
| NAAQS                  | National Ambient Air Quality Standards   |
| NAG                    | Nett Acid Generation   |
| NBA                    | National Biodiversity Assessment   |
| NCPGDS                 | Northern Cape Provincial Growth and Development Strategy                         |
| NCNCA                  | Northern Cape Nature Conservation Act (Act 9 of 2009)                            |
| NCPSDF                 | Northern Cape Provincial Spatial Development Framework                           |
| NDCR                   | National Dust Control Regulations  |
| NDP                    | National Development Plan  |
| NEMA                   | National Environmental Management Act (Act 107 of 1998, as amended)              |
| NEM: AQA               | National Environmental Management: Air Quality Act (Act 39 of 2004, as amended)  |
| NEM: BA                | National Environmental Management: Biodiversity Act (Act 10 of 2004, as amended) |
| NEM: WA                | National Environmental Management: Waste Act (Act 59 of 2008, as amended)        |

| Acronym / Abbreviation | Definition  |
|------------------------|---|
| NFEPA                  | National Freshwater Ecosystem Priority Area           |
| NHRA                   | National Heritage Resources Act (Act 25 of 1999)      |
| NO <sub>2</sub>        | Nitrogen Dioxide                                      |
| NO <sub>3</sub>        | Nitrate   |
| NO <sub>x</sub>        | Nitrous oxides  |
| NPAES                  | National Priority Areas Expansion Strategy            |
| NSSD                   | National Strategy for Sustainable Development         |
| NWA                    | National Water Act (Act 36 of 1998, as amended)       |
| O <sub>3</sub>         | Ozone   |
| OPP                    | Ore Processing Plant                                  |
| Pb                     | Lead  |
| PCD                    | Pollution Control Dam                                 |
| PES                    | Present Ecological State                              |
| PFS                    | Pre-Feasibility Study                                 |
| PM                     | Particulate Matter                                    |
| QDS                    | Quarter Degree Squared                                |
| ROM                    | Run of Mine   |
| S&EIA                  | Scoping and Environmental Impact Assessment           |
| SABAP2                 | South African Bird Atlas Project 2                    |
| SABS                   | South African Bureau of Standards                     |
| SACAD                  | South African Conservation Area Database              |
| SAHRA                  | South African Heritage Resources Agency               |
| SAMRAD                 | South African Mineral Resources Administration System |
| SANBI                  | South African National Biodiversity Institute         |
| SANS                   | South African National Standards                      |
| SAPAD                  | South African Protected Area Database                 |
| SCC                    | Species of Conservation Concern                       |
| SCS                    | Soil Conservation Services                            |
| SDF                    | Spatial Development Framework                         |
| SLP                    | Social and Labour Plan                                |
| SLR                    | SLR Consulting (South Africa) (Pty) Ltd               |
| SO <sub>2</sub>        | Sulphur dioxide                                       |
| SO <sub>4</sub>        | Sulphate  |
| South32                | South32 Limited                                       |
| SPLP                   | Synthetic Precipitation Leaching Procedure            |
| T.Alk                  | Total Alkalinity                                      |
| TC                     | Total Concentration                                   |
| TFR                    | Transnet Freight Rail                                 |
| THT                    | Training Handling Times                               |
| TPA                    | Tonnes per annum                                      |

| Acronym / Abbreviation | Definition   |
|------------------------|--|
| Tshipi                 | Tshipi é Ntle Manganese Mining (Pty) Ltd               |
| TSP                    | Total Suspended Parts.                                 |
| TWQR                   | Targeted Water Quality Range                           |
| UMK                    | United Manganese of Kalahari (Pty) Ltd                 |
| UMO                    | Upper Manganese Ore Body                               |
| US EPA                 | United States Environmental Protection Act             |
| WHO                    | World Health Organisation                              |
| WML                    | Waste Management Licence                               |
| WRD                    | Waste Rock Dump  |
| WUL                    | Water Use Licence                                      |
| WULAAS                 | Water Use License Application and Authorisation System |



# ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PROGRAMME FOR THE CHANGES TO INFRASTRUCTURE LAYOUT AND ACTIVITIES AT THE MAMATWAN MINE

## 1. INTRODUCTION

### 1.1 PROJECT BACKGROUND

HMM is the holder of a MR for the opencast manganese mine known as MMT. The MMT is operated by South32, a globally diversified mining and metals company producing bauxite, alumina, aluminium, energy and metallurgical coal, manganese, nickel, silver, lead and zinc in Australia, Southern Africa and South America. The MMT is located approximately 25 km to the south of the town Hotazel, in the JTGDM and JMLM of the Northern Cape Province of South Africa. The MMT is bordered by the Tshipi Borwa Mine (operated by Tshipi Tshipi) to the West and by the UMK Mine, to the North. The regional and local settings are illustrated in Figure 1-1 and Figure 1-2, respectively. HMM holds the following environmental permits and authorisations for the MMT:

- A MR (Reference number: NC 252 MR) issued and approved by the former Department of Minerals and Energy (DME) (currently the DMRE) in May 2006;
- An amended EMPr (Reference number: NC 6/2/2/118) issued and approved by the former DME (currently the DMRE) in November 2005;
- An Atmospheric Emissions Licence (AEL) (Licence number: NC/AEL/JTG/MAM01/2012) issued by the Northern Cape Department of Environment and Nature Conservation (DENC) in March 2020;
- An Integrated Water Use Licence (IWUL) (License number: 10/D41K/KAGJ/1537) issued by the Department of Water and Sanitation (DWS) in January 2012 and associated amendment issued in October 2017 and October 2020;
- An EA (Reference number: NC/KGA/HOT3/07) for bulk fuel storage issued by former Department of Tourism, Environment and Conservation (currently DENC) in July 2007); and
- An EA (Reference number: NC 30/5/1/2/3/2 (252) MR) for the merging of the Mamatwan Sinterfontein Waste Rock Dump (WRD) with the Tshipi Eastern WRD from the DMRE in January 2020.

### 1.2 SCOPE OF THE PROJECT

MMT is making an application to the DMRE for an integrated EA (including Waste Management License) and update of the mine's current EMPr to address a number of layout and activity changes that have already taken place at the MMT, as well as proposed layout and activity changes.

A list of layout and/or activity changes that have already taken place include:

- Expansion of the north and south- eastern WRDs;
- Changes to the rehabilitation criteria of WRDs;
- Expansion of the product stockyard;
- Establishment of potable and process water storage facilities; and
- Expansion of an existing road.

A list of the proposed layout and/or activity changes include:

- Establishment of a top-cut stockpile and associated mobile crushing and screening plant;
- Establishment of stormwater management infrastructure including a Pollution Control Dam (PCD) and evaporation channels;
- Change in height of the WRD (this excludes rehabilitated WRD's);
- Establishment of a pipeline to transfer water abstracted from the decommissioned Middelpplaats Mine to MMT;
- Upgrading the railway line and the railway loadout station;
- Sale of waste rock as aggregate; and
- Re-processing of material located in Adams Pit .

In addition to the above, MMT also proposes to amend specific management commitments in the approved EMPr which are no longer relevant to the operation.

SLR, an independent firm of EAPs, has been appointed to manage the EIA and EMPr process.

### 1.3 SUMMARY OF AUTHORISATION REQUIREMENTS

The proposed layout and activity changes will require an integrated EA (including Waste Management License) and amendment of MMT's current EMPR. The project includes activities listed under the National Environmental Management Act (No. 108 of 1998) (NEMA) and waste management activities listed under the National Environmental Management: Waste Act (No. 59 of 2008) (NEM: WA). Under both NEMA and NEM: WA, listed activities are prohibited from commencing until written authorisation is obtained from the competent authority, which in this case is the Northern Cape office of the DMRE.

The project requires approval of an integrated EA (including Waste Management License) in terms of Section 24 of NEMA and Section 45 of NEM: WA from the Northern Cape DMRE. In terms of Section 102 of the Mineral and Petroleum Resources Development Act (No. 59 of 2002) (MPRDA), an EMPR may not be amended or varied without the written consent of the Minister of Mineral Resources.

The MPRDA, NEMA and NEM: WA requires that an applicant submit the relevant environmental reports required in terms of NEMA. The Environmental Impact Assessment (EIA) Regulations, 2014 (published under Government Notice Regulation (GNR) 982 of 4 December 2014, as amended), promulgated in terms of NEMA set out the assessment process and reporting requirements where authorisation is required. For the purpose of this project, an integrated EIA process will be undertaken and will meet the requirements of:

- Regulation 31 (Part 2: substantive amendment process) to cater for changes to the approved 2005 EMPR in terms of the EIA Regulations (GNR 982 of 2014), as amended; and
- Regulation 21 and 23 (Scoping and Environmental Impact Assessment (S&EIA) process) to cater for listed activities in terms of the EIA Regulations (GNR 982 of 2014), as amended. Listed activities triggered as a result of the project are outlined in Section 4.1.

Further detail on the integrated environmental process is included in Section 5.2. In addition, the project also requires authorisation from the DHWS for specific water uses listed under Section 21 of the NWA. This report does not address the requirements of a water use licensing process. This will be handled as part of a separate process with the DWS.

This process does not cover occupational health and safety legislation requirements.

## 1.4 INTRODUCTION TO THE ENVIRONMENTAL ASSESSMENT PROCESS

An EIA is conducted in two phases. The first is the Scoping Phase and the second is the EIA Phase. The final Scoping Report was submitted to the DMRE on 26 March 2021 and was accepted on 27<sup>th</sup> October 2021. The objectives of the Scoping Phase were in line with Chapter 4, Part 3 of the EIA Regulations (GNR 982 of 2014), as amended. The terms of reference as identified in the Scoping Report for further assessment during the EIA phase enables the meaningful assessment of all relevant biophysical and socioeconomic issues.

This EIA and EMPR provides a description of the proposed project and the affected environment; summarises the EIA process followed to date; identifies and assesses the key project impacts and presents management and mitigation measures that are recommended to enhance positive and limit negative impacts.

## 1.5 TERMS OF REFERENCE

SLR Consulting (South Africa) (Pty) Ltd (SLR), as the independent Environmental Assessment Practitioner (EAP), is responsible for undertaking the required environmental regulatory process and conducting the public participation process. The terms of reference for this integrated regulatory environmental process were to:

- Make an application for the EA of the proposed project in terms of NEMA and NEM; WA;
- Ensure the EIA process is undertaken in accordance with the requirements of NEMA, EIA Regulations 2014 (GNR 982 of 2014), as amended;
- Ensure the EIA process is undertaken in an open and participatory manner to ensure that all potential impacts are identified;
- Undertake a formal public participation process, which includes the distribution of information to I&APs and provides the opportunity for I&APs to raise any concerns/issues, as well as an opportunity to comment on all documentation; and
- Integrate all the information, including the findings of the specialist studies (where relevant) and other relevant information, into an EMPr report to allow an informed decision to be taken by the competent authority.

Further to this and in accordance with Appendix 3 of the EIA Regulations (GNR 982 of 2014), as amended and the DMRE reporting requirements, the key objectives of the EIA process are to:

- Determine the policies and legislation relevant to the activity and document how the proposed activity complies with and responds to the policy and legislative context;
- Describe the need and desirability of the proposed activity in the context of the development footprint on the preferred site as contemplated in the accepted Scoping Report;
- Identify feasible alternatives related to the project proposal;
- Ensure that all potential key environmental issues and impacts that will result from the proposed project are identified;
- Assess potential impacts of the proposed project alternatives during the different phases of project development;

- Identify the most ideal location of the activity within the development footprint of the preferred site based on the lowest level of environmental sensitivity identified during the assessment;
- Present appropriate mitigation or optimisation measures to avoid, manage or mitigate potential impacts or enhance potential benefits, respectively; and
- Identify residual risks that need to be managed and monitored.

## 1.6 STRUCTURE OF THE REPORT

In terms of section 16(3) of the EIA Regulations, 2014 as amended, any report submitted as part of an application must be prepared in the format that may be determined by the competent authority. In this regard, the EMPr document has been prepared in accordance with the DMRE EIA and EMPr template format, in accordance with the requirements of the MPRDA. This report also complies with the requirements of the NEMA and Appendix 3 and Appendix 4 of EIA Regulations (GNR 982 of 2014), as amended. Table 1-1: Structure of the EIA report provides a summary of the requirements, with cross references to the report sections where these requirements have been addressed.

**Table 1-1: Structure of the EIA report**

| EMPR report requirement as per the DMRE template          | EMPR report requirements as per the 2014 NEMA regulations (as amended)   | Reference in the report     |
|---|--|-----------------------------|
| Part A of DMRE report template                            | Appendix 3 of the NEMA regulations   | Section/Appendix            |
| The EAP who prepared the report                           | Details of the EAP who prepared the report   | Section 2.1                 |
| Expertise of the EAP                                      | Details of the expertise of the EAP, including curriculum vitae  | Section 2.2                 |
| Description of the property                               | The location of the activity, including – the 21-digit Surveyor General code of each cadastral land parcel. Where available the physical address and farm name. Where the required information is not available, the coordinates of the boundary of the property or properties   | Section 3                   |
| Locality plan   | A plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken or on land where the property has not been defined, the coordinates within which the activity is to be undertaken | Section 3.2                 |
| Description of the scope of the proposed overall activity | A description of the scope of the proposed activity, including all listed and specified activities triggered   | Section 4                   |
| Description of the activities to be undertaken            | A description of the scope of the proposed activity, including all listed and specified activities triggered and being applied for and a description of the associated structure and infrastructure related to the development   | Section 4.1 and Section 4.2 |
| Policy and legislative context                            | A description of the policy and legislative context within which the development is located and an explanation of how the proposed development   | Section 5                   |

| EMPR report requirement as per the DMRE template  | EMPR report requirements as per the 2014 NEMA regulations (as amended)   | Reference in the report |
|---|--|-------------------------|
|   | complies with and responds to the legislation and policy context   |                         |
| Need and desirability of the proposed activity  | A motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location   | Section 6               |
| 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 | A motivation of 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   | Section 7               |
| Details of the development footprint alternatives considered  | Details of all the alternatives considered   | Section 7.1             |
| Details of the public participation process followed  | Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs   | Section 7.2             |
| Summary of issues raised by I&APs   | A summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them  | Section 7.3             |
| Environmental attributes associated with the development footprint alternatives   | The environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects  | Section 7.4             |
| Impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts including the degree of the impacts                                     | The impacts and risks identified, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts can be reversed, may cause irreplaceable loss of resources and can be avoided, managed and mitigated | Section 7.5             |
| Methodology used in determining the nature, significance, consequence, extent, duration and probability of potential environmental impacts and risks  | The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks  | Section 7.6             |
| The positive and negative impacts that the proposed activity (in terms of the initial site layout) and alternative will have on the environment and the community that may be affected                | Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects                                 | Section 7.7             |
| The possible management actions that could be applied and the level of risk   | The possible management actions that could be applied and level of residual risk   | Section 7.8             |
| Motivation where no alternative sites were considered   | If no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such  | Section 7.9             |
| Statement motivating the alternative development location within the overall site   | A concluding statement indicating the preferred alternatives, including preferred location within the approved site  | Section 7.10            |

| EMPR report requirement as per the DMRE template  | EMPR report requirements as per the 2014 NEMA regulations (as amended)   | Reference in the report |
|---|--|-------------------------|
| 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) through the life of the activity | A full description of the process undertaken to identify, assess and rank the impacts the activity and associated structure and infrastructure will impose on the preferred location through the life of the activity including a description of all environmental issues and risks that were identified during the environmental impact assessment process and an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of management actions | Section 8               |
| Assessment of each identified potentially significant impact and risk   | An assessment of each identified potentially significant impact and risk including cumulative impacts, the nature, significant and consequence of the impact and risk, the extent and duration of the impact and risk, the probability of the impact and risk occurring, the degree to which the impact can be reversed, the degree to which the impact and risk may cause irreplaceable loss of a resources and the degree to which the impact and risk can be mitigated.   | Section 9               |
| Summary of specialist reports   | Where applicable the summary of the findings and recommendations of any specialist report complying with Appendix 6 of these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report  | Section 10              |
| Environmental impact statement including a summary of the key findings, final site map and a summary of the positive and negative implications and risks of the proposed activity and identified alternatives       | An environmental impact statement which contains a summary of the key findings of the environmental impact assessment, a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers and a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives   | Section 11              |
| Proposed impact management objectives and the impact management outcomes for inclusion in the EMPR  | Based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPR as well as for inclusion as conditions of authorisation   | Section 12              |
| Final proposed alternatives   | The final proposed alternatives which respond to the impact management actions, avoidance, and management actions identified through the assessment  | Section 13              |
| Aspects for inclusion as conditions of authorisation  | Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation   | Section 14              |

| EMPR report requirement as per the DMRE template  | EMPR report requirements as per the 2014 NEMA regulations (as amended)   | Reference in the report |
|---|--|-------------------------|
| Description of any assumptions, uncertainties and gaps in knowledge   | A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and management actions proposed   | Section 15              |
| Reasoned opinion as to whether the proposed activity should or should not be authorised   | Reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation   | Section 16              |
| Period for which environmental authorisation is required  | Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised  | Section 17              |
| Undertaking   | An undertaking under oath or affirmation by the EAP in relation to the correctness of the information provided in the reports, the inclusion of comments and inputs from stakeholders and I&APs, the inclusion of inputs and recommendations from the specialist reports where relevant and any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties | Section 18              |
| Financial provision : how the amount required is derived and confirm that the amount can be provided for from operating expenditure | Where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts   | Section 19              |
| Deviation from the approved scoping report and plan of study  | An indication of any deviation from the approved scoping report, including the plan of study, including any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and a motivation for the deviation   | Section 20              |
| Other information required by the competent authority   | Any specific information required by the competent authority.  | Section 21              |
| Other matter required in terms of section 24(4)(a) and (b) of the Act   | Any other matter required in terms of section 24(4)(a) and (b) of the Act  | Section 22              |
| <b>Part B of DMRE report template</b>   | <b>Appendix 4 of the NEMA regulations</b>  | <b>Section/Appendix</b> |
| Details of EAP  | Details of the EAP who prepared the EMPR and the expertise of that EAP to prepare the EMPR, including a curriculum vitae   | Section 23              |
| Description of the aspects of the activity  | A detailed description of the aspects of the activity that are covered by the EMPR as identified by the project description  | Section 24              |
| Composite map   | A map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that any areas that should be avoided, including buffers  | Section 25              |



| EMPR report requirement as per the DMRE template   | EMPR report requirements as per the 2014 NEMA regulations (as amended)  | Reference in the report |
|--|---|-------------------------|
| Description of impact management objectives including management statements  | A description of the impact management objectives, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including planning and design, pre-construction activities, construction activities, rehabilitation of the environment after construction and where applicable post closure; and where relevant, operation activities  | Section 26              |
| The determination of closure objectives  |   | Section 26.1            |
| The process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of undertaking a listed activity | -   | Section 26.2            |
| Potential acid mine drainage   | -   | Section 26.3            |
| Steps taken to investigate, assess and evaluate the impact of acid mine drainage   | -   | Section 26.4            |
| Engineering or mine design solutions to be implemented to avoid or remedy acid mine drainage   | -   | Section 26.5            |
| Measures that will be put in place to remedy any residual or cumulative impact that may result from acid mine drainage   | -   | Section 26.6            |
| Volumes and rate of water use required for the mining  | -   | Section 26.7            |
| Has a water use licence (WUL) been applied for?  | -   | Section 26.8            |
| Impacts to be mitigated in the respective phases   | -   | Section 26.9            |
| Impact management outcomes   | A description and identification of impact management outcomes required for the aspects contemplated in paragraph   | Section 27              |
| Impact management actions  | A description of proposed impact management actions, identifying the manner in which the impact management objectives and outcomes be achieved, and must, where applicable, include actions to avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; comply with any prescribed environmental management standards or practices; comply with any applicable provisions of the Act regarding closure, where applicable comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable | Section 28              |
| Financial provision  |   | Section 29              |
| Mechanism for monitoring compliance with and performance assessment  | The method of monitoring the implementation of the impact management actions  | Section 30              |



| EMPR report requirement as per the DMRE template                     | EMPR report requirements as per the 2014 NEMA regulations (as amended)   | Reference in the report |
|--|--|-------------------------|
| against the environmental management programme and reporting thereon | The frequency of monitoring the implementation of the impact management actions  |                         |
|  | An indication of the persons who will be responsible for the implementation of the impact management actions   |                         |
|  | The time periods within which the impact management actions must be implemented  |                         |
|  | The mechanism for monitoring compliance with the impact management actions   |                         |
|  | A program for reporting on compliance, considering the requirements as prescribed by the Regulations   |                         |
| Environmental Awareness Plan   | An environmental awareness plan describing the manner in which the applicant intends to inform his or her employees of any environmental risk which may result from the work; and risks must be dealt with in order to avoid pollution or the degradation of the environment | Section 31              |
| Specific information required by the competent authority             | Any specific information that may be required by the competent authority   | Section 32              |
| Undertaking  | -  | Section 33              |

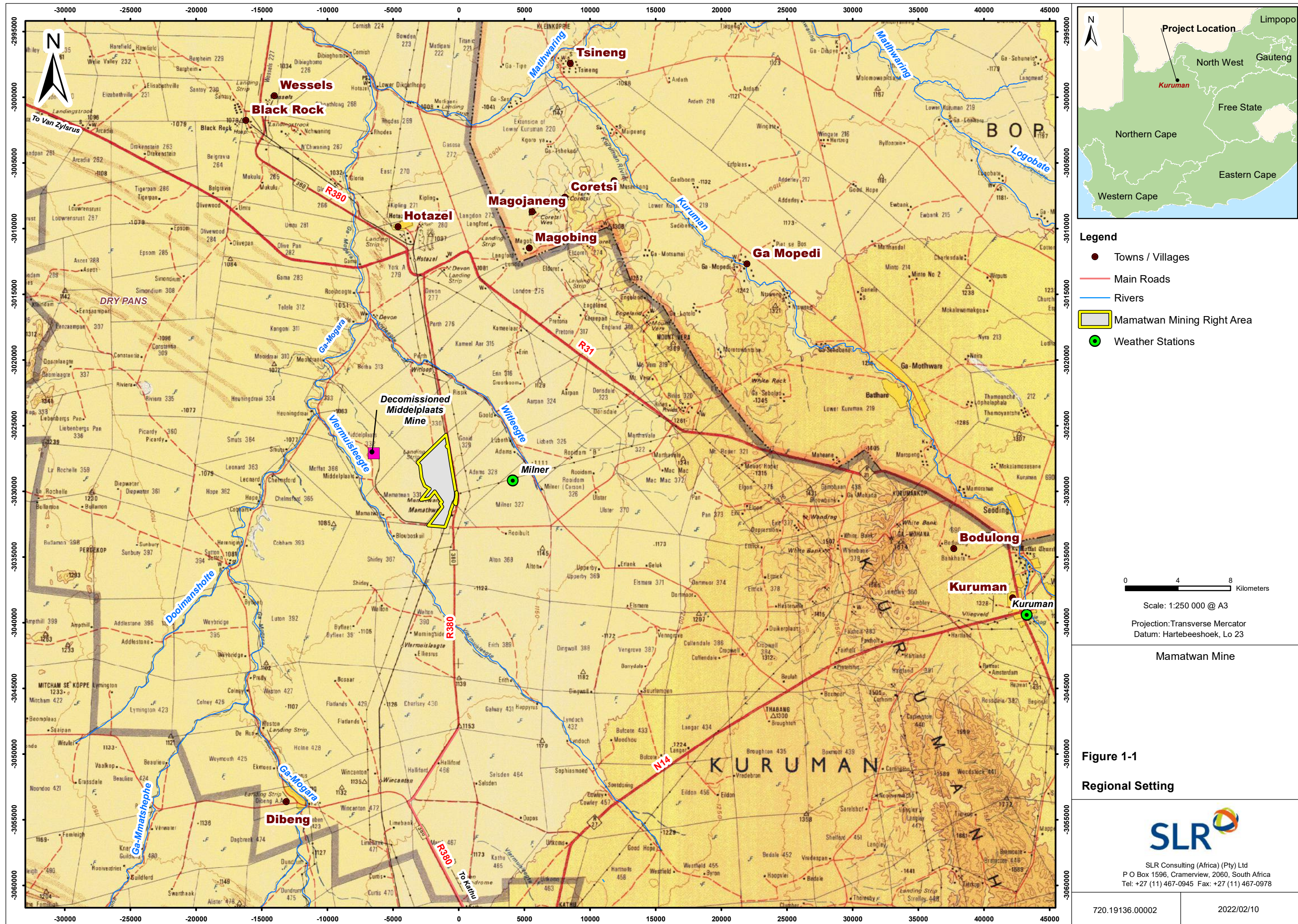
## 1.7 OPPORTUNITY TO COMMENT

This EIA Report (EIAR) was made available for a 30-day comment period from **22<sup>nd</sup> November 2021 to 6<sup>th</sup> January 2022** in order to provide I&APs with an opportunity to comment on any aspect of the project and the findings of the S&EIA process to date. Copies of the full report were made available on the SLR website (at <https://slrconsulting.com/public-documents>) and the SLR data free website (at <https://slrpublicdocs.datafree.co/public-documents>). Electronic copies (compact disk) of the report were made available from SLR, at the contact details provided below. This EIA and EMP has been updated to include any comments received during the public review period.

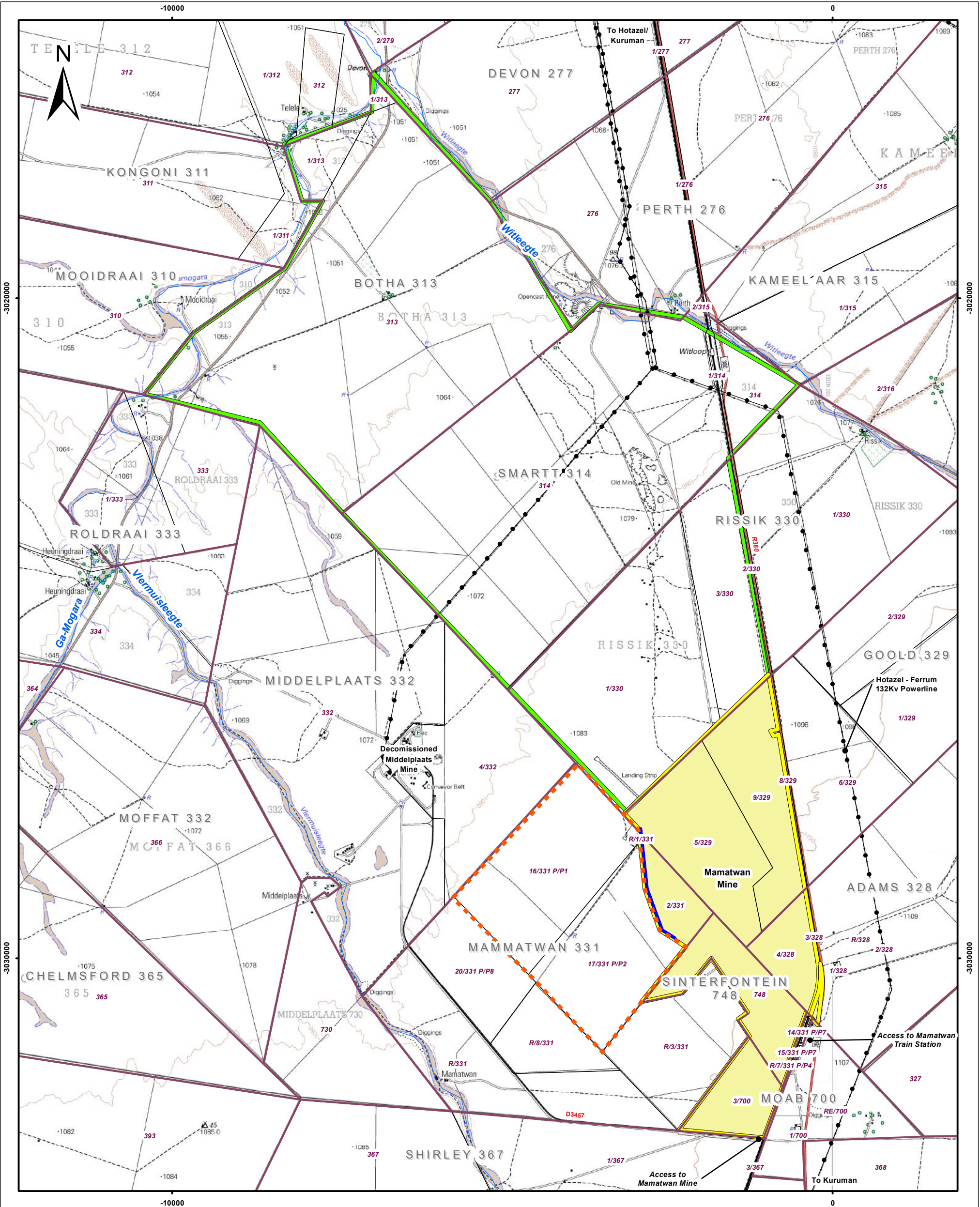
**SLR Consulting (South Africa) (Pty) Ltd**  
**Attention: Edwynn Louw**  
 PO Box 1596, Cramerview 2060 (if using post please call SLR to notify us of your submission)  
 Tel: (011) 467 0945  
 E-mail: [pppafr@slrconsulting.com](mailto:pppafr@slrconsulting.com)

By providing your personal information to be registered as an I&AP for this project you consent to SLR managing your information in accordance with the Protection of Personal Information Act 4 of 2013. This includes; (1) retaining and using your Personal Information as part of a contact database for this and/or other EIAs, (2) contacting you regarding this and/or other EIA processes, (3) disclosing the database to other authorised parties for lawful purposes, (4) processing it for lawful purposes, and (5) including correspondence in EIA Reports. You may request for your Personal Information to be deleted from the Project database or comments to be excluded from EIA Reports at any time by contacting SLR.









**Legend**

- Mamatwan Mining Right Area
- UMK Mining Right Area
- Tshipi Mining Right Area
- Barrier Pillar
- Main Roads
- Power Line
- Rivers and Streams
- 20m Contour Lines

0 1 000 2 000 Meters

Scale: 1:55 500 @ A3  
Projection: Transverse Mercator  
Datum: WGS1984, Lo23

Mamatwan Mine

**Figure 1-2**

**Local Setting**



SLR Consulting (Africa) (Pty) Ltd  
P O Box 1596, Cramerview, 2060, South Africa  
Tel: +27 (11) 467-0945 Fax: +27 (11) 467-0978

720.19136.00002

2022/02/10

# **PART A – SCOPE OF ASSESSMENT AND ENVIRONMENTAL IMPACT ASSESSMENT REPORT**

## 2. DETAILS OF THE EAP

### 2.1 DETAILS OF THE DETAILS OF THE EAP WHO PREPARED THE REPORT

The details of the EAP project team that were involved in the preparation of this EIA and EMP are provided in the table below.

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

| General        |   |  |
|----------------|---|--|
| Organisation   | SLR Consulting (South Africa) (Pty) Ltd   |  |
| Postal address | PO Box 1596, Cramerview, 2060   |  |
| Tel No.        | (011) 467 0945  |  |
| -              | Role  | Email  |
| Edward Perry   | Reviewer – Process review, quality control  | <a href="mailto:eperry@slrconsulting.com">eperry@slrconsulting.com</a> |
| Sharon Meyer   | EAP and Project Manager – Management of process, specialist review, public participation process and report compilation | <a href="mailto:smeyer@slrconsulting.com">smeyer@slrconsulting.com</a> |

SLR has no vested interest in the proposed project other than contractually agreed payment for consulting services rendered as part of the EIA process. An undertaking by SLR declaring its independence, as required by the EIA Regulations (GNR 982 of 2014), as amended, is provided in Section 18.

### 2.2 EXPERTISE OF THE EAP

**Edward Perry**, Edward Perry has worked in environmental consultancy for over 20 years for a wide range of public and private sector clients. Since moving to South Africa, Ed has been involved with Environmental and Social Impact Assessments and EAs throughout Africa. Ed has been Project Director of ESIs for a wide range of facilities including Renewable energy facilities; metal extractive industries; large water storage schemes; new mines, and extensions to mines. Edward has also undertaken a wide range of environmental audits including; due diligence audits, EMP audits, and over 20 international cyanide code audits of mines throughout Africa. These audits include assessing Environmental, Social and Health Impact Assessments and associated documentation against the requirements of the International Finance Corporation Performance Standards. Edward is a registered Environmental Assessment Practitioner with the Environmental Assessment Practitioners Association of South Africa.

**Sharon Meyer**, the project manager has over 20 years of experience as an environmental scientist and project manager. She has managed complex projects within the mining and power generation sectors, with a focus on industrial waste management. Sharon has managed multi-national and multi-disciplinary teams on environmental and social due diligence projects in Africa. Sharon has worked on a variety of mining projects including diamond, coal, gold, vanadium and tailings reclamation projects. Within the energy space, she has been involved in linear transmission line projects through sensitive socio-economic and biophysical environments within South Africa. Sharon has worked on coal-fired power station, gas turbine, photovoltaic solar, wind turbine and hydro-electric scheme projects. Sharon also has experience on Resettlement Action Plans, Livelihood

Restorations Plans and Community Census within southern Africa. Sharon has worked on various projects within Mozambique, Botswana, Namibia, Nigeria, Lesotho and South Africa.

Curriculum vitae of the project team are attached in Appendix A.



### 3. LOCATION OF THE ACTIVITY

#### 3.1 LOCATION OF THE OVERALL ACTIVITY

A description of the property on which the project activities are located is provided in the table below.

**Table 3-1: Description of the property**

| Description                   | Detail  |  |
|-------------------------------|---|--|
| Farm name of the project area | Project component   | Relevant farm and portion  |
|                               | Expansion of the north and south-eastern WRDs.  | <ul style="list-style-type: none"> <li>Portion 5 of the farm Goold 329.</li> </ul>   |
|                               | Changes to rehabilitation criteria for WRDs.  | <ul style="list-style-type: none"> <li>Portion 5 of the farm Goold 329 (North, central and southeast waste rock dumps);</li> <li>Remaining extent of the farm Sinterfontein 748 (Sinterfontein waste rock dump);</li> <li>Portion 2 of the farm Mamatwan 331 (South waste rock dump); and</li> <li>Portion 4 of the farm Adams 328 (Rehabilitated waste rock dump).</li> </ul> |
|                               | Expansion of product stockyard.   | <ul style="list-style-type: none"> <li>Remaining Extent of the farm Sinterfontein 748.</li> </ul>  |
|                               | Establishment of potable and process water facilities.  | <ul style="list-style-type: none"> <li>Portion 5 of the farm Goold 329 (Aqua tanks); and</li> <li>Remaining Extent of the farm Sinterfontein 748.</li> </ul>   |
|                               | Expansion of existing road.   | <ul style="list-style-type: none"> <li>Portion 9 of the farm Goold 329.</li> </ul>   |
|                               | Establishment of a top-cut stockpile and associated crushing and screening facilities.                      | <ul style="list-style-type: none"> <li>Portions 5 and 9 of the farm Goold 329; and</li> <li>Portion 4 of the farm Adams 328.</li> </ul>  |
|                               | Establishment of stormwater management infrastructure.  | <ul style="list-style-type: none"> <li>Portions 5 and 9 of the farm Goold 329;</li> <li>Remaining Extent of the farm Sinterfontein 748; and</li> <li>Portion 4 of the farm Adams 328.</li> <li>(The proposed stormwater management plan is being finalised, however likely farms on which proposed infrastructure may be located is listed above.)</li> </ul>                  |
|                               | Changes to all WRD heights (excluding rehabilitated WRD).   | <ul style="list-style-type: none"> <li>Portion 5 of the farm Goold 329 (North, central and southeast waste rock dumps);</li> <li>Remaining extent of the farm Sinterfontein 748 (Sinterfontein waste rock dump); and</li> <li>Portion 2 of the farm Mamatwan 331 (South waste rock dump).</li> </ul>   |
|                               | Establishment of a pipeline to transport abstracted water from the decommissioned Middelplaats Mine to MMT. | <ul style="list-style-type: none"> <li>Portion 3 of Middelplaats 332 (Decommissioned Middelplaats Mine and proposed boreholes);</li> <li>Remaining extent and portions 8 and 20 of the farm Mamatwan 331; and</li> <li>Portion 3 of the farm Moab 700.</li> </ul>  |

| Description   | Detail   |  |
|---|--|--|
|   | Upgrading the railway loadout station.   | <ul style="list-style-type: none"> <li>Remaining extent of the farm Sinterfontein 748.</li> </ul>  |
|   | Sale of waste rock as aggregate (excludes rehabilitated WRD).  | <ul style="list-style-type: none"> <li>Portion 5 of the farm Goold 329;</li> <li>Remaining extent of the farm Sinterfontein 748; and</li> <li>Portion 2 of the farm Mamatwan 331.</li> </ul> |
|   | Re-processing of material located in Adam's pit.   | Portion 4 of the farm Adams 328.   |
| <b>Project application area (ha)</b>                        | Collectively approximately 70 ha will be disturbed as part of the project.   |  |
| <b>Magisterial district</b>                                 | Kuruman Magisterial District   |  |
| <b>Distance and direction from nearest town</b>             | The project site is located approximately 25 km south of Hotazel (Refer to Figure 1-2).  |  |
| <b>21-digit Surveyor General code for each farm portion</b> | <ul style="list-style-type: none"> <li>C04100000000032900005</li> <li>C04100000000032900009</li> <li>C04100000000032800004</li> <li>C04100000000033200003</li> <li>C04100000000033200000</li> <li>C04100000000033100000</li> <li>C04100000000033100008</li> <li>C04100000000033100020</li> <li>C04100000000070000000</li> <li>C04100000000036700001</li> <li>C04100000000033100017</li> <li>C04100000000074800000</li> </ul> |  |

### 3.2 LOCALITY MAP

The regional and local settings of the MMT are illustrated in Figure 1-1 and Figure 1-2, respectively. The location and layout of the project components are illustrated in Figure 4-1 to Figure 4-10 in Section 4.



## 4. DESCRIPTION OF THE SCOPE OF THE ACTIVITY

### 4.1 LISTED AND SPECIFIED ACTIVITIES

The project triggers various activities for which authorisation is required in terms of the NEMA, NEM: WA and NWA. The associated listed or specified activities are summarised below.

#### 4.1.1 NEMA and the EIA Regulations

The EIA Regulations (GN R 982 of 2014), as amended promulgated in terms of Chapter 5 of NEMA provides for control over certain Listed Activities. These Listed Activities are detailed in Listing Notice 1 (GN R 983 of 2014, as amended) and Listing Notice 2 (GN R 984 of 2014, as amended) as well as Listing Notice 3 (GN R 985 of 2014, as amended). The undertaking of activities specified in the Listing Notices is prohibited until EA has been obtained from the competent authority. Such EA, which may be granted subject to conditions, will only be considered once there has been compliance with the EIA Regulations (GN R 982 of 2014) as amended. Where a development triggers activities listed in Listing Notice 1 and 3, a Basic Assessment process must be applied for the application. Where a development triggers activities listed in Listing Notice 2, a S&EIA process must be applied for the application. As the project would trigger activities specified in Listing Notices 1 and 2, a S&EIA process has to be conducted. In addition to this, the NEMA EIA Regulations (GN R 982 of 2014), as amended stipulates that an application submitted after the commencement of these Regulations for an amendment of an EMPr, issued in terms of the MPRDA, must be dealt with in terms of Part 1 or Part 2 of Chapter 5 of the regulations. Part 1 allows for the amendment of an EA if a project will not change the scope of a valid EA, nor increase the level or nature of the impact, which impact was initially assessed and considered when application was made. Part 2 allows for the amendment of an EA if the project will result in a change to the scope of a valid EA where such change will result in an increased level or change in nature of impact where such level or change in nature of impact was not assessed or taken into consideration in the initial EA and the change does not, on its own, constitute a listed or specified activity. The project also requires an amendment in terms of Part 2 of Chapter 5 of NEMA EIA Regulations (GN R 982 of 2014) as amended.

With reference to Section 1.1, MMT is making an application to the DMRE to update of the mine's current EMPr to address several layout and activity changes that have already taken place at the MMT, as well as proposed layout and activity changes. MMT also wishes to include administrative changes to the approved EMPr commitments. Table 4-1 below, outlines the main project components that trigger listed activities in terms of NEMA and the EIA Regulations (GNR 982 of 2014), as amended. The project activities that do not trigger any Listed Activities but require an amendment to the EMPr are included in Table 4-1. Taking this into consideration, for the purpose of this project, an integrated environmental authorisation process will be undertaken and will meet the requirements of:

- Regulations 27 and 28 (amendment, suspension, withdrawal and auditing of EMPr) for the amendment of the EMPr in terms of NEMA EIA Regulations;
- Regulation 31 (Part 2: substantive amendment process) to cater for changes to the approved EMPr in terms of the NEMA EIA Regulations (GNR 982 of 2014); and
- Regulation 21 and 23 (Scoping and EIA process) to cater for listed activities in terms of the NEMA EIA Regulations (GNR 982 of 2014), as amended.

**Table 4-1: Project activities and associated listed activities**

| Description of the project activity  | Aerial extent of the activity (ha) or m³  | Listed activity – Mark with an X where applicable | Listed activity number, applicable listing notice and activity description  |
|--|---|---|---|
| <b>Proposed layout/activity changes (Application in terms of NEMA - Regulation 21 and 23 of GNR 982 of 2014)</b> |   |   |   |
| Establishment of a top-cut stockpile and associated mobile crushing and screening plant.                         | 34 ha   | X   | <b>NEMA (GNR 984 of 2014) as amended by GNR.325 of 2017 (G.G. 40772 of 07/04/2017: Listing Notice 2, Activity 15:</b> The clearance of an area of 20 ha or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for: (i) The undertaking of a linear activity; or<br>(ii) Maintenance purposes undertaken in accordance with a maintenance management plan.<br><br><b>RELEVANCE:</b> The clearance of 34 ha of land for the establishment of the topsoil stockpile is above the 20 ha threshold, therefore triggering this activity.  |
|  |   | X   | <b>NEMA (GNR 984 of 2014) as amended by GNR.325 of 2017 (G.G. 40772 of 07/04/2017: Listing Notice 2, Activity 6:</b> The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent.<br><br><b>RELEVANCE:</b> Product stockpiles require a WUL in terms of the NWA. It follows that the existing IWUL, will need to be amended to cater for the top-cut stockpile.   |
| Establishment of stormwater management infrastructure – PCD and evaporation channels                             | Estimated combined capacity exceeding 66 000 m³ covering an area of more than 1 ha. | X   | <b>NEMA (GNR 983 of 2014) as amended by GNR.327 of 2017 (G.G. 40772 of 07/04/2017) and GNR.706 of 2018 (G.G. 41766 of 13/07/2018): Listing Notice 1, Activity 13:</b> The development of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50 000 m³ or more, unless such storage falls within the ambit of activity 16 in Listing Notice 2 of 2014.<br><br><b>RELEVANCE:</b> Based on preliminary design it is envisaged that a PCD will be required which will exceed a combined capacity of 50 000 m³.  |
|  |   | X   | <b>NEMA (GNR 983 of 2014) as amended by GNR.327 of 2017 (G.G. 40772 of 07/04/2017) and GNR.706 of 2018 (G.G. 41766 of 13/07/2018): Listing Notice 1, Activity 27:</b> The clearance of an area of 1 ha or more, but less than 20 ha of indigenous vegetation, except where such clearance of indigenous vegetation is required for:<br>(i) The undertaking of a linear activity; or<br>(ii) Maintenance purposes undertaken in accordance with a maintenance management plan.<br><br><b>RELEVANCE:</b> The proposed pollution control dam may be established in areas that will require the clearance of more than 1 ha of indigenous vegetation but less than 20 ha. |
|  |   | X   | <b>NEMA (GNR 984 of 2014) as amended by GNR.325 of 2017 (G.G. 40772 of 07/04/2017: Listing Notice 2, Activity 16:</b> The development of a dam where the highest part of the dam wall, as measured from the outside toe of the  |

| Description of the project activity  | Aerial extent of the activity (ha) or m <sup>3</sup> | Listed activity – Mark with an X where applicable | Listed activity number, applicable listing notice and activity description   |
|--|--|---|--|
|  |  |   | wall to the highest part of the wall, is 5 m or higher or where the highwater mark of the dam covers an area of 10 ha or more.<br><br><b>RELEVANCE:</b> Based on preliminary design it is likely that one of the proposed PCDs may be 5 m deep.  |
|  |  | X   | <b>NEMA (GNR 984 of 2014) as amended by GNR.325 of 2017 (G.G. 40772 of 07/04/2017: Listing Notice 2, Activity 6:</b> The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent.<br><br><b>RELEVANCE:</b> The PCD requires a WUL in terms of the NWA. It follows that the existing IWUL will need to be amended to cater for the proposed PCDs if they are required.  |
| Establishment of stormwater management infrastructure – Proposed pumping system to transfer process water from the PCD to the plant for re-use.<br>(May be required depending on the outcome of detailed design work and alternatives assessment). | More than 1 000 m in length.                         | X   | <b>NEMA (GNR 983 of 2014) as amended by GNR.327 of 2017 (G.G. 40772 of 07/04/2017) and GNR.706 of 2018 (G.G. 41766 of 13/07/2018): Listing Notice 1, Activity 10:</b> The development and related operation of infrastructure exceeding 1 000 m in length for the bulk transportation of sewage, effluent, process water, wastewater, return water, industrial discharge or slimes:(i) With an internal diameter of 0,36 m or more; or<br>(ii) With a peak throughput of 120 l/s or more; excluding where:<br>(a) Such infrastructure is for the bulk transportation of sewage, effluent, process water, wastewater, return water, industrial discharge or slimes inside a road reserve or railway line reserve; or<br>(b) Where such development will occur within an urban area.<br><br><b>RELEVANCE:</b> Based on preliminary designs a pumping system to transfer water from the PCDs to the plant for re-use may be required. In this regard, it is envisaged that pipelines exceeding 1 000 m in length with an internal diameter of 0.36 m or more may be required.   |
| Changes to WRD height (excludes rehabilitated WRDs).   | Not applicable.                                      | X   | <b>NEMA (GNR 983 of 2014) as amended by GNR.327 of 2017 (G.G. 40772 of 07/04/2017) and GNR.706 of 2018 (G.G. 41766 of 13/07/2018): Listing Notice 1, Activity 34:</b> The expansion of existing facilities or infrastructure for any process or activity where such expansion will result in the need for a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the release of emissions, effluent or pollution, excluding:(i) where the facility, infrastructure, process or activity is included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies;<br>(ii) the expansion of existing facilities or infrastructure for the treatment of effluent, wastewater, polluted water or sewage where the capacity will be increased by less than 15 000 cubic metres per day; or<br>(iii) the expansion is directly related to aquaculture facilities or infrastructure where the wastewater discharge capacity will be increased by 50 cubic meters or less per day. |

| Description of the project activity   | Aerial extent of the activity (ha) or m <sup>3</sup>  | Listed activity – Mark with an X where applicable | Listed activity number, applicable listing notice and activity description  |
|---|---|---|---|
|   |   |   | <b>RELEVANCE:</b> The change in the height of the WRDs will increase the volume of the existing dumps and as such the IWUL will need to be amended.   |
| Establishment of a pipeline to transport abstracted water from the decommissioned Middelplaats Mine to MMT. | Approximately 4 km in length.   | X   | <b>NEMA (GNR 983 of 2014) as amended by GNR.327 of 2017 (G.G. 40772 of 07/04/2017) and GNR.706 of 2018 (G.G. 41766 of 13/07/2018): Listing Notice 1, Activity 9:</b> The development of infrastructure exceeding 1 000 m in length for the bulk transportation of water or stormwater: i) With an internal diameter of 0,36 m or more; or (ii) With a peak throughput of 120 l/s or more.<br>excluding where:<br>(a) Such infrastructure is for bulk transportation of water or stormwater or stormwater drainage inside a road reserve or railway line reserve; or<br>(b) Where such development will occur within an urban area.<br><br><b>RELEVANCE:</b> A pipeline of 10 inches (0.26 m) in diameter, with a maximum pumping capacity in excess of 120 l/s exceeding 1 000 m in length will be required.  |
| Upgrading the railway loadout station.  | Approximately 5.6 ha for non-linear activities including the contractors' offices and parking, and future stockpile area. | X   | <b>NEMA (GNR 983 of 2014) as amended by GNR.327 of 2017 (G.G. 40772 of 07/04/2017): Listing Notice 1, Activity 27:</b> The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for:<br>i) The undertaking of a linear activity; or<br>ii) Maintenance purposes undertaken in accordance with a maintenance management plan.<br><br><b>RELEVANCE:</b> The clearance of 5.6 ha of land for the establishment of the future stockpile area and contractors' areas is above the 1 ha threshold, therefore triggering this activity.  |
| Sale of waste rock as aggregate.  | Not applicable.   | X   | <b>NEMA (GNR 984 of 2014) as amended by GNR.325 of 2017 (G.G. 40772 of 07/04/2017): Listing Notice 2, Activity 17:</b> Any activity including the operation of that activity which requires a mining right as contemplated in section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including -<br>(a) associated infrastructure, structures and earthworks, directly related to the extraction of a mineral resource; or<br>(b) the primary processing of a mineral resource including winning, extraction, classifying, concentrating, crushing, screening or washing; but excluding the secondary processing of a mineral resource, including the smelting, beneficiation, reduction, refining, calcining or gasification of the mineral resource in which case activity 6 in this Notice applies.<br><b>RELEVANCE:</b> The sale of waste rock as aggregate may require crushing and screening prior to sale to third parties. |
| Re-processing of material located in Adams Pit.   | 14 ha   | X   | <b>NEMA (GNR 984 of 2014) as amended by GNR.325 of 2017 (G.G. 40772 of 07/04/2017): Listing Notice 2, Activity 17:</b> Any activity including the operation of that activity which requires a mining right as contemplated in section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including -   |

| Description of the project activity  | Aerial extent of the activity (ha) or m <sup>3</sup>   | Listed activity – Mark with an X where applicable | Listed activity number, applicable listing notice and activity description   |
|--|--|---|--|
|  |  |   | <p>(a) associated infrastructure, structures and earthworks, directly related to the extraction of a mineral resource; or</p> <p>(b) the primary processing of a mineral resource including winning, extraction, classifying, concentrating, crushing, screening or washing; but excluding the secondary processing of a mineral resource, including the smelting, beneficiation, reduction, refining, calcining or gasification of the mineral resource in which case activity 6 in this Notice applies.</p> <p><b>RELEVANCE:</b> The re-processing of material in Adams Pit requires the use of screening and is therefore considered a primary process.</p> |
| <b>Layout/activity changes that have already taken place (Application in terms of NEMA - Regulation 31 of GNR 982 of 2014)</b> |  |   |  |
| Expansion of the north and south-eastern WRDs.   | 10 ha  | Not applicable                                    | HMM is committed to undertake rehabilitation concurrent with mining operations as per the approved 2005 EMPR. As part of rehabilitation the north-eastern WRD and the south eastern WRD footprints were extended. The extension does not increase the capacity of the WRDs. It follows that the expansion falls within the ambit of the approved EMPR and does not trigger Listed Activities in terms of NEMA.   |
| Changes to the rehabilitation criteria of WRDs.  | Not applicable.  | Not applicable                                    | Changes to the rehabilitation criteria will be included in the updated EMPR, but do not trigger Listed Activities in terms of NEMA.  |
| Expansion of the product stockyard.  | 13 ha  | Not applicable                                    | The product stockyard is catered for in the approved 2005 EMPR. The expansion takes place within the overall existing plant area and as such does not trigger Listed Activities in terms of NEMA.  |
| Establishment of potable and process water storage facilities.   | <ul style="list-style-type: none"> <li>0.66 ha (total area)</li> </ul> <p>Capacities:</p> <ul style="list-style-type: none"> <li>Process water tank: 564 m<sup>3</sup></li> <li>Catchment tank: 300 m<sup>3</sup></li> <li>Overflow tank: 300 m<sup>3</sup></li> <li>Aqua tanks: 5 000 m<sup>3</sup></li> <li>Potable water tank: 164 m<sup>3</sup></li> </ul> | Not applicable                                    | Potable and process water facilities are generally approved in the approved EMPR. Updating the EMPR to provide specific information pertaining to the number of facilities, location and capacities does not trigger Listed Activities in terms of NEMA.   |
| Expansion of an existing road.   | Widened by 4 to 5 m.   | Not applicable                                    | The expansion of the existing road located to the east of the open pit is below NEMA Listed Activity thresholds and as such does not trigger Listed Activities in terms of NEMA.   |



#### 4.1.2 NEM: WA

Waste management activities that have, or are likely to have, a detrimental effect on the environment are listed in GNR 921 (as amended). Activities above certain thresholds are subject to a process of impact assessment and licensing. NEM: WA also provides for the setting of norms and standards for the storage and disposal of waste. Where a development triggers activities listed in Category A, a Basic Assessment process must be applied for. Where a development triggers activities listed in Category B, a S&EIA process must be applied for the application. As the proposed project would trigger activities specified in Category A and B, a S&EIA process has to be conducted. The waste management activities in Category A and Category B triggered by the proposed project are shown in the table below

**Table 4-2: Waste management activities in terms of the NEM: WA**

| Description of project activity                      | Aerial extent of the activity (ha) | Listed activity number, applicable listing notice and activity description  |
|--|------------------------------------|---|
| Changes to WRD height (excludes rehabilitated WRDs). | Not applicable.                    | <p><b>NEM: WA (GNR 921 of 2013) as amended by GNR.332 of 2014 (G.G. 37604 of 02/05/2014), GNR.633 of 2015 (G.G. 39020 of 24/07/2015) and GNR.1094 of 2017 (G.G. 41175 of 11/10/2017): Category A, Activity 13:</b> The expansion of a waste management activity listed in Category A or B of this Schedule which does not trigger an additional waste management activity in terms of this Schedule.</p> <p><b>RELEVANCE:</b> The definition of 'expansion' includes modifications or alterations which result in increases to the capacity of a facility. Increasing the height of the WRDs above what is provided for in the approved EMPr will provide for greater capacity.</p> |
| Sale of waste rock as aggregate.                     | Not applicable.                    | <p><b>NEM: WA (GNR 921 of 2013) as amended by GNR.332 of 2014 (G.G. 37604 of 02/05/2014), GNR.633 of 2015 (G.G. 39020 of 24/07/2015) and GNR.1094 of 2017 (G.G. 41175 of 11/10/2017): Category B, Activity 11:</b> The establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a mining right, exploration right or production right in terms of the MPRDA.</p> <p><b>RELEVANCE:</b> The sale of waste rock as aggregate is considered to be reclamation of a residue stockpile.</p>   |

## 4.2 DESCRIPTION OF ACTIVITIES

The subsections below provide some detail around the existing operations and the proposed activities as applied for through this environmental authorisation process.

### 4.2.1 Overview of Existing Operations

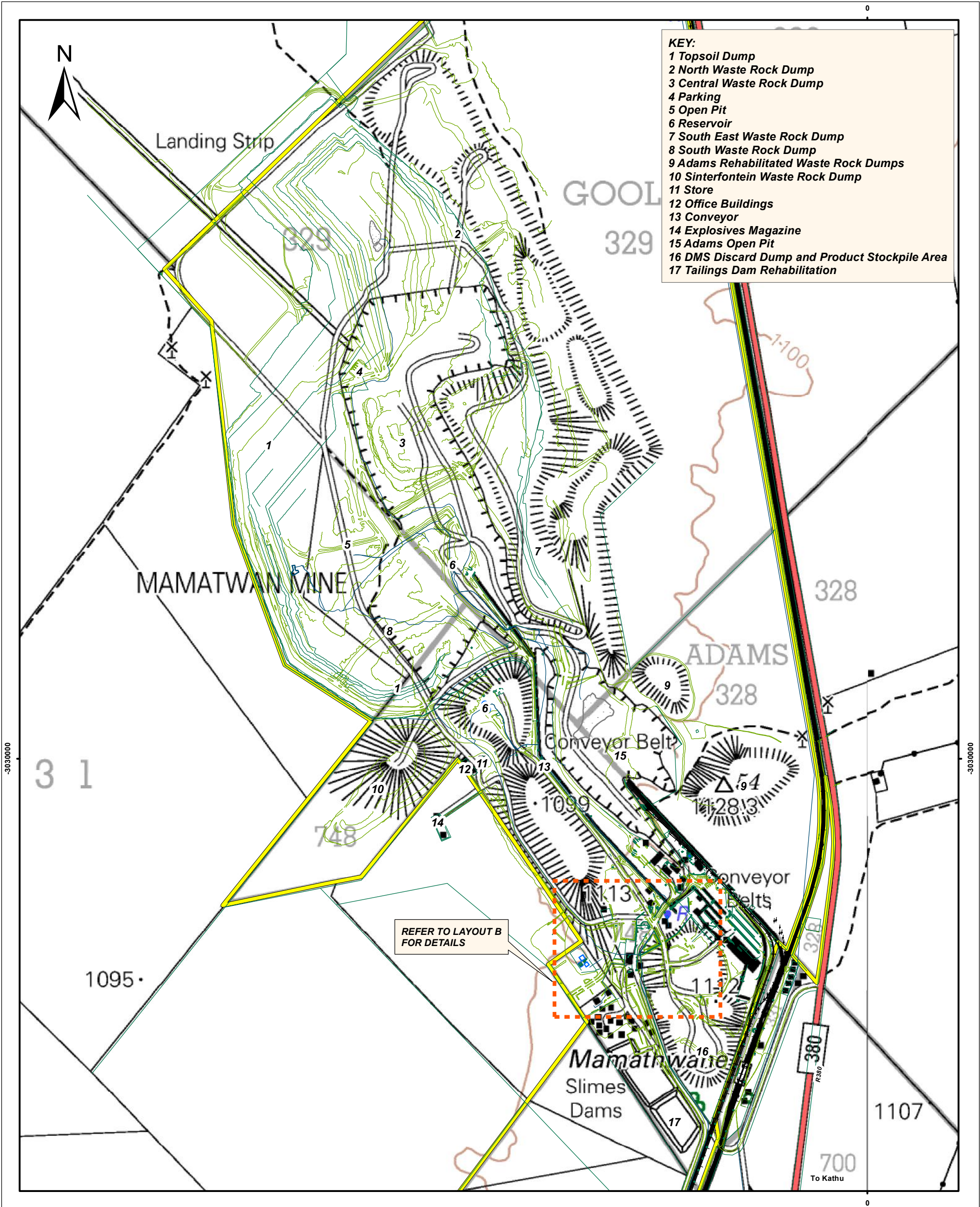
The MMT is an approved open cast mine which commenced operations in 1963. The mining operations target local manganese orebodies. The current Run of Mine (RoM) for MMT is in the order of 3 million tons per annum (TPA). MMT has an estimated remaining life of mine (LOM) of 17 years. A layout map detailing the approved layout is provided in Figure 4-1 and a process flow diagram is provided in Figure 4-3.

#### 4.2.1.1 Surface Infrastructure

An overview of infrastructure currently located at the MMT is illustrated in Figure 4-1 and Figure 4-2 and includes the following:

- Open pit and Adams open pit;
- WRDs (North WRD, Central WRD, Southeast WRD, South WRD, Sinterfontein WRD, Dense Medium Separator (DMS) discard dump and rehabilitated WRDs)
- Processing infrastructure comprising:
  - Crushing and screening (in-pit crusher, Kawasaki crushers, ROM cone crusher);
  - DMS plant;
  - Sinter plant;
  - Coke; and
  - Ore processing plant.
- Stockpiles including:
  - Topsoil stockpiles; and
  - Product stockpile area.
- Tailings dam (rehabilitated);
- Transport infrastructure (conveyors, haul roads, loadout station and weighbridge, railway siding);
- Sewage treatment plant;
- Water storage (water tanks, water reservoirs and pump house);
- Waste management areas (general and hazardous waste yard);
- Soil remediation facility;
- Diesel refuelling and storage facilities (fuel bay);
- Washbays and tyre bay;
- Explosive magazine; and
- Support infrastructure including:
  - Substation and MMC (loadout station, in-pit crusher, sinter plant, ore processing plant, ROM)
  - Office buildings, ore processing plant office, main office, sinter offices, tearoom, clinic, walkways, stores, laboratory, change house and parking areas (north pit parking and parking);
  - Workshops, Barloworld workshop, sinter workshops, Ore processing plant workshop; and
  - Main gate with security and access control.










**Legend**

 Mamatwan Mining Right Area

**KEY:**

- 4 Parking
- 6 Reservoir
- 11 Stores
- 13 Conveyor
- 18 Wash Bay
- 19 Workshop
- 20 Fuel Bay
- 21 Laboratory
- 22 Barlows Workshop
- 23 Ore Processing Plant Sampling Office
- 24 Ore Processing Plant Workshop
- 25 Tea Room
- 26 Tyre Bay
- 27 Walkway
- 29 Ore Processing Plant
- 30 Railway Siding
- 31 Sewage Treatment Plant
- 32 Kawasaki Crushers
- 34 Internal Haul Roads
- 36 Main Offices
- 37 General and Hazardous Waste Yard
- 38 Change House
- 39 Clinic
- 40 Main Gate
- 41 Security
- 42 Workshop
- 43 Sinter Offices and Workshops
- 44 Sinter Plant
- 45 Load Out Station

0 50 100  
Meters

Scale: 1:3 500 @ A3  
Projection: Transverse Mercator  
Datum: WGS1984, Lo23

Mamatwan Mine

**Figure 4-2b**

**Approved Site Layout - B**



SLR Consulting (Africa) (Pty) Ltd  
P O Box 1596, Cramerview, 2060, South Africa  
Tel: +27 (11) 467-0945 Fax: +27 (11) 467-0978



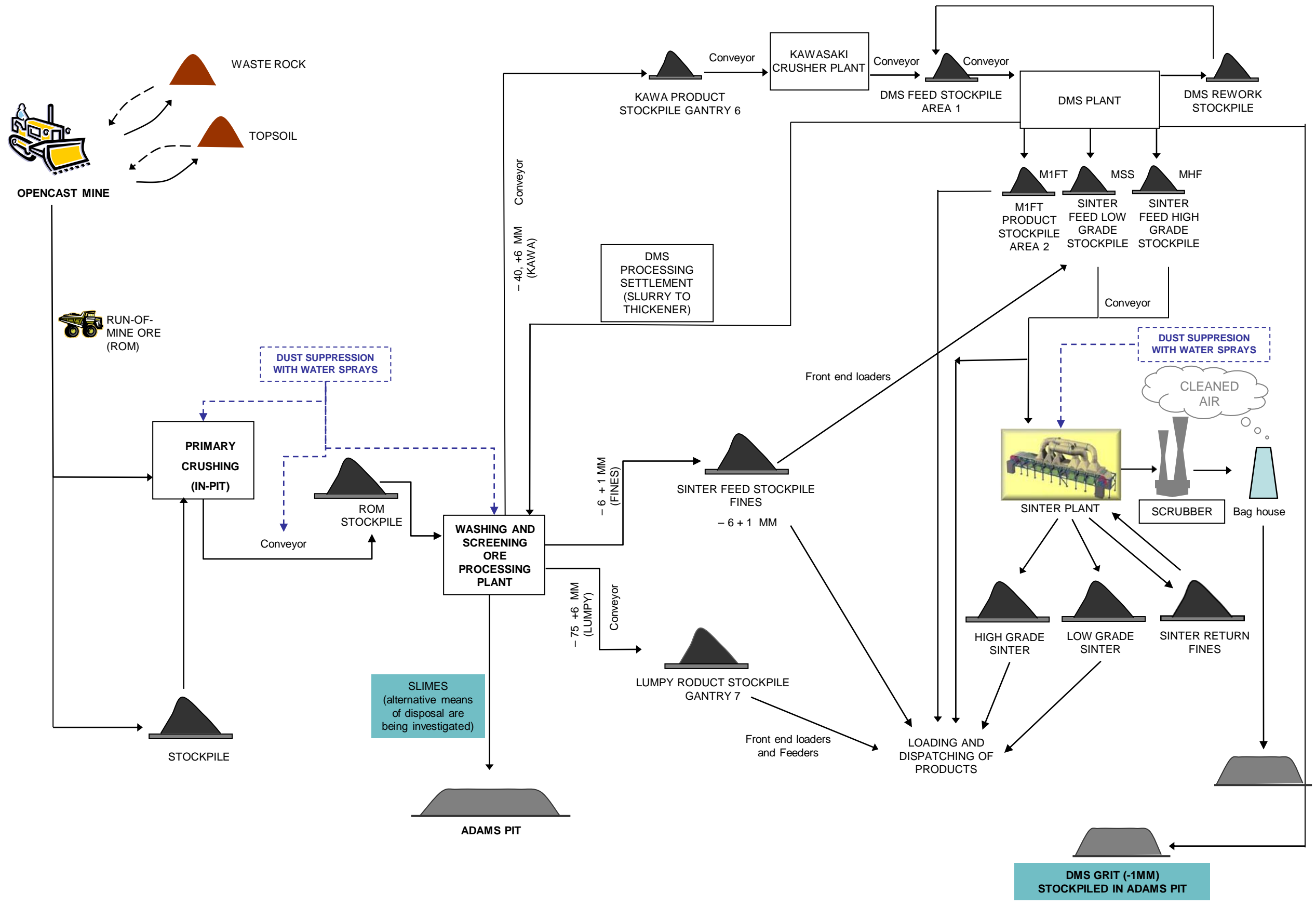


FIGURE 4-3: PROCESS FLOW DIAGRAM



#### 4.2.1.2 Open Pit Mining Method

MMT is approved for conventional opencast mining methods. Topsoil is stripped and waste rock is blasted and removed to uncover the manganese ore body. This is done using traditional truck and shovel methods. The table below provides an overview of the open cast mining methods employed at MMT.

**Table 4-3: Summary of open cast activities**

| Activity   | Description  |
|--|--|
| Open Pit   | Mining activities are currently being undertaken in the open pit as indicated in Figure 4-1. This pit is currently being extended to the north and west in compliance with the existing EMPR.  |
| Mining of the barrier pillar between MMT and Tshipi Borwa Mine | MMT has received approval from the Northern Cape DMRE (Reference number: NC 30/5/1/2/3/2 (252) MR) in January 2020, to mine the barrier pillar between their operation and the Tshipi Borwa Mine. The approved barrier boundary is 18 m wide.<br><br>The approved activities designate Tshipi Borwa Mine with responsibility for stripping waste, drilling and blasting the ore on behalf of both parties. Waste rock would be deposited onto each party's WRD. Ore would be loaded by each party and delivered to their respective stockpile areas. |
| Removal of overburden and topsoil stripping                    | The removal of overburden is undertaken in stages. First, soft overburden (primarily sand) is stripped and stockpiled or replaced on to backfilled spoils. The exposed rock is then drilled and blasted, generally in two cuts (for the limestone) and further cuts for the banded ironstone where this is present. When necessary, three cuts may be employed for safety reasons. Topsoil is transported via truck to designated topsoil stockpile areas for later use as part of rehabilitation.   |
| Drilling and blasting  | Ore faces are drilled at 70° to the vertical by truck mounted percussion drills, with ammonium nitrate explosives being used for blasting.   |
| Removal of ore   | Mining of the ore body is done in three cuts (top, middle and bottom) with thickness of approximately 0 – 25 m (soft overburden), 11 m (rock) and 3 - 15 m (ore), respectively. The stratigraphy of the orebody is; however, variable.   |
| Removal of waste Rock  | Waste rock is stripped and transported to one of the designated WRDs at the MMT. Waste rock is either backfilled into the open pit or used to flatten the slopes of existing dumps.  |
| Access to opencast workings                                    | Ore is drilled and blasted and hauled using front end loaders and shovels to the "in-pit" primary crusher, forming part of the mineral processing operations (see Table 4-4 below).  |

#### 4.2.1.3 Mineral Processing Method

A summary of the mining and mineral processing activities that take place at the MMT is provided in the table below.

**Table 4-4: Overview of approved mineral processing activities**

| Activity                          | Detail  |
|-----------------------------------|---|
| In-pit crushing and screening     | Ore is crushed using a “in-pit” jaw crusher to reduce the size of the ore for further downstream processes. Crushed ore is conveyed to a ROM stockpile near the mineral processing plant. Excess ore is stored and crushed as required.   |
| Conveying, washing, and screening | <p>Ore from the ROM stockpile is conveyed along a 2 km belt to the primary stockpile. Two parallel circuits comprising scalping screens, cone crushers and double-deck sizing screens and a horizontal dewatering screen at the Ore Processing Plant (OPP).</p> <p>Lumpy material (– 75 +6 mm) from the OPP is stockpiled in marked allocated lumpy product stockpile area (Gantry 7) prior to being sent to the load out station using front end loaders. The product is conveyed to railway trucks via the load out section for sale to third parties.</p>  |
| DMS Plant and Sintering           | <p>The natural Mamatwan ore ideally lends itself to upgrading by technologically advanced beneficiation processes. In this regard, the –40 +6 mm feed from the OPP is stockpiled (KAWA product stockpile Gantry 6) and is subjected to crushing prior to being sent to the DMS via conveyer.</p> <p>The DMS plant can be used to beneficiate the ore prior to sintering by recovering the upgradeable portion of the ore body. The product (low grade and high grade) from the DMS is stored on the sinter feed stockpiles prior to being subjected to the sinter plant process. Correctly graded material and sized from the DMS is stockpiled prior to be sent to the loading and dispatch. The DMS grit (low grade product), that is currently not sold is currently stored in. Plant spillages occurs within the plant area. Fines (–6+1 mm) from the OPP is stockpiled at the Fines Sinter Feed stockpile prior to being conveyed directly to the sinter plant. Some of this material is sold directly to third parties and is not sent to the sinter plant.</p> <p>Material that is not sent to the sinter plant from the DMS plant is stockpiled for rework.</p> <p>During the sintering process calcium carbonate and other impurities are driven off resulting in an increase in the grade. In this regard, the sinter plant generates a high and standard grade sinter product which is conveyed to loading and dispatching of MMT products. Fugitive dust is extracted from the process through a series of extraction ducts with the particulate matter being captured in bag houses. Dust from the baghouses is either recycled back into the sinter process or captured in bulk bags which is currently sold to third parties. Off gas and particulate matter (PM) is extracted and scrubbed.</p> |
| Disposal                          | Slimes material from the OPP is sent to Adams Pit for disposal. Alternative methods of disposal are however being investigated. The DMS grit (low grade product), that is currently not sold is currently stored in Adams Pit. Dust from the baghouses is either recycled back into the sinter process or captured in bulk bags which is currently stored in Adams Pit .  |
| Load - out station and rail       | The material is conveyed to railway trucks via the load out section (refer to Figure 4-1 for the location of the approved load-out station).  |
| Sale of product                   | <p>The processing plant has been designed to generate saleable manganese ore product which meets certain grades and size specifications. Manganese ore is sold to both local and international markets. Further processing occurs by third parties involved with furnace smelting production of the ferroalloy or direct sale of manganese ore to the market.</p> <p>Prior to being sent to the load out station using front end loaders, the product is conveyed to railway trucks via the load out section for sale to third parties.</p>   |

#### 4.2.1.4 Mineralised Waste Management

Details of the waste management is discussed in the sections below. Table 4-5 provides a summary of the features of the WRDs.

**Table 4-5: Design features of the WRD's**

| Feature   | Detail  |   |             |             |        |
|---|---|---|-------------|-------------|--------|
| Physical dimensions                                     |   | East  | West        | North       | Total  |
|   | Area (ha)   | 54 (49)   | 215.76 (41) | 94.75 (118) | 364,51 |
|   | Height (m)  | 80  | 86          | 86          |        |
|   | Capacity (Mm³)  | 24 (17)   | 117.15 (41) | 47 (59)     | 188.15 |
|   |   | (values in parenthesis are those approved in 2017 EMPR) |             |             |        |
| Physical characteristics                                | The material comprises rock including sand, calcrete, clay and (uneconomic) banded iron. The water content is expected to be about 5%. The void ratio is approximately 0.5.   |   |             |             |        |
| Management, transport, placement                        | Waste rock will be loaded into mining dump trucks and hauled to the Sinterfontein WRD where it is tipped and dozed into final position.   |   |             |             |        |
| Diversion of clean water and containment of dirty water | Water management infrastructure such as berms around the existing WRD would be adapted as required to manage run-off from the WRD.  |   |             |             |        |
| Topsoil stripping                                       | Topsoil in the WRD void will be stripped and stockpiled at existing stockpile areas at the mine in accordance with existing approved soil conservation procedures. Stripping and stockpiling of topsoil is done immediately in advance of dumping. Topsoil will be stripped to a depth of at least 0.2 m. The first 0.15 m of topsoil should be stripped separately and not mixed with the deeper horizons. |   |             |             |        |
| Lining  | The foundations will be designed taking cognisance of the geotechnical conditions and the base preparation will be in accordance with the required barrier system determined by a waste classification in accordance with regulations R632 and R634, promulgated in terms of NEM: WA. In this regard, the WRD will need to conform to a Class D liner specification (Rip and Re- Compact).                  |   |             |             |        |
| Side slopes   | The slopes of the WRDs will include 20 m lifts with wide platforms, the benches are 30 m wide, which reduces the overall side slopes. A bench face angle of 35 degrees will be ensured.   |   |             |             |        |
| Under drains  | No under drainage has been provided. Surface runoff is directed around the WRD and dump surfaces provide positive drainage to prevent ponding and infiltration.   |   |             |             |        |
| Access and access control                               | Access to the Sinterfontein WRD will be via existing haul roads within the MMT surface use area. A perimeter fence has been installed around the perimeter of the MMT preventing unauthorised access.   |   |             |             |        |
| Dust control  | During operation roads are watered using water and/or chemical solutions for dust suppression. During the post operational phase, no measures are necessary due to the rehabilitation of the WRDs. Monitoring forms part of the overall site monitoring.  |   |             |             |        |
| Closure   | The WRD should be shaped to ensure the area is free draining (i.e. no ponding of water on the top surface post closure. The WRD side slopes to be confirmed through on-going field trails. The WRD should be capped with a minimum of 300 mm soil/growth medium material. The capping thickness should be confirmed through on-going field trails.  |   |             |             |        |
|   | No active groundwater protection measures are envisaged during closure given the relatively low pollution potential of the residual waste rock material. In the event that water quality monitoring around any WRD indicates that the WRDs are causing pollution,   |   |             |             |        |

| Feature        |                                 | Detail  |
|----------------|---------------------------------|---|
|                |                                 | additional management measures will be investigated in consultation with a qualified specialist.  |
| Rehabilitation | Revegetation                    | WRD to be revegetated using a mix of indigenous grasses (i.e. dry seeding) and trees/shrubs (i.e. hand planting of seedlings). Vegetation species to be confirmed through ongoing field trials.   |
|                | Erosion control                 | Erosion management measures and/or mitigation measures to be confirmed through ongoing field trials.  |
|                | Maintenance and aftercare       | Maintenance and aftercare period to be confirmed through ongoing field trials.  |
|                | Rehabilitation success criteria | Rehabilitation success will be determined by monitoring trends in soil nutrient levels, soil microbial levels, vegetation cover and vegetation biodiversity levels and comparing data and temporal trends in the data to numerical targets. |

### Safety classification of waste rock dumps

The safety classification for the approved WRDs was determined in accordance with the South African Code of Practice for Mine Residue Deposits (South African National Standards (SANS) 10286:1998) and the requirements of the MPRDA. The summarised classifications are included in Table 4-6 below.

**Table 4-6: Safety classification criteria for waste rock dumps**

| Criteria No. | Criteria   |                                   | Comment   | Safety Classification |
|--------------|--|-----------------------------------|---|-----------------------|
| 1            | No. of Residents in Zone of Influence              | 0 (Low hazard)                    | There are no farmhouses or other structures within the zone of influence.   | Low Hazard            |
|              |  | 1 -10 (Medium hazard)             |   |                       |
|              |  | >10 (High hazard)                 |   |                       |
| 2            | No. of Workers in Zone of Influence                | <10 (Low hazard)                  | The waste rock dumps are located near the open pit and as such mine workers may be located in the zone of influence, however majority of the main activities will take place in the pit area.                         | Medium Hazard         |
|              |  | 11 – 100 (Medium hazard)          |   |                       |
|              |  | >100 (High hazard)                |   |                       |
| 3            | Value of third party property in zone of influence | 0 – R 2 million (Low hazard)      | No formal assessment of the value of property has been done in the zone of influence. The characteristics of the WRDs are such that catastrophic failures will be localised and no extended flow will be experienced. | Low Hazard            |
|              |  | R2 – R 20 million (Medium hazard) |   |                       |
|              |  | >R 20 million (High hazard)       |   |                       |
| 4            | Depth to underground mine workings                 | >200 m (Low hazard)               | There are no known underground mine workings beneath the tailings dam site. Any future workings would be more than 270 m below surface.   | Low Hazard            |
|              |  | 50 – 200 m (Medium hazard)        |   |                       |
|              |  | <50 m (High hazard)               |   |                       |

### Environmental classification

In accordance with Regulation 5 of GNR 632 of the NEM:WA, waste rock stockpiles need to be classified utilising a risk-based analysis. In the absence of a prescribed methodology to undertake a risk-based analysis, waste rock material was classified in accordance with (refer to specialist study included in Appendix E):

- The National Norms and Standards for the assessment of waste for landfill disposal (GNR 635 of 2013); and

- The National Norms and Standards for disposal of waste to landfill (GNR 636 of 2013).

The results of the waste classification undertaken on waste rock material at the MMT indicates that the lithology samples are assessed to be a Type 3 waste in terms of the total concentration and a Type 4 waste in terms of the leachable concentrations. The legislation does not specify the waste type for samples with these conditions:

- In accordance with GN. R. 635 of 2013, for a waste to be **Type 3**, results must meet the following criteria:
  - Leachable concentration of any elements above the LCT0 but below or equal to LCT1, and
  - Total concentrations of ALL elements below or equal to TCT1.
- In accordance with GN R.635 of 2013, for a waste to be **Type 4**, samples must meet the following criteria:
  - All LC must be below or equal to the 'Leachable Concentration Threshold' LCT0 limits; AND
  - All TC must be below or equal to the 'Total Concentrations Threshold' TCT0 limits.

For a waste to be a Type 3, *in addition* to the total concentrations being below TCT1, the leachable concentrations of elements need to be *"above the LCT0 but below or equal to LCT1"*. In all the MMT lithology samples except for calcrete, the leachable concentrations are below the LCT0. The calcrete-top line lithology makes up 17% of the composite waste rock sample. The leachable concentrations of the composite waste rock samples were below LCT0 for all the constituents assessed. Therefore, the addition of the calcrete-top line lithology to the waste rock does not result in leachable concentrations in excess of the LCT0 value.

Correspondence (3<sup>rd</sup> March 2016) from the DWS for a mine in the Northern Cape, provides clarity where a waste assessment is inconclusive between waste types. The DWS stated that *".....the classification is based on the principle of assessing what is leachable and if it is leachable then what is the total concentration which will influence decisions on the total polluting period". "In the case of", Northern Cape Mine, "the leachable concentrations are reported to not exceed LCT0 values for any of the samples and hence a Class D barrier of only stripping of topsoil and foundation preparation is the requirement...."*. The DWS accepted a proposal by the Chamber of Mines of South Africa to follow a risk-based approach on a case-by-case basis to allow for representations on alternative barrier systems for Mine Residue Deposits and Stockpiles based on a risk assessment (29 June 2016). The risk assessment will enable an evaluation of the efficacy of the alternative barrier system to prevent pollution as required in terms of Section 19 (1) and (2) of the NEM:WA (Singh, 2016). Since the purpose of the Norms and Standards is to protect water resources it may be appropriate to consider the potential water quality risk associated with existing facilities, rather than retroactively applying the legislated liner requirements.

Based on the results presented above, SLR undertook a risk-based approach for protection of the quality of water resources for the MMT WRD. It follows that a Class D barrier is deemed sufficient for MMT WRD's for following reasons:

- The leachable concentrations of all the constituents are below the LCT0 limit which indicates a low seepage risk;
- The material will be placed dry and not contain wastewater;
- From the geochemical study conducted by SLR it was concluded that the materials are not PAG;
- A Class C liner is impractical for a WRD due to the possibility of failure; and
- A representation of the Class D GLB- liner requirements are presented in

**The WRD's already exist at the MMT. It follows that this assessment was undertaken for completeness purposes in order to understand the risk in order to manage the protection of water quality. It is understood from MMT that the current base preparations of the existing WRD's are in line with a Class D GLB-liner.**



## Non-Mineralised Waste Management

### *Domestic and industrial waste*

Waste will be disposed of at appropriate permitted waste disposal facilities. For general waste the closest permitted site is in Kuruman. For hazardous waste, the closest permitted site is at Holfontein.

### *Sewage*

The MMT has an established sewage system. As part of the proposed project, no mobile toilets will be on-site as existing contractors will continue to utilise existing mine facilities.

## **4.2.1.5 Transport System**

### *Transport System – Site Access and Roads*

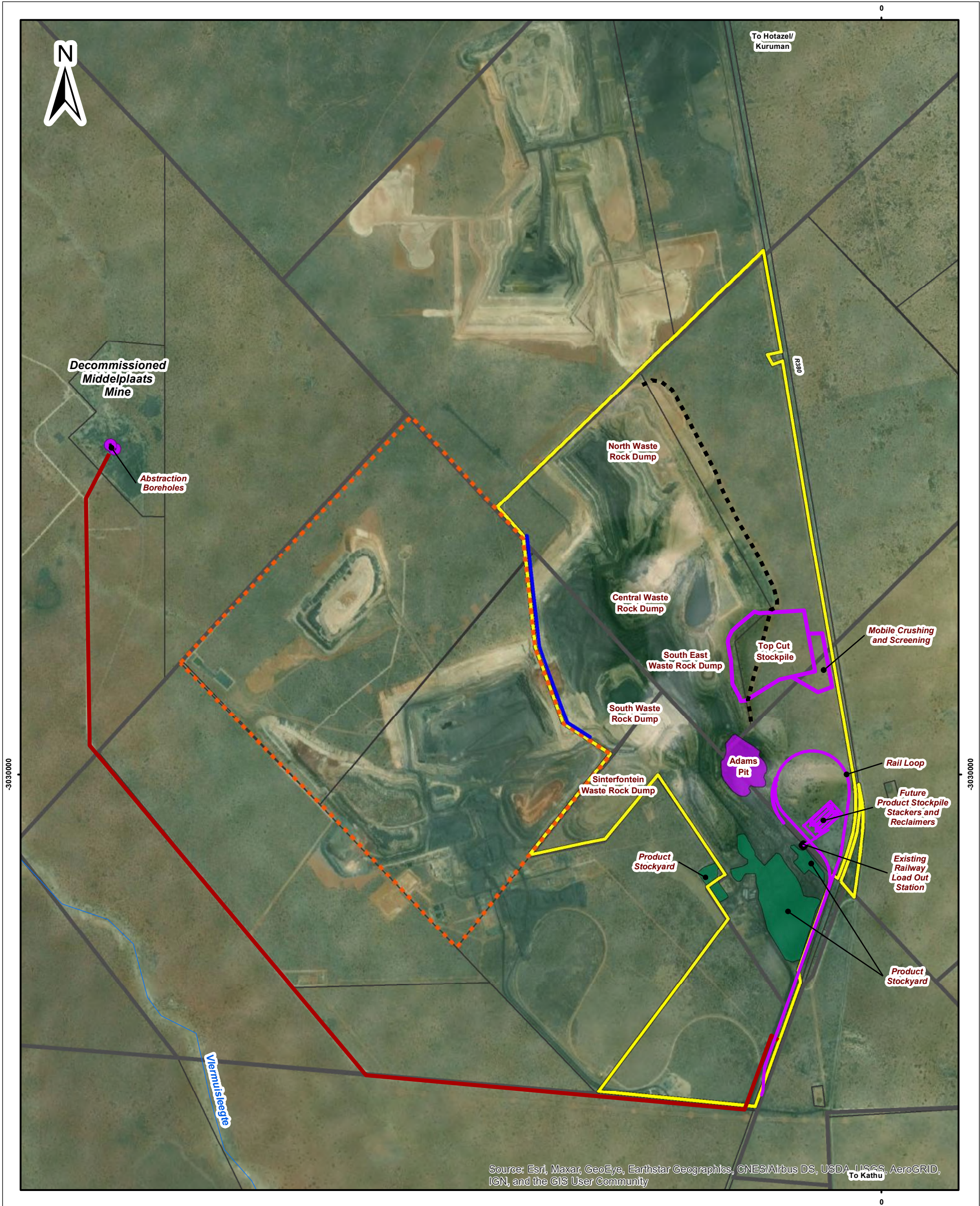
The proposed project will require the establishment of a new access road from the regional R380 road. A new site entrance and security checkpoint will be built to allow access to the client and the Engineering, Procurement and construction Management (EPCM) project office and parking, the rail, civil and other contractor site office and laydown areas, and the future stockpile area. This will include two level crossings to allow vehicles to cross the proposed new rail loop.

Existing internal haul roads will be utilised. In addition to this, existing contractors will be utilised for the stockpiling of waste rock material and as such the proposed project will not result in any changes to the existing internal transport system.

### *Railway siding*

A proposed new railway siding will be constructed immediately west of the R380 and will contain the client and EPCM project office and parking, the rail, civil and other contractor site office and laydown areas, and the future stockpile area within the contained loop area (see Figure 4-4). This is discussed further in section 4.2.3.5.





**Legend**

- Mamatwan Mining Right Area
- Layout Changes Already Taken Place
- Proposed Layout Changes
- Proposed Dewatering Boreholes
- Expansion of Existing Road
- Farm Boundaries
- Farm Portions
- Tshipi Mining Right Area
- Barrier Pillar

**Legend**

- Alternative Pipeline Route 1 - Preferred Route

0 300 600 Meters  
Scale: 1:30 000 @ A3  
Projection: Transverse Mercator  
Datum: WGS1984, Lo23

Mamatwan Mine

**Figure 4-4**  
**Mamatwan Mine Rail Infrastructure**

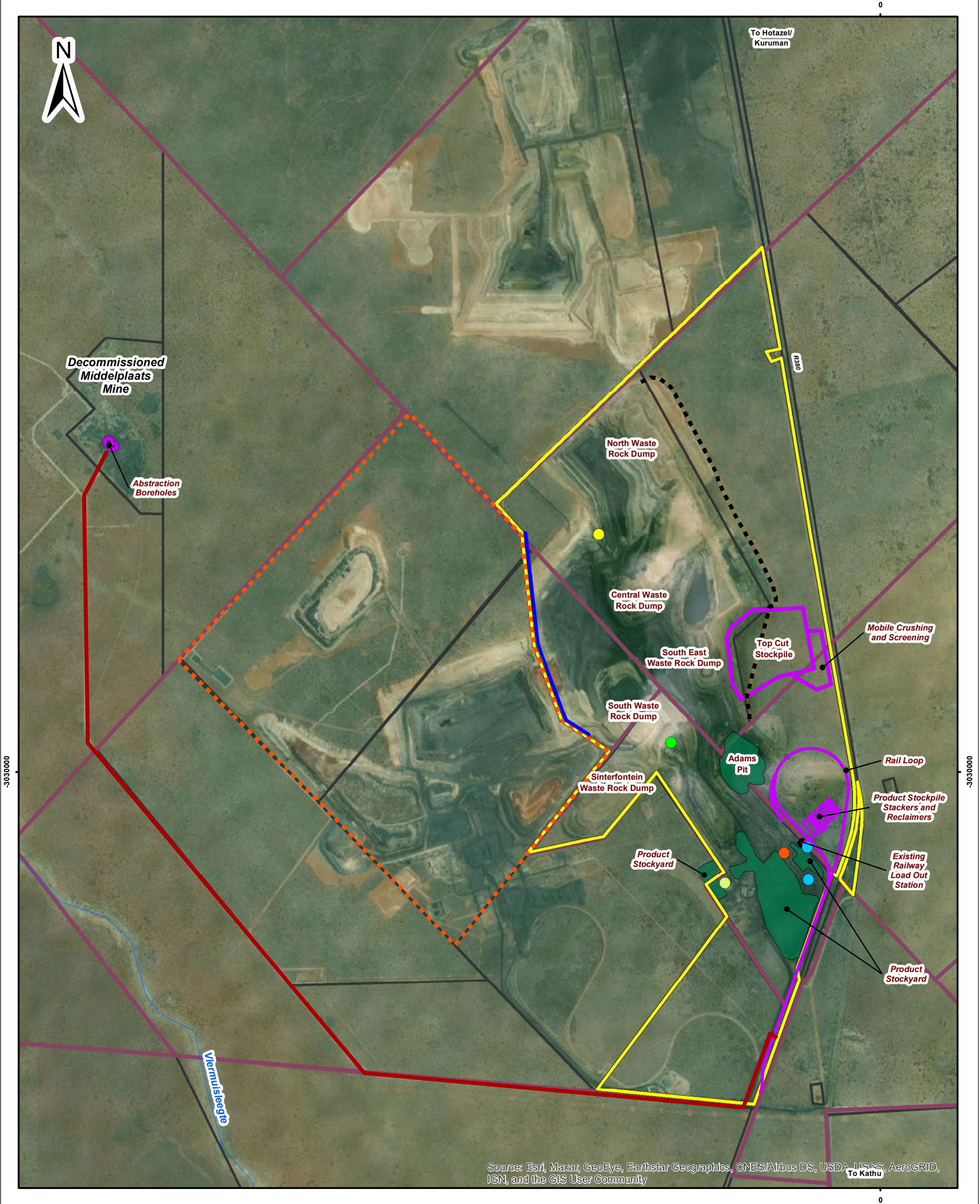


SLR Consulting (Africa) (Pty) Ltd  
P O Box 1596, Cramerville, 2060, South Africa  
Tel: +27 (11) 467-0945 Fax: +27 (11) 467-0978

710.20008.00072

2022/02/10





|   |  |
|---|--|
| <b>Legend</b>                             |  |
| Mamatwan Mining Right Area                | Farm Boundaries                                |
| Layout Changes Already Taken Place        | Farm Portions                                  |
| Proposed Layout Changes                   | Tshipi Mining Right Area                       |
| Proposed Dewatering Boreholes             | Barrier Pillar                                 |
| Expansion of Existing Road                | Alternative Pipeline Route 1 - Preferred Route |
| Catchment Tanks and Overflow Tanks        |  |
| JoJo Process Water Tanks                  |  |
| JoJo Potable Water Tanks                  |  |
| Aqua Tanks                                |  |
| Potable Water Tank and Process Water Tank |  |

0 300 600 Meters

Scale: 1:30 000 @ A3

Projection: Transverse Mercator

Datum: WGS1984, Lo23

Mamatwan Mine

**Figure 4-5**

**Water Storage Infrastructure**

SLR Consulting (Africa) (Pty) Ltd  
P O Box 1596, Cramerville, 2060, South Africa  
Tel: +27 (11) 467-0945 Fax: +27 (11) 467-0978

|                 |            |
|-----------------|------------|
| 710.20008.00072 | 2022/02/10 |
|-----------------|------------|



#### 4.2.1.6 Water Supply and Management

##### *Potable water*

Drinking water is obtained from the Vaal Gamagara pipeline. It is anticipated that potable water use will not increase significantly and will be related only to the construction workforce on site.

##### *Process water*

Process water will be required during the operational phase for dust suppression and maintenance (e.g. cleaning). This will be sourced from the mine's existing process water supply system and will be piped to the respective areas or supplied by means of water bowsers. The proposed height increases to the existing WRDs will not require any additional potable water supply.

##### *Water storage facilities*

MMT has the following water storage facilities in place (see Figure 4-5):

- Catchment tanks and overflow tanks;
- JoJo process and potable water tanks;
- Aqua Tanks; and
- Potable water tank and process water tank.

#### 4.2.1.7 Storm Water Management

Formal stormwater infrastructure exists in the southern-central portion of the site (plant area) and this area is shown in Figure 4-6. Currently the dirty runoff generated from this portion of the site is conveyed via concrete channels, concrete pipe culverts and an unlined earthen channel to discharge into Adams Pit. It is an unlined and informal facility.

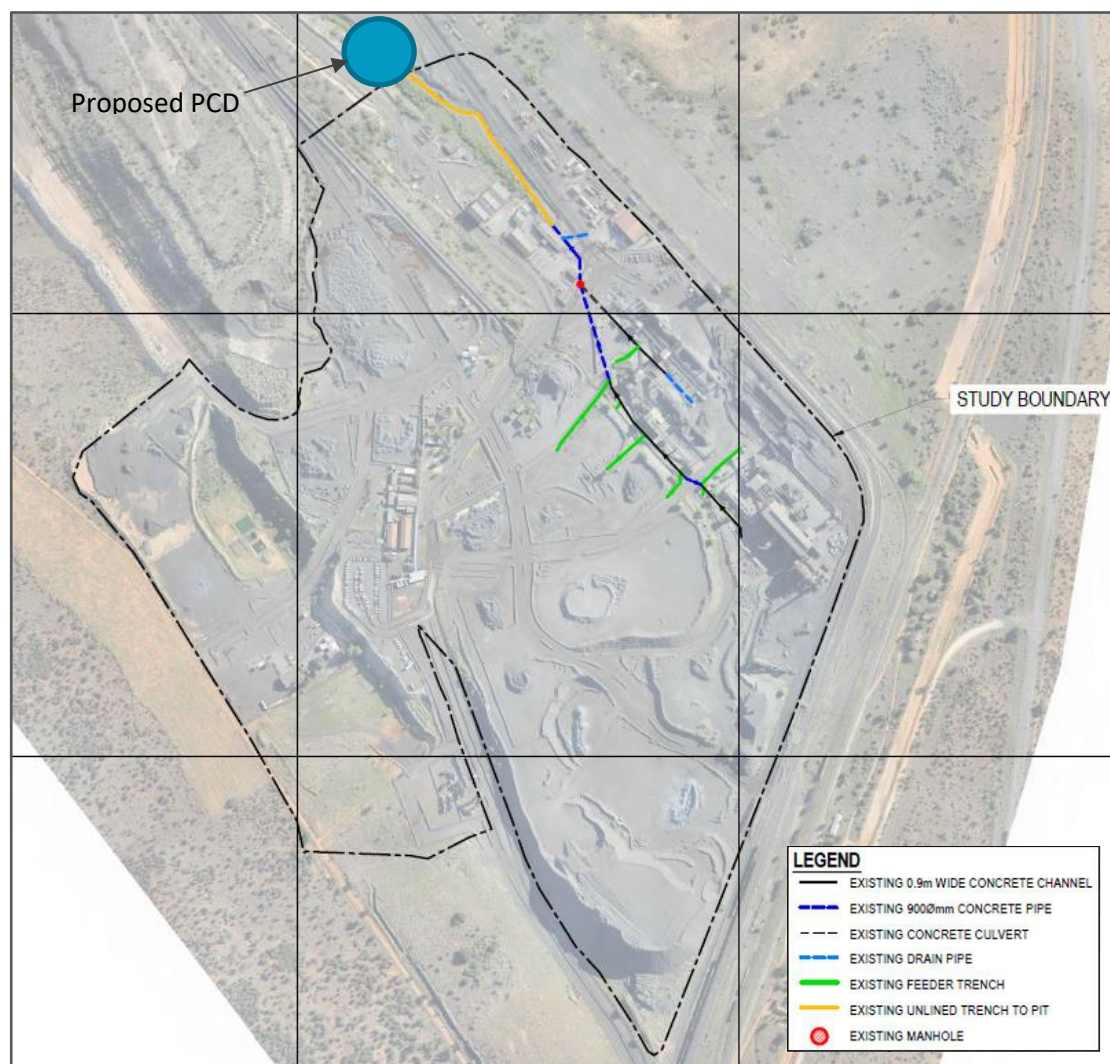
The existing storm water management system will be upgraded to allow the dirty runoff, within the mine area, to flow across the site as surface flow before discharging into lined storage facilities. Earthen cut-off channels and berms are proposed for construction towards the toe of the upstream catchment to contain and direct clean runoff away from the site.

##### *Pollution Control Dam*

A PCD is proposed as the alternative storage facility to Adams Pit. As the topography currently facilitates flow of dirty runoff from the site towards Adams Pit, the proposed position of the PCD is in the same area (see Figure 4-7). Three PCD sizing options are proposed for the PCD, which will be addressed as part of the IWUL application (e-WULAAS ref: WU21230). Details of the three PCD options are described in Table 4-7.

**Table 4-7: Sizing options for the PCD - volumes and required daily abstraction rates**

| PCD (5m deep)                        |                |                                      |                |                                      |                |
|--------------------------------------|----------------|--------------------------------------|----------------|--------------------------------------|----------------|
| Option A – 50 000 m <sup>3</sup> Dam |                | Option B – 60 000 m <sup>3</sup> Dam |                | Option C – 70 000 m <sup>3</sup> Dam |                |
| Abstraction                          | % Annual Spill | Abstraction                          | % Annual Spill | Abstraction                          | % Annual Spill |
| (m <sup>3</sup> /day)                |                | (m <sup>3</sup> /day)                |                | (m <sup>3</sup> /day)                |                |
| 620                                  | 4.52           | 350                                  | 4.52           | 210                                  | 4.52           |
| 720                                  | 3.39           | 460                                  | 3.39           | 260                                  | 3.39           |
| 1070                                 | 2.26           | 590                                  | 2.26           | 350                                  | 2.26           |
| 2240                                 | 1.13           | 1320                                 | 1.13           | 470                                  | 1.13           |



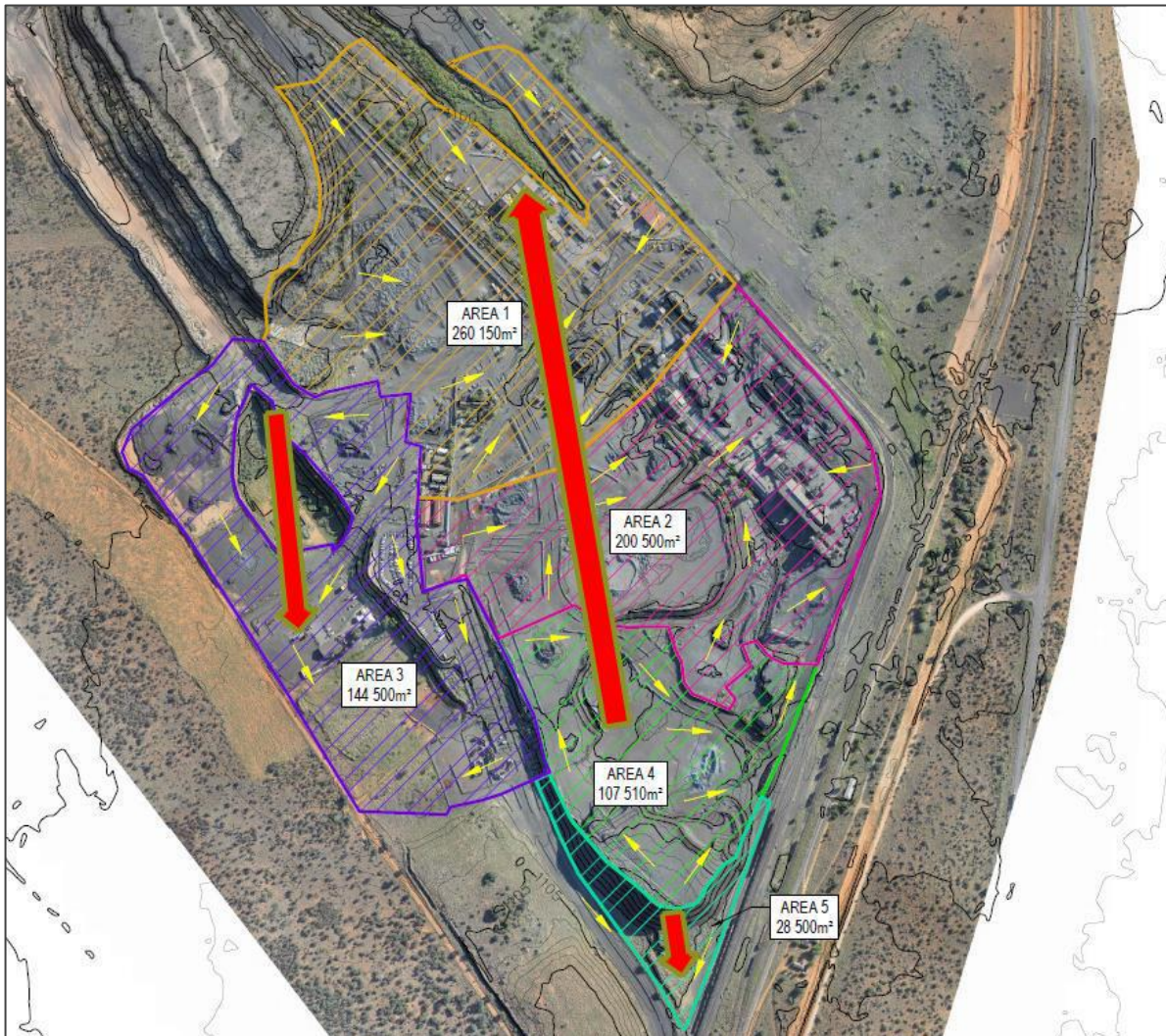
**Figure 4-6: Existing storm water infrastructure and proposed PCD location**

#### Conveyance Infrastructure

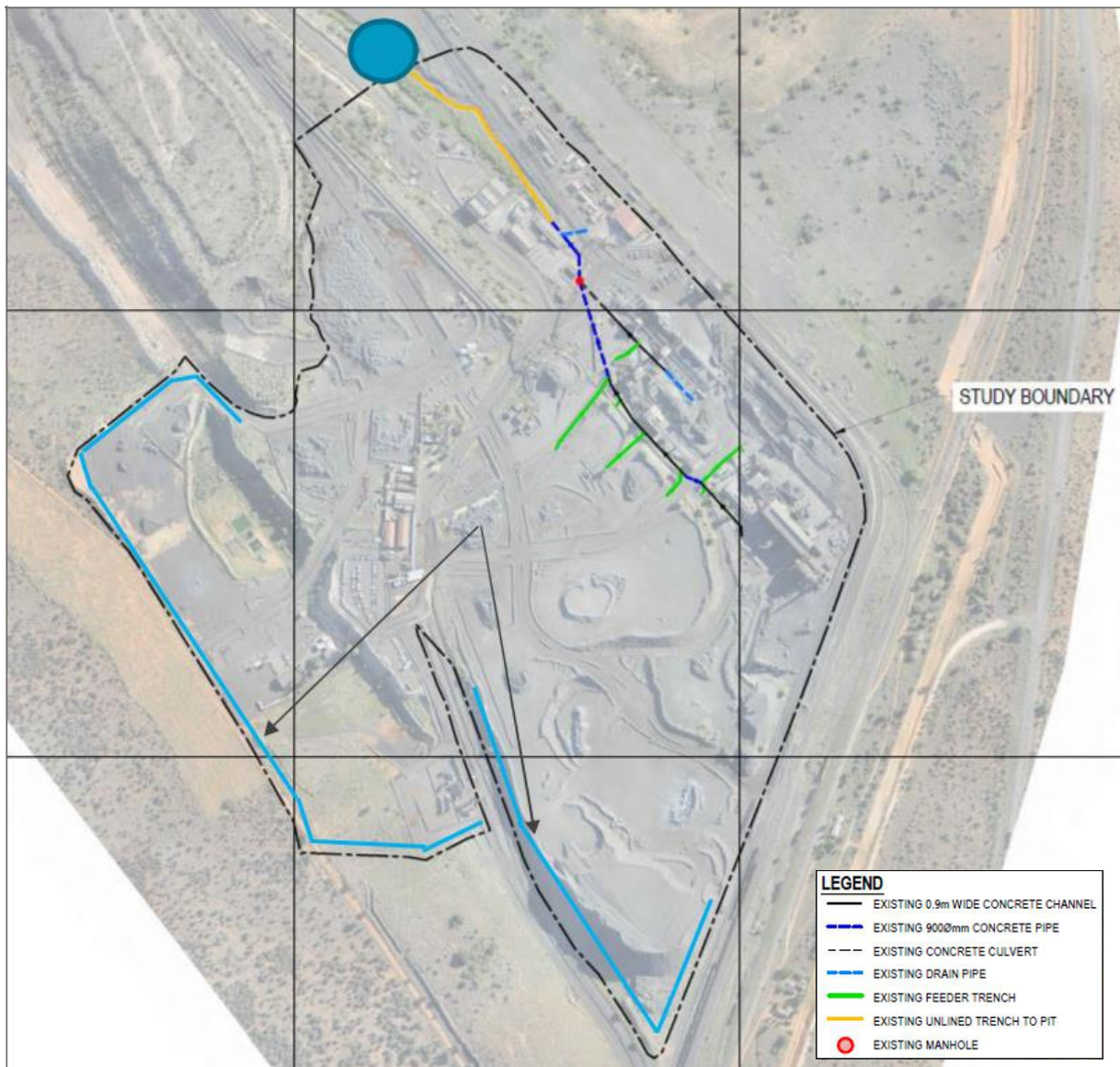
The existing concrete infrastructure is adequately for a sized 1:50 year-(24 hour) peak flow event, however the channel that directs flow from Areas 1, 2 and 4 is unlined and will need to be lined and realigned to direct the



dirty runoff into the proposed PCD (see Figure 4-6). New conveyance infrastructure will be required in Areas 3 and 5 as there is no existing infrastructure to contain the dirty runoff from these areas. Lined channels are recommended for construction around the perimeter of Areas 3 and 5 (see Figure 4-7). A wide channel/evaporation paddock structure that facilitates evaporation of this runoff, may be needed to attenuate flows from Area 3. As the expected runoff volume from Area 5 are comparatively small, dirty water that collects in the proposed lined channels are expected to evaporate.



**Figure 4-7: Dirty catchment areas within the plant area and the direction of flow**

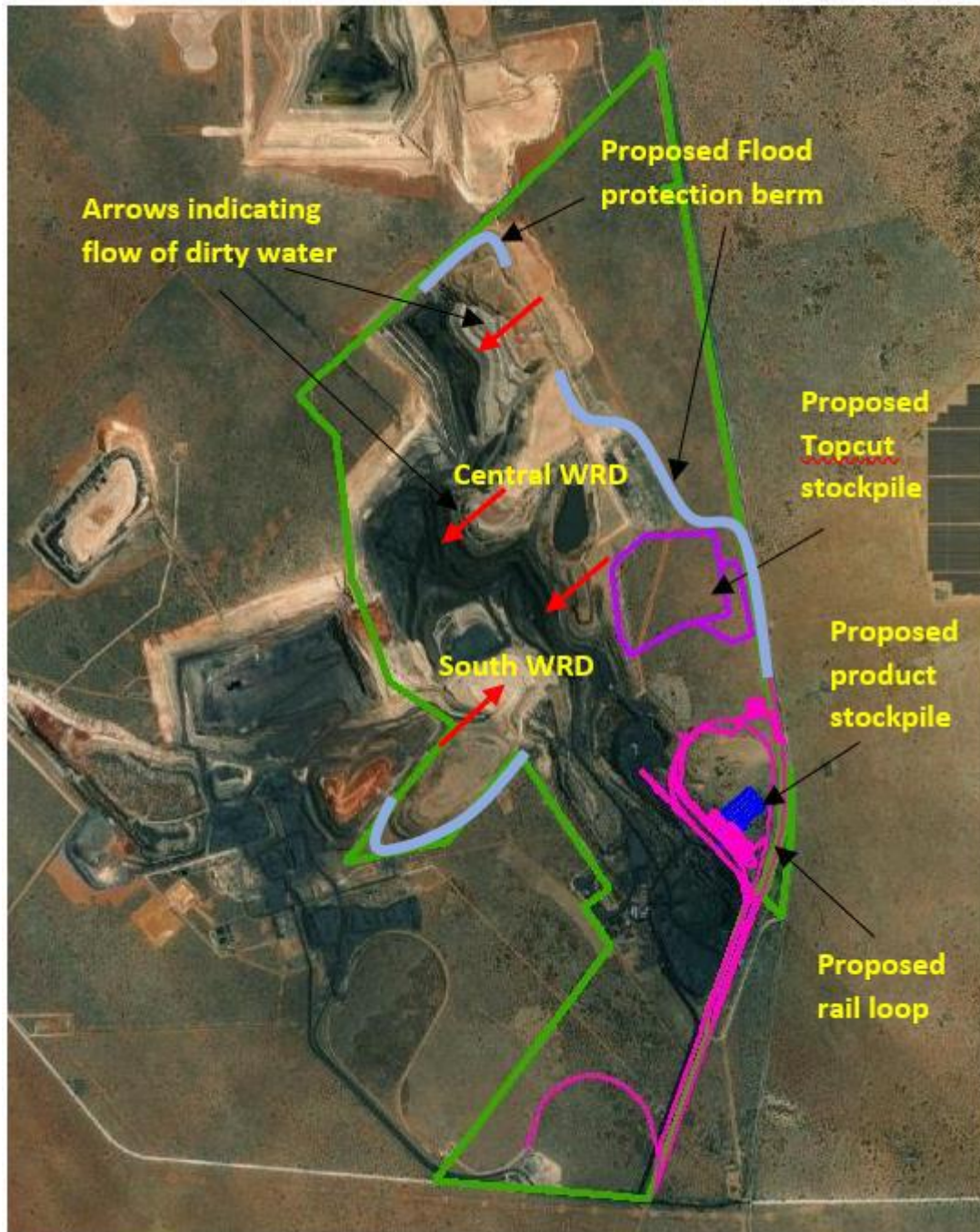


**Figure 4-8: Proposed lined channels**

#### *Earth Cut-Off Channels*

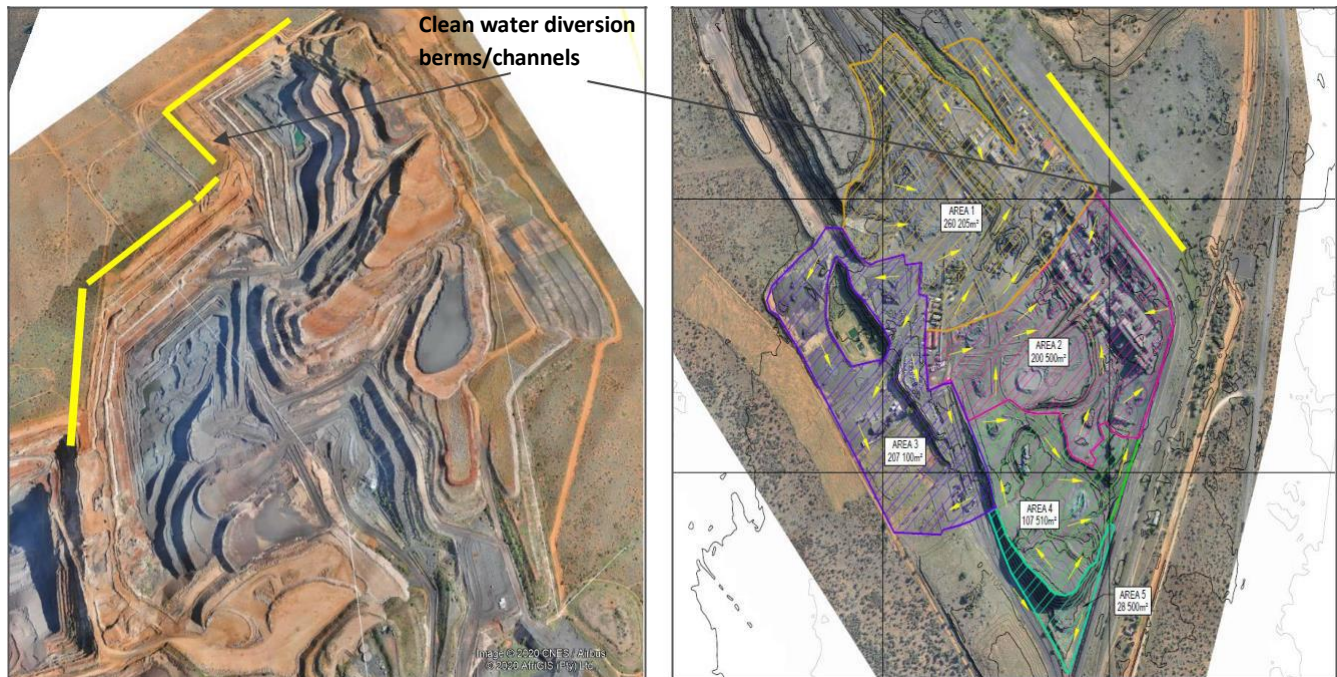
The design and construction of earthen cut-off channels and berms are proposed to prevent dirty water from leaving the northern portion of the site (see Figure 4-8). A low volume of water is expected to collect in these channels and so will be allowed to evaporate. No storage facilities are deemed necessary for areas north of the plant. These channels will be constructed using a simple cut to fill operation and can be maintained regularly.





**Figure 4-9: Expected direction of flow of dirty water in the northern portion of the site**

The clean water will be kept out of the dirty water catchments through the construction of berms and cut-off channels, constructed at the toe of the upstream clean catchments. The dirty water collection channels will have a 0.8 m freeboard height, in line with the GN704 regulation. These channels and berms will be constructed using a simple cut to fill operation and can be maintained regularly.



**Figure 4-10: Proposed positions of clean water diversion berms/channels**

#### 4.2.1.8 Water Balance

A daily time step rainfall-runoff model for the dirty stormwater catchments was coupled with a daily time step water balance model for the PCD. The rainfall-runoff model is based on the Soil Conservation Services (SCS) method and is used to estimate the portion of the rainfall which infiltrates or runs off from each catchment, for each day of the simulation. The PCD water balance model considers stormwater inflows, the direct rainfall reaching the dam, the evaporation losses and the return water pumping policy and calculates the volume of water in the PCD for each day of the simulation.

The results of the PCD simulations show three potential dam sizes and related daily abstraction volumes. Three options were considered to allow the mine to choose whether a smaller dam, with a higher abstraction rate suited them or conversely whether a larger dam with a lower abstraction rate suited the MMT Mine more. A 70 000 m<sup>3</sup> dam size is recommended for the PCD. Table 4-7 shows the three potential dam volumes and the required daily abstraction amounts. The option that has been recommended is based on the current dirty water reuse practice. Should the mine adopt a practice of utilising (reusing) more dirty water moving forward, then the three options give the mine the flexibility to suit a range of future water management possibilities. The mine will have to abstract and reuse the amount of water that is shown in Table 4-7. Refer to Appendix I for the Storm Water Management Plan (SLR, 2021) for more information on the stormwater management.

#### 4.2.1.9 Electricity

The proposed project will not result in an increase in power supply at the MMT. This will form part of existing services and capacities at the MMT.

#### 4.2.1.10 Support Services

The activities and infrastructure that is being applied for constitutes supporting services to the current mining operation.



#### **4.2.1.11 Operating Hours and LOM**

MMT operates continuously (24 hours per day, 7 days a week). MMT has a remaining Life of Mine (LOM) of 17 years.

### **4.2.2 Layout Changes / Activities That Have Already Taken Place**

#### **4.2.2.1 Expansion of the northeastern and southeastern WRDs**

MMT is committed to undertake rehabilitation concurrent with mining operations as per the approved 2005 EMPR. As part of rehabilitation, the north-eastern WRD and the south-eastern WRD footprints were extended in order to enable a reduction in the steepness of the side wall slope. The approved north-eastern and south-eastern WRDs, as well as the expansion areas, are depicted in Figure 4-1.

#### **4.2.2.2 Change in WRD rehabilitation criteria**

The approved 2005 EMPR committed MMT to rehabilitate the WRDs to a 1:3 slope. As part of rehabilitation trials, the north-eastern WRD was shaped to a 1:5 slope with 2 m high stormwater interception bench drains constructed at approximately 40 m intervals along the slopes. Significantly less erosion was associated with the change in rehabilitation strategy and this approach is proposed to be implemented for all future WRD rehabilitation. It follows that as part of the proposed project it is proposed to change the rehabilitation criteria detailed in the EMPR.

#### **4.2.2.3 Expansion of the product stock yard**

The approved 2005 EMPR makes provision for a product stockyard. Within this approved stockyard area various materials such as coal, coke, ROM, DMS discard, sinter and product (varying in grades) can be stockpiled. As output has increased there has been a need for additional space to store larger volumes of material. The project stockyard area has been extended within the overall existing plant area (refer to Figure 4-1 for the extended stockyard area).

### **4.2.3 Proposed Layout and/or Activity Changes**

#### **4.2.3.1 Establishment of top-cut stockpile and mobile crushing and screening plant**

Top-cut material has historically been discarded onto a current WRD (Central WRD) because of its lower manganese content. A 2015 Opportunity Assessment highlighted the need for a top-cut viability study. Following investigations done by MMT, the viability of selling top-cut material (also referred to as low-grade product) was realised. It follows that additional storage space is required to stockpile the top-cut material. The top-cut material will need to be subjected to crushing and screening prior to being sent to the sinter plant. The proposal includes the establishment of a mobile crushing and screening plant adjacent to the stockpile area. After processing at the sinter plant, the low-grade product will be sold to local and/or international markets.

The required stockpile area capacity is estimated at approximately 43Mt, would be up to 34 ha in extent and would be located to the east of the eastern WRD, extending to the property boundary adjacent to the R380 (refer to Figure 4-1).



A prefeasibility study is in progress validating trade-off studies for value in the remaining top-cut ore. The value will be unlocked by stockpiling top-cut, crushing and processing through DMS and sinter plants. This will increase MMT's resource utilisation, reduce stripping ratio and add ability to react to manganese price fluctuation.

#### **4.2.3.2 Stormwater infrastructure**

Please refer to section 4.2.1.7.

#### **4.2.3.3 WRD height increase**

The approved 2005 EMPR specifies the height of the MMT WRDs to be 50 m above natural ground level. MMT is proposing to increase this to 80 m in order to provide additional capacity for the disposal of waste rock. The height increase would not be applied to rehabilitated WRDs.

#### **4.2.3.4 Water supply pipeline from Middelplaats Mine**

MMT utilises groundwater for the washing and screening processes in the OPP, as well as for the beneficiation process through cyclones at the DMS plant. MMT currently sources this water from ingress in the open pit for use in the processing and beneficiation plants. This groundwater is currently obtained by pumping it from the south pit of Mamatwan mine into various water storage dams and then into the plants. This source of water is unreliable as water is not always available within the open pit and as such MMT has started to source water from the Sedibeng Vaal Gamagara Water Supply Scheme. The Sedibeng Vaal Gamagara Water Supply Scheme is known for challenges associated with water shortage and as such this is not deemed a sustainable long-term solution for MMT.

MMT is proposing to source water from the decommissioned Middelplaats Mine for back-up purposes in the event of process water shortages at the mine. The underground workings of the decommissioned Middelplaats mine are flooded and as such MMT is proposing on abstracting this water via two boreholes that still need to be drilled. A pipeline to transfer the water from the decommissioned Middelplaats Mine to the MMT will need to be established. It is anticipated that the pipeline will be an HDPE pipe with a diameter of 260 mm and will be located above ground.

It is unknown if the current water at Middelplaats will be sustainable water supplementary to the process water, or a once off dewatering of the shaft and underground workings. The flow level will be determined once pumping can start to evaluate the water level drop vs. quantity pumped out.

#### **4.2.3.5 Upgrading the railway loadout station**

South32 has a Manganese Export Corridor Allocation on the Transnet Freight Rail (TFR) manganese line between Hotazel, in the Northern Cape, and Coega, in the Eastern Cape. The allocation is underutilised due to train loading inefficiencies at MMT. This results in TFR liability payments and increased road haulage costs. There is therefore a need to improve the loading rate of trains at the MMT. Additionally, the TFR has initiated a manganese expansion programme which will increase manganese export capacity by upgrading the rail network. TFR plans to increase capacity of the manganese rail line beyond the current 4-million TPA to 16 million TPA.

In order to meet the TFR's expanded capacity requirements, the loading rate of trains at the MMT needs to be increased. It currently takes MMT an average of 14 hours to load a train consisting of 104 wagons. South32 is

therefore proposing on upgrading the existing load out station and conveyor to improve the loading capacity and time. Increasing global demands of manganese ore creates opportunities for resources in South Africa to expand current facilities in order produce increased volumes and sell more products.

TFR's has initiated a manganese expansion programme which will increase manganese export capacity allocation (MECA) by upgrading the rail network between Hotazel, in the Northern Cape, and Coega, in the Eastern Cape. The project will include a new bulk terminal at the Port of Ngqura. The target completion date is in year 2023, subject to approvals.

TFR has distributed technical requirements to its manganese customers and outlined the new requirements for Train Handling Times (THT), locomotive requirements, wagons to be loaded of at a time, loading rates and locomotive requirements.

These requirements translate to increased loading rates that result in increased train handling times: -

- MECA 3 Loading rate of 3500 TPA loaded on 104 wagons which translates to a two-four-hour train turnaround time;
- MECA 2 requires 104 trains be completely loaded and ready for departure in 12 hours from train arrival at the compilation yard;
- The current rail wagon train size is 104 units. The basic engineering design study for the upgrade will include a train size of 125 units to meet possible future TFR train size configurations; and
- Consideration will be made to achieve a four-hour loading period to fully exploit the opportunity of the Raptor Project and maximize the benefit for the business.

The current train loading infrastructure at MMT and Wessels Mine, also a South32 HMM owned Mine in Northern Cape, is not capable of achieving this loading rate. The reduced loading periods as outlined by TFR, has necessitated the need for a pre-feasibility study (PFS) which will investigate and identify the most cost-effective way to upgrade the loading infrastructure for Mamatwan Mine and Wessels Mine to comply with the changing requirements from TFR. These changes are triggered by TFR through the MECA3 contract and Saldanha capacity increase readiness requirements.

The constraint will be where improvements to the current system are required to maintain a 100% strike rate to MECA 2 train handling conditions of 12 hours, as effort must be able to provide this improvement with minimal interruption and outages to the current operation and daily shipment of ore. It is also necessary to constantly take into consideration how the community and environmental permitting risks can be mitigated while developing the project. An integrated approach will be followed throughout the study of the investment alternatives as well as with the development of the preferred investment alternative to incorporate environmental considerations (wetlands, closure strategy, water use license amendments environmental permitting timelines) and community risks (community unrest, exposure to dust, noise and vibration).

Possible consequences if the project does not proceed:

- Penalties due to loading a train in more than the required 12-hour THT;
- The possibility of loss of access to reliable export lines (Saldanha);

- Possible misalignment between marketing and the mine about what the purpose of the project is (marketing view is that the project will address the requirement for increased volumes in the future whilst the Mine's view is that the project needs to match current market demand);
- Penalties due to non-adherence to profile requirements – Existing Load-out Station (LoS) does not consider change in profile. It is envisioned that settings will be optimised to ensure that the required profile is achieved as closely as possible; and
- Loss of loading spot due to competition with peer.

#### *Criticality of project including Inputs and Outputs*

The critical aspects of the rail loop and loadout station are discussed in the table below.

**Table 4-8: Criticality of the project**

| Criticality of the project                                 | Description  |
|--|--|
| Fit with Business strategy                                 | Manganese through existing logistics, and maximising South32's exposure to export markets  |
| Lowering of logistics cost                                 | Lower the logistics cost as the envisaged transportation will mean that trucking of ore to port are no longer used   |
| Reduced train loading times                                | By reducing the train loading time, South32 will now have a time buffer available which can be utilised to service for increased volumes of manganese exports  |
| Increased train loading cycles                             | South32 can increase the train loading cycle and have more trains loaded per day. This opportunity will see increased earnings   |
| Reduce stockyard inventory                                 | Rapid loading will reduce ore inventory in the stockyard and allow space for newly mined ore to be stored. Large product containment has a risk of miscellaneous charges which will be reduced when ore stock is moved quickly.  |
| Improve regional job prospects                             | The rapid loading project will increase the job prospect of people around Hotazel and create a chance for South32 to improve its BBBEE scoring. Furthermore, if ore is loaded at a rapid rate, the overall mining activities will improve and create more opportunities for good business. |
| Improve the socio-economies                                | Where possible, the rail loading upgrading project will seek to address the socio-economic development and create mini-projects that would uplift the local community and local entrepreneurs.   |
| Modernise load-out Station to date with current technology | The overall out-of-date infrastructure, resource and operating procedures slows the sequential rail loading and is disposed to high recapitalisation costs.  |
| Compliance to TFR standard and terms & conditions          | System upgrades, compliance to TFR's new MECA3 contract and avoid possible penalties.  |
| Proven technology  | The project will use proven technology.  |
| Maintain market share                                      | The load-out station upgrade allows South32 to meet its criteria of TFR and to its customers, it will also maximize value from the South32 export allocation at Saldanha port.   |

The rail loop and LoS will be located immediately west of the R380 on the remaining extent of the farm Sinterfontein 748 (refer to Figure 4-4).

Approval of the EIA will determine the initiation of the construction phase, but expectations are that construction would commence by end of first quarter 2022.

#### **4.2.3.6 Sale of waste rock as aggregate**

The approved 2005 EMPR makes provision for the storage of waste rock along the eastern and southern side of the open pit. WRDs established on site include the north-eastern WRD, the central WRD, the south-eastern WRD, the south WRD,s; the Adams rehabilitated WRDs and the Sinterfontein WRD. MMT is committed to partially backfilling the open pit with waste rock and concurrently rehabilitating WRDs that will remain on surface in perpetuity.

MMT is proposing on selling some of the waste rock that would have remained on surface in perpetuity as aggregate to third parties. Doing so could reduce the size of the WRDs remaining on surface at closure.

#### **4.2.3.7 Re-processing of material located in Adams Pit**

Adams Pit contains numerous materials that have been stockpiled or disposed in the pit since the Adams Pit was decommissioned in the 1980s. The materials include tailings, slimes, general waste, sinter de-dust, plant spillages and DMS grit.

MMT is proposing on re-processing the tailings, DMS grit, sinter de-dust and plant spillages currently stockpiled within Adams Pit as part of rehabilitation of the pit. Market depending, it is anticipated that a maximum of 40 000 tons of material could be sold to third parties per month. The re-processing of the material stored in Adams Pit would include:

- The use of an excavator to remove the material within the Pit;
- The use of a new temporary mobile screen to remove unwanted material (general waste and sinter de-dust bags) and screen the material into different size fractions;
- The material would be transported by truck to dispatch using road or rail, for sale to third parties;
- Unwanted material (general waste and sinter de-dust bags) will be deposited at the designated MMT waste disposal site; and
- Waste rock will be used to backfill the open pit as part of rehabilitation.

**Table 4-9: List of proposed project actions / activities / processes**

| Main activity/ process                           | Sub-activities  | Construction Phase | Operation Phase | Decommissioning Phase | Closure Phase |
|--|---|--------------------|-----------------|-----------------------|---------------|
| <b>Site preparation</b>                          | Selective vegetation clearance (in line with the sites existing EMPR commitments and DAFF guidelines) .               |                    |                 |                       |               |
|  | Removal of existing minor structures such as fencing (if present).  |                    |                 |                       |               |
|  | Demarcation of temporary working corridors such as access routes and pathways where required.                         |                    |                 |                       |               |
|  | Establishment of construction material and equipment laydown area within existing disturbed areas.                    |                    |                 |                       |               |
| <b>Earthworks</b>                                | Earth moving activities for stripping of topsoil and sub-soil in line with the soil management procedure in the EMPR. |                    |                 |                       |               |
|  | Cleaning, grubbing and bulldozing activities.   |                    |                 |                       |               |
|  | Temporary stockpiling of topsoil and sub-soil.  |                    |                 |                       |               |
|  | Excavation of trenches and foundations and compaction of soils.   |                    |                 |                       |               |
| <b>Civil works</b>                               | Mixing of concrete and concrete work (such as laying of foundations).   |                    |                 |                       |               |
|  | Erection, use and removal of scaffolding and cranes.  |                    |                 |                       |               |
|  | General building activities and erection of equipment and structures.   |                    |                 |                       |               |
|  | Steel work(including installing re-enforcement steel, grinding and welding).  |                    |                 |                       |               |
|  | Installation and lay down of water pipelines .  |                    |                 |                       |               |
| <b>Waste rock (Mineralised waste) management</b> | Hauling, tipping and dozing of waste rock.  |                    |                 |                       |               |
|  | Concurrent backfilling of the pit (in-pit dumping).   |                    |                 |                       |               |
|  | Rehabilitation of WRDs (on-site, on surface).   |                    |                 |                       |               |
|  |   |                    |                 |                       |               |



| Main activity/ process  | Sub-activities   | Construction Phase | Operation Phase | Decommissioning Phase | Closure Phase |
|---|--|--------------------|-----------------|-----------------------|---------------|
| <b>Storm water management</b><br><i>*continue until infrastructure can be removed or successfully rehabilitated</i> | Diversion of clean water from dirty areas.   |                    |                 |                       |               |
|   | Containment of dirty water collected from dirty areas.   |                    |                 |                       |               |
| <b>Transport systems</b>  | Construction and maintenance of on-mine private (gravel) haul, access and service roads.                           |                    |                 |                       |               |
|   | Movement of construction vehicles/machinery within the site boundary (via on-mine private roads).                  |                    |                 |                       |               |
|   | Movement of waste rock with dozers, excavators, loaders and/or haul-trucks.  |                    |                 |                       |               |
| <b>Continued use of existing services</b><br>Non-mineralised (general and industrial hazardous) waste management    | Railway loop   |                    |                 |                       |               |
|   | Collection of general and hazardous waste on mine site.  |                    |                 |                       |               |
|   | Disposal and/or treatment of contaminated soils.   |                    |                 |                       |               |
|   | Removal of waste by contractor for recycling, re-use and/or final disposal at permitted waste disposal facilities. |                    |                 |                       |               |
| <b>Site management</b>  | Site management (monitoring, inspections, maintenance of facilities, security, access control).                    |                    |                 |                       |               |
|   | Environmental awareness training and emergency response.   |                    |                 |                       |               |
|   | On-going rehabilitation of facilities/disturbed areas (where possible).  |                    |                 |                       |               |
|   | Implementing and maintaining management plans.   |                    |                 |                       |               |
| <b>Continued use of existing services</b><br>Transport systems  | Vehicle and plant equipment servicing and maintenance workshops, spray painting and wash bays.                     |                    |                 |                       |               |
|   | Use of parking, loading and off-loading areas for trucks, busses, and other vehicles.                              |                    |                 |                       |               |

| Main activity/ process                           | Sub-activities   | Construction Phase | Operation Phase | Decommissioning Phase | Closure Phase |
|--|--|--------------------|-----------------|-----------------------|---------------|
|  | Transportation of staff to and from site (using private cars and busses via surfaced roads).   |                    |                 |                       |               |
|  | Transport of input materials, supplies, services, and waste removal (using trucks and vans via surfaced roads).  |                    |                 |                       |               |
| <b>Continued use of existing services</b>        | Waste management: <ul style="list-style-type: none"> <li>Handling and storage and removal of general waste on site (domestic waste; cleared vegetation; building rubble) (as per waste management procedures).</li> <li>Handling and storage of hazardous waste on site (fuel; lubricants; cement; explosive packaging; solvents).</li> </ul> Separation of oil and water at wash bays<br>Continued use of sewage facilities |                    |                 |                       |               |
|  | Water supply for domestic use.   |                    |                 |                       |               |
|  | Use of existing process water supply from the Plant Dam.   |                    |                 |                       |               |
|  | Recycling and re-use of water within the operations via pipelines.   |                    |                 |                       |               |
|  | Use of established roads and access roads.   |                    |                 |                       |               |
|  | Use of existing security and access infrastructure.  |                    |                 |                       |               |
|  |  |                    |                 |                       |               |
|  |  |                    |                 |                       |               |
| <b>Demolition</b>                                | Dismantling and demolition of fixed infrastructure and removal of equipment.   |                    |                 |                       |               |
|  | Demolition of ramps, haul, service and access roads (no longer needed).  |                    |                 |                       |               |
|  | Replacing soil resources.  |                    |                 |                       |               |
| <b>Rehabilitation, maintenance and aftercare</b> | Slope stabilisation, erosion control and landscaping.  |                    |                 |                       |               |
|  | Re-vegetation of landscaped areas.   |                    |                 |                       |               |

| Main activity/ process       | Sub-activities   | Construction Phase | Operation Phase | Decommissioning Phase | Closure Phase |
|------------------------------|--|--------------------|-----------------|-----------------------|---------------|
|                              | Removal of alien invasive species from rehabilitated sites.  |                    |                 |                       |               |
|                              | Restoration of natural drainage patterns as far as practically possible.                           |                    |                 |                       |               |
|                              | Erosion control and landscaping.   |                    |                 |                       |               |
|                              | Re-vegetation of disturbed areas and where infrastructure is removed.                              |                    |                 |                       |               |
|                              | Removal of alien invasive species from disturbed and rehabilitated sites.                          |                    |                 |                       |               |
|                              | Restoration of natural drainage patterns as far as practically possible.                           |                    |                 |                       |               |
|                              | Maintenance and repair of post closure landforms, facilities, and rehabilitated areas.             |                    |                 |                       |               |
|                              | Erosion control and landscaping.   |                    |                 |                       |               |
| <b>Site support services</b> | Access control and roaming security activities at mine entrance and on MR and surface right areas. |                    |                 |                       |               |

## 5. POLICY AND LEGISLATIVE CONTEXT

### 5.1 LEGAL FRAMEWORK

#### 5.1.1 Mineral and Petroleum Resources Development (No. 28 of 2002) (MPRDA), as amended

The MPRDA, as amended, governs the acquisition, use and disposal of mineral and petroleum resources in South Africa. The MPRDA promotes equitable access to the nation's mineral and petroleum resources. The objectives of the Act, amongst others, are to promote economic growth and mineral and petroleum resources development in the Republic, particularly development of downstream industries through provision of feedstock and development of mining and petroleum inputs industries and also to promote employment and advance the social and economic welfare of all South Africans.

Chapter 4 of the Mineral and Environmental Regulation provides a framework to regulate the application for mining, prospecting and closure rights. In addition, Section 102 of the MPRDA governs the amendment of rights, permits, mine work programmes, EAs and EMP's, and ministerial consent is required.

With the establishment of the "One Environmental System" in 2014, the DMRE must apply the range of environmental principles included in Section 2 of NEMA when taking decisions that significantly affect the environment. To give effect to the general objectives of Integrated Environmental Management (IEM), the potential impacts on the environment of listed or specified activities must be considered, investigated, assessed and reported on to the competent authority. Section 24(4) of NEMA provides the minimum requirements for procedures for the investigation, assessment, management, and communication of the potential impacts.

**The proposed project will require an amendment to the approved 2005 EMP and associated update of the current mine work programme. It follows that a Section 102 Amendment will be applied for in terms of the MPRDA.**

#### MPRDA Regulations, 2004

The MPRDA Regulations, 2004 (as amended by GN No. 420 of 27 March 2020), promulgated in terms of Section 107 of the MPRDA, provide for a range of matters relating to the administration of the Act. Part 1 details regulations for the lodging of applications, Part 2 deals with Social and Labour Plans (SLP) while Part 3 set out environmental regulations for mineral development. The recent amendment in March 2020 removed the great majority of the environmental provisions from the Regulations. These Regulations had not been practicably implementable since the December 2014 introduction of the "One Environmental System" and the amendment of the overriding legislation (MPRDA and NEMA).

#### 5.1.2 National Environmental Management Act (No. 107 of 1998) (NEMA), as amended

NEMA establishes principles and provides a regulatory framework for decision-making on matters affecting the environment. All organs of state must apply the range of environmental principles included in Section 2 of NEMA when taking decisions that significantly affect the environment. Included amongst the key principles is that all development must be socially, economically and environmentally sustainable and that environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably. The participation of I&APs is stipulated, as is that decisions must consider the interests, needs and values of all I&APs.



Chapter 5 of NEMA provides a framework for the integration of environmental issues into the planning, design, decision-making and implementation of plans and development proposals. Section 24 provides a framework for granting of environmental authorisations. To give effect to the general objectives of IEM, the potential impacts on the environment of listed or specified activities must be considered, investigated, assessed and reported on to the competent authority. Section 24(4) provides the minimum requirements for procedures for the investigation, assessment, management and communication of the potential impacts. In terms of the management of impacts on the environment, Section 24N details the requirements for an EMPr.

### **EIA Regulations, 2014 (as amended by GN No. 326 of 7 April 2017)**

The EIA Regulations, 2014 (as amended by GN No. 326 of 7 April 2017) promulgated in terms of Chapter 5 of NEMA provide for control over certain Listed Activities. These Listed Activities are detailed in Listing Notice 1 (as amended by GN No. 327 of 7 April 2017), Listing Notice 2 (as amended by GN No. 325 of 7 April 2017) and Listing Notice 3 (as amended by GN No. 324 of 7 April 2017). The undertaking of activities specified in the Listing Notices is prohibited until EA has been obtained from the competent authority. Such EA, which may be granted subject to conditions, will only be considered once there has been compliance with the EIA Regulations (GNR 982 of 2014), as amended.

In addition to the above, the NEMA EIA Regulations (GN R 982 of 2014), as amended stipulates that an application submitted after the commencement of these Regulations for an amendment of an EMPr, issued in terms of the MPRDA, must be dealt with in terms of Part 1 or Part 2 of Chapter 5 of the regulations. Part 1 allows for the amendment of an EA if a project will not change the scope of a valid EA, nor increase the level or nature of the impact, which impact was initially assessed and considered when application was made. Part 2 allows for the amendment of an EA if the project will result in a change to the scope of a valid EA where such change will result in an increased level or change in nature of impact where such level or change in nature of impact was not assessed or taken into consideration in the initial EA and the change does not, on its own, constitute a listed or specified activity.

The EIA Regulations (GNR 982 of 2014), as amended) set out the procedures and documentation that need to be complied with when applying for EA. A Basic Assessment process must be applied to an application if the authorisation applied for is in respect of an activity or activities listed in Listing Notices 1 and/or 3 and a S&EIA process must be applied to an application if the authorisation applied for is in respect of an activity or activities listed in Listing Notice 2.

**The proposed project will trigger activities specified in Listing Notice 2 (refer to section 1.3) and therefore a S&EIA process is required in order for the DMRE to consider the application in terms of NEMA. As the DMRE are the competent authority for the NEMA and NEM: WA activities, MMT will apply for an integrated EA, as provided for in section 24L of the NEMA.**

### **Regulations pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations, 2015**

The purpose of the Regulations pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations (GN R 1147 of 2015) is to regulate the determination and making of financial provision as contemplated in the Act for the costs associated with the undertaking of management, rehabilitation and remediation of environmental impacts from prospecting, exploration, mining or production operations through

the lifespan of such operations and latent or residual environmental impacts that may become known in the future.

**The compilation of a financial provision report in support of the proposed project is outlined in Section 29.**

### **National Guideline on minimum information requirements for preparing Environmental Impact Assessments for mining activities that require environmental authorisation, 2018**

The Minister of Environmental Affairs gave a notice (GN 86 of 2018) of intent to publish National Guideline on minimum information requirements for preparing EIAs for mining activities that require EA. The purpose of the guideline is to allow for a more standardised approach during the compilation of EIAs for mining activities. This guideline remains in draft format.

### **5.1.3 National Environmental Management: Waste Act (No. 59 of 2008) (NEM: WA)**

The NEM: WA regulates all aspects of waste management and has an emphasis on waste avoidance and minimisation. NEM: WA creates a system for listing and licensing waste management activities which may have a detrimental effect on the environment. A waste management activity identified in terms of the NEM: WA may not commence, be undertaken or conducted except in accordance with published standards or a Waste Management Licence.

#### **Listed waste management activities**

Listed waste management activities are included in GN R 921 of November 2013, as amended. Category A and Category B listed waste management activities above certain thresholds are subject to a process of impact assessment and licensing. Category C listed waste management activities do not require a waste management license but are subject to the provisions of National Norms and Standards (GN R 926, November 2013). The assessment and reporting process in support of a WML application must be undertaken in accordance with the EIA Regulations (GNR 982 of 2014), as amended. These Regulations define the requirements for the submission, processing, consideration and decision of applications authorisation of listed activities. Activities listed in Category A require a Basic Assessment process, while activities listed in Category B require a S&EIA process in order for authorities to consider an application in terms of NEM: WA.

**The MMT project activities will trigger waste management activities under Category A (refer to Table 4-2), requiring a WML. As the DMRE is the competent authority for the NEMA and NEM: WA activities, HMM will apply for an integrated EA, as provided for in section 24L of the NEMA.**

### **Waste Classification and Management Regulations, 2013**

The purpose of the Waste Classification and Management Regulations (GNR 634 of 23 August 2013) is to ensure adequate and safe storage and handling of hazardous waste, and to inform the consideration of suitable waste management options. These regulate the classification of waste in terms of SANS 10234; prescribe requirements for the assessment of waste destined for disposal (GN R 635); require that disposal of waste to landfill take place in terms of GN R 636; prescribe requirements and timeframes for the management of certain wastes and prescribe the general duties of waste generators, transporters and managers. They also include communication elements for labelling and information required for Safety Data Sheets.

**Although the Norms and Standards primarily refer to landfills, the definition of waste in South Africa includes mine residues such as waste rock and therefore the Norms and Standards apply to mine residue classification.**

### **Regulations regarding the Planning and Management of Residue Stockpiles and Residue Deposits, 2015**

The purpose of these Regulations (GN R 632) is to regulate the planning and management of residue stockpiles and residue deposits from a prospecting, mining, exploration or production operation. The management of residue stockpiles and deposits must be undertaken in accordance with the Regulations, as well as the complimentary Norms and Standards and other Regulations published under the NEM: WA.

In accordance with Regulation 5 of GNR 632 of the NEM:WA, waste rock stockpiles need to be classified utilising a risk-based analysis. In the absence of a prescribed methodology to undertake a risk-based analysis, waste rock material was classified in accordance with (refer to specialist study included in Appendix E):

- The National Norms and Standards for the assessment of waste for landfill disposal (GNR 635 of 2013); and
- The National Norms and Standards for disposal of waste to landfill (GNR 636 of 2013).

### **National Norms and Standards for the Assessment of Waste for Landfill Disposal, GNR 635 of 2013 and National Norms and Standards for Disposal of Waste to Landfill, GNR 636 of 2013**

The GN R 635 prescribes the requirements for the assessment of waste prior to disposal to landfill. Waste generators must ensure their waste is assessed in terms of the standard prior to disposal. The assessment is based on the total concentration (TC) and leachable concentration (LC) of certain elements and chemical substances in the waste compared against concentrations specified in the standard. Following laboratory analysis, the TC and LC are compared with specific TC and LC threshold values in the standard, which then determines the particular type of waste (Type 0, 1, 2, 3 and 4) for disposal.

The GN R 636 determines the requirements for the disposal of waste to landfill; define landfill classification and containment barrier designs, waste acceptance criteria for landfills and certain restrictions on waste disposal. Four classes of landfill (Class A, B, C or D) are prescribed in the standard, each with a particular barrier (liner) design. The new landfill classes do not make a distinction between sites for the disposal of general or hazardous waste. The standard stipulates which types of waste are allowed to be disposed at a particular class of landfill. Waste disposal prohibitions, aimed at eliminating the disposal of certain wastes within set periods of time include certain hazardous wastes, recoverable materials such as used oils and solvents, liquid wastes and brines, as well as high calorific value wastes.

#### **5.1.4 National Water Act (No. 36 of 1998) (NWA)**

The NWA provides a legal framework for the effective and sustainable management of water resources in South Africa. It serves to protect, use, develop, conserve, manage and control water resources as a whole, promoting the integrated management of water resources with the participation of all stakeholders. This Act also provides national norms and standards, and the requirement for authorisation (either a WUL or General Authorisation) of water uses listed in Section 21 of the Act. The competent authority is the DWS. This Report does not address the requirements of a WUL process. This will be handled as part of a separate process with the DWS.

### **Regulations on the use of Water for Mining and Related Activities, 1999**

GNR. 704 of June 1999, was established to provide regulations on the use of water for mining and related activities aimed at the protection of water resources. The principal conditions of GNR. 704 of June 1999 applicable to this project are:

- Condition 5 which indicates that no residue or substance which causes or is likely to cause pollution of a water resource may be used in the construction of any dams, impoundments or embankments or any other infrastructure which may cause pollution of a water resource;

- Condition 6 which describes the capacity requirements of clean and dirty water systems. Clean and dirty water systems must be kept separate and must be designed, constructed, maintained and operated to ensure conveyance of flows of a 1:50 year recurrence event. Clean and dirty water systems should not spill into each other more frequently than once in 50 years. Any dirty water dams should have a minimum freeboard of 0.8m above full supply level; and
- Condition 7 which describes the measures which must be taken to protect water resources. All dirty water or substances which may cause pollution should be prevented from entering a water resource (by spillage, seepage, erosion etc.) and ensure that water used in any process is recycled as far as practicable.

### **Regulations Regarding the Procedural Requirements for WUL Applications and Appeals, 2017**

These Regulations, published in terms of the NWA (GN R 267), prescribe the procedure and requirements for WUL applications as contemplated in sections 41 of the NWA; as well as an appeal in terms of section 41(6) of the NWA. The WUL application process requires:

- A pre-application enquiry meeting with the responsible authority;
- The making of an application in the prescribed form, with documents relevant to a particular water use application;
- Conducting a site inspection;
- A public participation process; and
- Assessment and consideration of the technical documents by the responsible authority.

A separate WUL application process will be undertaken in consultation with the DWS and will be undertaken in accordance with these Regulations.

### **5.1.5 National Environmental Management: Air Quality Act (No. 39 of 2004) (NEM: AQA)**

The NEM: AQA regulates all aspects of air quality, including prevention of pollution and environmental degradation; providing for national norms and standards (through a National Framework for Air Quality Management) regulating air quality monitoring, management and control; and licencing of activities that result in atmospheric emissions and have or may have a significant detrimental effect on the environment.

#### **Listed activities and Minimum Emission Standards**

In terms of Section 22 of NEM: AQA no person may conduct an activity releasing emissions (GN No. 893, 22 November 2013) without an AEL. MMT holds an AEL for their operations. The proposed activity and layout changes do not trigger any activity set out in the notice and thus there is no requirement for an amendment to the AEL.

#### **National Ambient Air Quality Standards, 2009**

National Ambient Air Quality Standards (NAAQS) (GN 1210) were determined in for South Africa, based on international best practice for inhalable PM (PM<sub>2.5</sub>), thoracic PM (PM<sub>10</sub>), sulphur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>), carbon monoxide (CO), ozone, lead and benzene. The NAAQS permit a frequency of exceedance (FOE) of 1% per year (88 hours or 4 days per year for 1-hour and 24-hour average concentrations) for some pollutants. The NAAQS is presented in the Air Quality Study (see Appendix H).



### **National Dust Control Regulations, 2013**

The National Dust Control Regulations (NDCR) (GN 827) were gazetted on 1 November 2013. The purpose of the regulations is to prescribe general measures for the control of dust in all areas including residential and light commercial areas. The Regulations provide a guideline for monitoring and measuring dust fall. Dust fall is assessed for nuisance impact and not an inhalation health impact. The acceptable dust fall rates is presented in the Air Quality Study (see Appendix H). Potential dust fall from the project will be assessed against the NDCR.

### **National Atmospheric Emission Reporting Regulations, 2015**

MMT is required by the AEL to report in terms of the National Atmospheric Emission Reporting Regulations (GN 283).

### **Greenhouse Gas Reporting Regulations, 2017**

MMT is required by the AEL to report annually in terms of the Greenhouse Gas Reporting Regulations (GN 275)

#### **5.1.6 National Environmental Management: Biodiversity Act (No. 10 of 2004) (NEM: BA)**

The NEM: BA provides for the management and conservation of South Africa's biodiversity and the protection of species and ecosystems that warrant national protection. NEM: BA regulates the carrying out of restricted activities, without a permit, that may harm listed threatened or protected species or activities that encourage the spread of alien or invasive species and makes provision for the publication of bioregional plans and the listing of ecosystems and species that are threatened or in need of protection. Bioregional plans should be considered by competent authorities in their decision-making regarding an application for EA.

Where protected species may be located within the proposed development footprint, these will need to be removed. Prior to removal NEM: BA, as well as the Northern Cape Nature Conservation Act (Act 9 of 2009) requires that these species be identified and that a permit be obtained for damage or removal of these species.

#### **Alien and Invasive Species Regulations, 2014 and Lists**

Alien and Invasive Species Regulations (GN R 598 of 2014) as well as the Alien and Invasive Species List (GN R 864 of 2016) have been published to regulate the monitoring, control and eradication of listed invasive species. All landowners on whose land alien and invasive species occur must make the necessary arrangements to be compliant with these Regulations. These will guide the EMPR for the project.

#### **5.1.7 National Heritage Resources Act (No. 25 of 1999) (NHRA)**

The NHRA provides for the identification, assessment and management of the heritage resources of South Africa. The Act lists development activities that would require authorisation by the responsible heritage resources authority. The Act requires that a person who intends to undertake a listed activity notify the relevant provincial heritage authority at the earliest stages of initiating such a development. The relevant provincial heritage authority would then in turn, notify the person whether a Heritage Impact Assessment (HIA) should be submitted. However, according to Section 38(8) of the NHRA, a separate report would not be necessary if an evaluation of the impact of such development on heritage resources is required in terms of the Environment Conservation Act (No. 73 of 1989) (now replaced by NEMA) or any other applicable legislation. The decision-making authority should, however, ensure that the heritage evaluation fulfils the requirements of the NHRA and

consider in its decision-making any comments and recommendations made by the relevant heritage resources authority.

Where new land is disturbed by the project, the provisions of the NHRA will be considered. The BID was uploaded to the South African Heritage Resources Agency (SAHRA) website (SAHRA Case No. 14 985).

## 5.2 LEGISLATION CONSIDERED IN THE PREPARATION OF THE EIA REPORT

A summary of the applicable legal framework that has been considered in the assessment process is provided in the table below.

**Table 5-1: Legal framework**

| Applicable legislation                                      | Reference where applied                          | How does this development comply with and respond to the policy and legislative context?   |
|---|--|--|
| The South African Constitution, 1996.                       | All  | The MMT and proposed activity/layout changes must comply with South African constitutional and common law by conducting its construction and operational activities with due diligence and care for the rights of others. Section 24 (a) of the South African Constitution states that everyone has the right to an environment that is not harmful to their health and well-being. This provision supersedes all other legislation. |
| MPRDA as amended and associated regulations.                | All  | A section 102 application was prepared by HMM and was submitted to the DMRE on 17 March 2021 via the DMRE South African Mineral Resources Administration System (SAMRAD).  |
| NEMA and associated regulations.                            | All  | An integrated EA and WML application was prepared by SLR and was submitted to the DMRE on 17 March 2021 via the DMRE SAMRAD.   |
| NEM: WA and associated regulations.                         | All waste related activities and infrastructure  |  |
| NWA and water use licensing regulations.                    | All new water uses and amended water uses.       | This report acknowledges that an IWUL Application process is required for the proposed project which will be handled as part of a separate process with the DWS.   |
| NEM: AQA  | All emissions that may impact on the environment | Air emissions were considered as part of project planning and an Air Quality Study has been compiled for the proposed project.   |
| NEM: BA   | All  | Biodiversity was considered as part of project planning and a Biodiversity Study has been compiled for the proposed project.   |
| Conservation of Agricultural Resources Act (No. 43 of 1983) |  |  |
| Northern Cape Nature Conservation Act, 2009 (No. 9 of 2009) |  |  |

| Applicable legislation | Reference where applied                             | How does this development comply with and respond to the policy and legislative context? |
|------------------------|---|--|
| NHRA                   | All new areas that will be cleared for development. | A Heritage/cultural and Palaeontological Study has been compiled for the project.        |

### 5.3 GUIDELINES, POLICIES, PLANS AND FRAMEWORKS

The guidelines and policy framework listed in the table below that have been considered during the EIA phase of project.

**Table 5-2: Guideline and policy framework**

| Guideline  | Governing body   | Relevance  |
|--|--|--|
| Public participation guideline in terms of NEMA (2012, updated in 2017)  | Department of Environmental Affairs (DEA) now the Department of Forestry, Fisheries and Environment (DFFE) | The purpose of this guideline is to ensure that an adequate public participation process is undertaken during the S&EIA process.   |
| Guideline on need and desirability (2014, updated in 2017)   | DEA now the DFFE   | This guideline informs the consideration of the need and desirability aspects of the proposed project.   |
| National Development Plan (NDP) 2030   | National Planning Commission   | The NDP (2030) is the overarching development planning policy for the country, to which all other development planning, in particular spatial planning, must be aligned. The NDP outline South Africa's Vision and provides the Framework for eliminating poverty and reducing inequality by 2030.   |
| Northern Cape Provincial Spatial Development Framework (NCPSDF, 2012)  | Department of Rural Development and Land Reform (DRDLR)  | The NCPSDF is needed for coherent prioritisation of projects within a spatial economic framework that takes cognises of environmental realities and the imperative to create a developmental state. The NCPSDF was designed as an integrated planning and management tool to facilitate on-going sustainable development through the province. The NCPSDF recognises the importance of the mining sector in the province's economic growth. However, it also aims to manage any direct detrimental impacts of resource use and promote positive socio-economic conditions once the resource use has reached its productive life cycle. |
| Joe Morolong Local Municipal Integrated Development Plan (IDP) 2016  | JMLM   | The JMLM IDP is the principle strategic instrument guiding all planning, management, investment and development within the province in order to provide best solutions towards sustainable development.  |
| Best Practicable Guidelines (BPGs) for the mining industry including:<br>BPG G1: Stormwater Management.<br>BPG A4: PCDs.<br>BPG G2: Water and Salt Balances. | DWS  | These local and international standards provide best practice for the prediction, prevention and management of water in mining. These standards have been considered during the Surface Water Study.   |

| Guideline   | Governing body                                     | Relevance   |
|---|--|---|
| SANS Drinking water standard SANS 241: 2015   | South African Bureau of Standards (SABS)           |   |
| Targeted Water Quality Range (TWQR) (DWA, 1996)   | DWS  |   |
| Water Quality Resource Objectives for Catchment D41K as specified in the MMT WUL (DWA, 2012).   | DWS  |   |
| SANS 10103 (2008)   | SABS   | These local and international standards provide best practice for the prediction, prevention and management of mine drainage. These standards have been considered during the Geochemical study.                                  |
| World Health Organisation (WHO) Standard for drinking water   | WHO  |   |
| International Finance Corporation (IFC) Mining Effluent (2007)  | IFC  |   |
| SANS 241 (2015) (Operational, Aesthetic, Acute health and Chronic   | SABS   | These local and international standards provide best practice for the prediction of noise related impacts to third parties. These standards have been considered during the preparation of the Noise Study.                       |
| WHO guidelines for community noise, health  | WHO  |   |
| IFC General Environmental, Health and Safety (EHS) Guidelines on noise  | IFC  |   |
| Quality of Domestic Water Supplies Volume 1: Assessment Guide, Second Edition, (1998)   | DSWS   | Groundwater quality at MMT is compared against these guidelines and standards.  |
| South African Water Quality Guidelines – Volume 1 Domestic Use (1993 and 1996)  | DWS  |   |
| SANS for drinking water (SANS 241:2015)   | SABS   |   |
| NAAQS for PM <sub>10</sub> , SO <sub>2</sub> , NO <sub>2</sub> , ozone (O <sub>3</sub> ), CO, lead (Pb) and benzene (2009). PM <sub>2.5</sub> in 2012 | DEA now the DFFE                                   | These local and international standards provide best practice for the measurement and prediction of dust related impacts to third parties. These standards will be considered during the preparation of the Air Quality Study.    |
| National Freshwater Ecosystem Priority Areas 2011 (NFEPA)   | DWS  | Biodiversity was considered as part of project planning and in the assessment of potential impacts. Reference was made to various national and provincial databases to determine potential presence and conservation sensitivity. |
| Northern Cape Critical Biodiversity Areas (CAN) (2016)  | South African National Botanical Institute (SANBI) |   |
| South Africa Conservation Areas Database (SACAD, 2017)  |  |   |
| South Africa Protected Area Database (SAPAD, 2017)  |  |   |
| Mining and Biodiversity Guideline (2013)  |  |   |
| Important Bird and Biodiversity Areas (IBAs)  | Birdlife International                             |   |



| Guideline  | Governing body   | Relevance |
|--|------------------|-----------|
| National Biodiversity Assessment (NBA) 2018              | DEA now the DFFE |           |
| National Protected Areas Expansion Strategy 2008 (NPAES) |                  |           |
| National Threatened Ecosystems (2011)                    |                  |           |

## 6. NEEDS AND DESIRABILITY

The DFFE (formerly DEA) guideline on need and desirability (GN R891, 20 October 2014) notes that while addressing the growth of the national economy through the implementation of various national policies and strategies, it is also essential that these policies take cognisance of strategic concerns such as climate change, food security, as well as the sustainability in supply of natural resources and the status of our ecosystem services. In 2017, the DFFE published an updated guideline on project need and desirability, although this is yet to be formally gazetted. The 2017 guideline on need and desirability provides that addressing the need and desirability of a development is a way of ensuring sustainability – in other words, that a development is ecologically sound and socially and economically justifiable.

When considering how the development may affect or promote justifiable economic and social development, the relevant spatial plans must be considered, including Municipal IDPs Spatial Development Frameworks (SDF) and Environmental Management Frameworks (EMF). The assessment reports need to provide information as to how the development will address the socio-economic impacts of the development, and whether there would be any socio-economic impact resulting from the development on people's environmental rights. Considering the need and desirability of a development entails the balancing of these factors. Consistent with the aim and purpose of the EIA, the concept of "need and desirability" relates to, amongst others, the nature, scale and location of the development being proposed, as well as the wise use of land and natural resources.

The National Strategy for Sustainable Development and Action Plan 2011 - 2014 (NSSD 1) (2011) states the following:

- In the first instance, it recognises that the maintenance of healthy ecosystems and natural resources are preconditions for human wellbeing. In the second instance, it recognises that there are limits to the goods and services that can be provided. In other words, ecological sustainability acknowledges that human beings are part of nature and not a separate entity.
- What is needed and desired for a specific area should primarily be strategically and democratically determined beyond the spatial extent of individual EIAs. The strategic context for informing need and desirability may therefore firstly be addressed and determined during the formulation of the sustainable development vision, goals and objectives of Municipal IDPs and SDFs during which collaborative and participative processes play an integral part, and are given effect to, in the democratic processes at local government level.
- When formulating project proposals and when evaluating project specific applications, the strategic context of such applications and the broader societal needs and the public interest should be considered. In an effort to better address these considerations and their associated cumulative impacts, the NEMA also provides for the compilation of information and maps that specify the attributes of the environment in particular geographical areas, including the sensitivity, extent, interrelationship and significance of such attributes which must be considered. Whether a proposed activity will be in line with or deviate from the plan, framework or strategy per se is not the issue, but rather the ecological, social and economic impacts that will result because of the alignment or deviation. As such, the EIA must specifically provide information on these impacts in order to be able to consider the merits of the specific application. Where a proposed activity deviates from a plan, framework or strategy, the burden of proof falls on the applicant (and the EAP) to show why the impacts associated with the deviation might be justifiable. The need and desirability of the development must be measured against the abovementioned contents of the IDP, SDF and EMF for the area, and the sustainable development vision, goals and objectives formulated in, and the desired spatial form and pattern of land use reflected in, the area's IDP and SDF. While project-level EIA decision-making therefore must help us stay on course by finding the alternative that will take us closer to the desired aim/goal, it is through Integrated Development Planning

(and the SDF process) that the desired destination is firstly to be considered and the map drawn of how to get there.

## 6.1 NATIONAL AND REGIONAL POLICY AND PLANNING FRAMEWORK

This section aims to provide an overview of the national and regional policy and planning context relating to the mining sector within South Africa and Northern Cape.

### 6.1.1 National Development Plan 2030 (NDP)

The NDP aims to ensure that all South Africans attain a decent standard of living through the elimination of poverty and reduction of inequality by 2030. The core elements of a decent standard of living identified in the plan are:

- Housing, water, electricity and sanitation;
- Safe and reliable public transport;
- Quality education and skills development;
- Safety and security;
- Quality health care;
- Social protection;
- Employment;
- Recreation and leisure;
- Clean environment; and
- Adequate nutrition.

The NDP provides the context for all growth in South Africa, with the overarching aim of eradicating poverty and inequality between people in South Africa through the promotion of development. The NDP provides a broad strategic framework, setting out an overarching approach to confronting poverty and inequality based on six focused and interlinked priorities.

One of the key priorities is “faster and more inclusive economic growth”. In order to transform the economy and create sustainable expansion for job creation, an average economic growth exceeding 5% per annum is required. The NDP sets out that transforming the economy also requires changing patterns of ownership and control. It is also acknowledged that environmental challenges are in conflict with some of these development initiatives. As such, it is emphasised that there is also a need to:

- Protect the natural environment;
- Enhance the resilience of people and the economy to climate change;
- Reduce carbon emissions in line with international commitments;
- Make significant strides toward becoming a zero-waste economy; and
- Reduce greenhouse gas emissions and improve energy efficiency.

### 6.1.2 New Growth Path 2010

South Africa has embarked on a new economic growth path in a bid to create 5 million jobs and reduce unemployment from 25% to 15% over the next ten years. The plan aims to address unemployment, inequality,

and poverty by unlocking employment opportunities in South Africa's private sector and identifies seven job drivers. These job drivers have the responsibility to create jobs on a large scale. The seven key economic sectors or “job drivers” for job creation are listed below:

- Infrastructure development and extension: Public works and housing projects;
- Agricultural development with a focus on rural development and specifically; and
- Agro-processing;
  - Mining value chains;
  - Manufacturing and industrial development;
  - Knowledge and green economy;
  - Tourism and services; and
  - Informal sector of economy.

The New Growth Path reflects the commitment of government to prioritise employment creation in all economic policies and sets out the key drivers and sectors for employment which will be the focus of government. Mining is identified as a key sector for prioritisation in order to drive economic growth and create jobs.

### 6.1.3 Northern Cape Provincial Spatial Development Framework 2018

The reviewed Northern Cape PSDF 2018 identifies the PSDF as an enabling mechanism to comply with the National Spatial Development framework. The PSDF functions as an innovate strategy that will apply sustainability principles to all spheres of land use management throughout the Northern Cape and which is to facilitate practical results, as it relates to the eradication of poverty and inequality and the protection of the integrity of the environment. In short, the PSDF is to serve as a mechanism towards enhancing the future of the Northern Cape and its people.

Five growth and development strategies are proposed to assist the province and municipalities in managing future growth of settlements. These strategies are listed below:

- Strategy 1: A Diversification and Maintenance Strategy for settlements with a Low Social Need and High Development Potential (60% of the provincial population);
- Strategy 2: A Growth Management Strategy for settlements with a High Social Need and High Development Potential. (20% of the provincial population);
- Strategy 3: A Migration and Maintenance Strategy for settlements with a High Social Need and Low Development Potential. (10% of the provincial population);
- Strategy 4: A Sustainable Livelihood Strategy for settlements with Low Social Need and Low Development Potential (10% of the provincial population); and
- Strategy 5: Mining development management strategy.

In addition, the PSDF identifies five zones of development in the province, these zones are listed below:

- Manufacturing;
- Agriculture;
- Administrative;
- Transportation; and
- Logistics.



The project will optimise mining-related activities at the site and provide economic opportunities derived from wages, taxes, and profits. Indirect economic benefits associated with the project are derived from the procurement of goods and services and the spending power of employees.

#### 6.1.4 The Northern Cape Provincial Growth and Development Strategy 2009 – 2014

The primary purpose of the Northern Cape Provincial Growth and Development Strategy (NCPGDS) is to provide a collaborative framework within which to drive and ensure effective and coordinated delivery and implementation in the Province. It provides the public and private sector and parastatals, as well as labour and civil society, with a strategic focus derived through consensus, to harness their collective efforts in promoting economic growth and social development. The vision of the NCPGDS is to build a prosperous, sustainable growing provincial economy to reduce poverty and improve social development for a caring society by promoting growth, diversification, and diversification of local economy as well as eradication of poverty through social development. The project will continue to contribute to poverty eradication by providing economic opportunities in the broader area.

### 6.2 ENSURING ECOLOGICAL SUSTAINABLE DEVELOPMENT AND USE OF NATURAL RESOURCES

Mining is a necessary activity in order to extract natural resources for manufacturing and development. Manganese is primarily used by the steel industry in deoxidizing and desulfurizing additives and as an alloying constituent. As such it is in high demand. Due to the nature of mining projects, impacts on biodiversity and the role that it plays in the ecosystem are inevitable.

MMT has been in operation since the 1960s and biodiversity across the site has been substantially transformed. Previous studies have identified habitats of intermediate importance for floral communities around the perimeter of MMT. Species of conservation concern (SCC) may occur within these habitats. The proposed layout and activity changes at the MMT largely fall within the current, ongoing operations and would likely not constitute a significant, new disturbance to biodiversity. The project has the potential to directly disturb soils, vegetation and fauna. The disturbances also have the potential to allow proliferation of alien and invasive plants (AIP). In addition, the changes may further disrupt the ecological functions and ecosystem services derived from the site.

Biodiversity and soil studies would be necessary to determine the sensitivity of the project area and potential impacts of the proposed changes. The biophysical impacts of the proposed project have been investigated as part of the EIA phase. Measures to enhance the benefits and mitigate the impacts to these resources are included in this EIAR.

### 6.3 PROMOTING JUSTIFIABLE ECONOMIC AND SOCIAL DEVELOPMENT

According to DMRE (2011) *“South Africa has been a resource economy in excess of a century. An independent evaluation of South Africa’s non-energy in-situ mineral wealth is estimated at US\$2.5 trillion (Citibank report, May 2010), making the country the wealthiest mining jurisdiction. However, a considerable amount of South Africa’s mineral resources is exported as raw ores or only partially processed. Although South Africa has steadily improved its ratio of beneficiated to primary products exported since the 1970s, these ratios are still well below the potential suggested by the quality and quantity of its mineral resource’s endowment. The Government’s industrialisation policy calls for a paradigm shift in mineral development, strategic investment in assets to maximise long-term growth beneficiation projects, enhance value of exports, increase sources for consumption*

*of local content, and create opportunities for sustainable jobs. Minerals are a vital input to an industrialisation programme, which is intended to accelerate manufacturing in South Africa (for local consumption and export). Competitive access to minerals for local beneficiation is one of the key success factors for the country's industrialisation initiative."*

The Kalahari Manganese Field (KMF) contains approximately 80% of the world's known high-grade manganese ore reserves. Mining of the manganese results in the production of ore for sale, creates sustainable jobs and supports economic activity. The export of ore generates foreign income. Direct economic benefits from MMT are derived from wages, taxes and profits. Indirect economic benefits are derived from the procurement of goods and services and the spending power of employees. Further to this, through employment, employees of the mine are afforded the opportunity to further their education through the skills development plan of the mine's SLP. The skills development plan is not the extent of human resources development at the mine. Supplementary plans to enhance the socio-economic benefits of the project are also in place, and these include a career progression plan, a mentorship plan and internships and bursaries. In addition to these social development plans, the mine also has in place an Employment Equity Plan and targets relating to historically disadvantaged South Africans (HDSAs). The benefits not only contribute to the country's Gross Domestic Product (GDP) but result in significant contributions to the economies and people of the Northern Cape, and specifically the JTGDm.

Community/society priorities are officially expressed through public documents including the provincial growth and development strategy and spatial development framework documents. In this regard, the priorities of the JMLM's IDP and the JTGDm's SDF are mainly focused on the reduction of unemployment and halving poverty, as well as establishing affordable accommodation in towns experiencing rapid expansion by investing in key sectors and developing and upgrading basic service delivery and infrastructure. In order to achieve this, development must be channelled into specific nodes and corridors (JTGDm, 2016). One of the Key Focus Areas for economic growth is the Gamagara Development Corridor, within which the MMT is located (see Figure 6-1).

Taking the above into consideration the project will support and enable continuation of current operations of the MMT, which will in turn sustain economic and social development. The MMT contributes to the national South African economy at macro level by exporting its product that leverages foreign income into the country. Direct economic benefits are derived from wages, taxes and profits. Indirect economic benefits will be derived from the procurement of goods and services and the spending power of employees. Further to this, through employment, employees of the mine are afforded the opportunity to further their education through the skills development plan of the mine's SLP. Supplementary plans to enhance the socio-economic benefits of the MMT are also in place, and these include a career progression plan, a mentorship plan and internships and bursaries. In addition to these social development plans, the mine also has in place an Employment Equity Plan and targets relating to HDSAs. The SLP is in line with the IDP of the JTGDm and the JMLM.

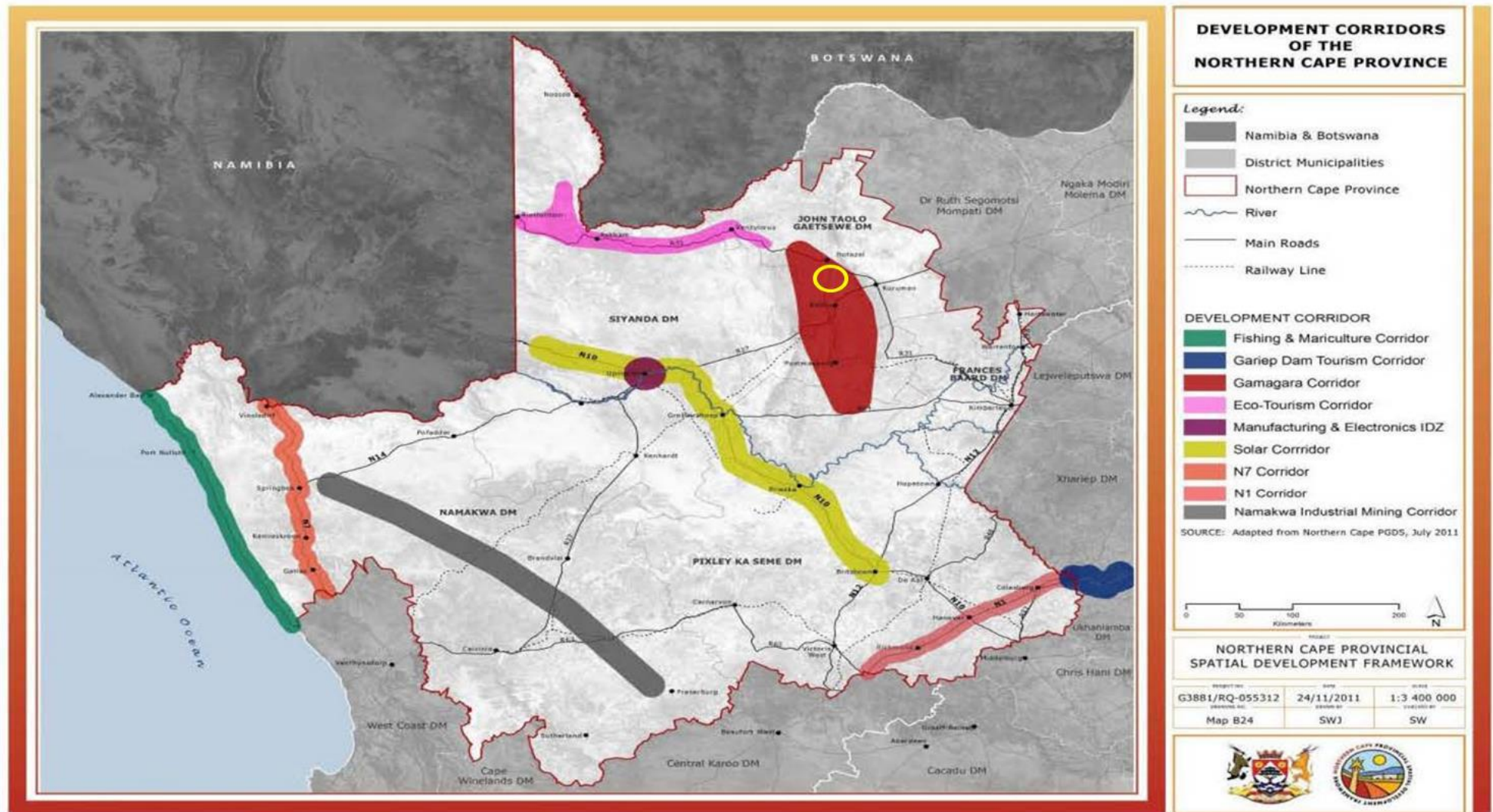


Figure 6-1: Development corridors of the Northern Cape source: NPSDF, 2012 (MMT location shown by yellow circle)

## 7. MOTIVATION FOR THE PREFERRED SITE, ACTIVITIES AND TECHNOLOGY ALTERNATIVES AND A FULL DESCRIPTION OF THE PROCESS FOLLOWED TO REACH THE PREFERRED ALTERNATIVES

The alternatives identified and preferred for this project are strongly dependent on the existing surface infrastructure locations as the new infrastructure must link at specific points. For this reason, the routes of the linear infrastructure were assessed in terms of alternatives. The project is located within the MR Area which has been disturbed and impacted by the construction and operation of the mining infrastructure. Furthermore, the link points to existing infrastructure are fixed and therefore the new infrastructure must take this into consideration in alignment of linear infrastructure.

The identification of alternatives was carried out through the assessment of the site by the engineering and EAP project team. The engineering team identified potential alternatives for the pipeline route and the railway loop. These alternatives were feasible in terms of the terrain and engineering requirements for the linear infrastructure. The engineers focused on the use of existing servitudes for the railway loop and pipeline route in order to minimise additional footprints that would need to be cleared, levelled and prepared for this linear infrastructure.

Once engineering alternatives had been identified, the EAP project team analysed and selected the alternatives that posed the least risk to the environment. These alternatives are discussed below. The alternatives were analysed against environmental and social criteria to select the preferred alignment or route.

### 7.1 DETAILS OF THE ALTERNATIVES CONSIDERED

#### 7.1.1 The “No-Go” Alternative

The No-Go alternative would be to not undertake any of the below activities:

- Establishment of a top-cut stockpile and associated mobile crushing and screening plant;
- Establishment of stormwater management infrastructure ;
- Change in height of WRD (this excludes rehabilitated WRDs);
- Establishment of a pipeline to transfer water abstracted from the decommissioned Middelplaats Mine to MMT;
- Upgrading the railway line and railway loadout station;
- Sale of waste rock as aggregate; and
- Re-processing of material located in Adams Pit.

The No-Go option would mean that the efficacy of the mine would not be optimised, and the LOM may be reduced. Furthermore, many of the activities applied for are focused on improving environmental management on site.

- The establishment of the pipeline to transfer abstracted water from Middelplaats mine to MMT is optimising the water available at Middelplaats for use at MMT. Should this not be possible, additional water would need to be sourced at MMT, and the Middelplaats water would be managed independently;



- The upgrade and extension of the railway line is allowing for the continued rail transport of product and supply, avoiding the requirement for trucking, which has an impact on roads, road users and road safety; and
- The sale of waste rock as aggregate negates the requirement for expanded or additional waste rock dumps for long term disposal of this material; and
- Reprocessing of material in Adams Pit is optimising resources within an existing impacted footprint. This is the best method to rehabilitate Adams Pit without the requirement for disposal of waste at a new facility.

### 7.1.2 Location Alternatives

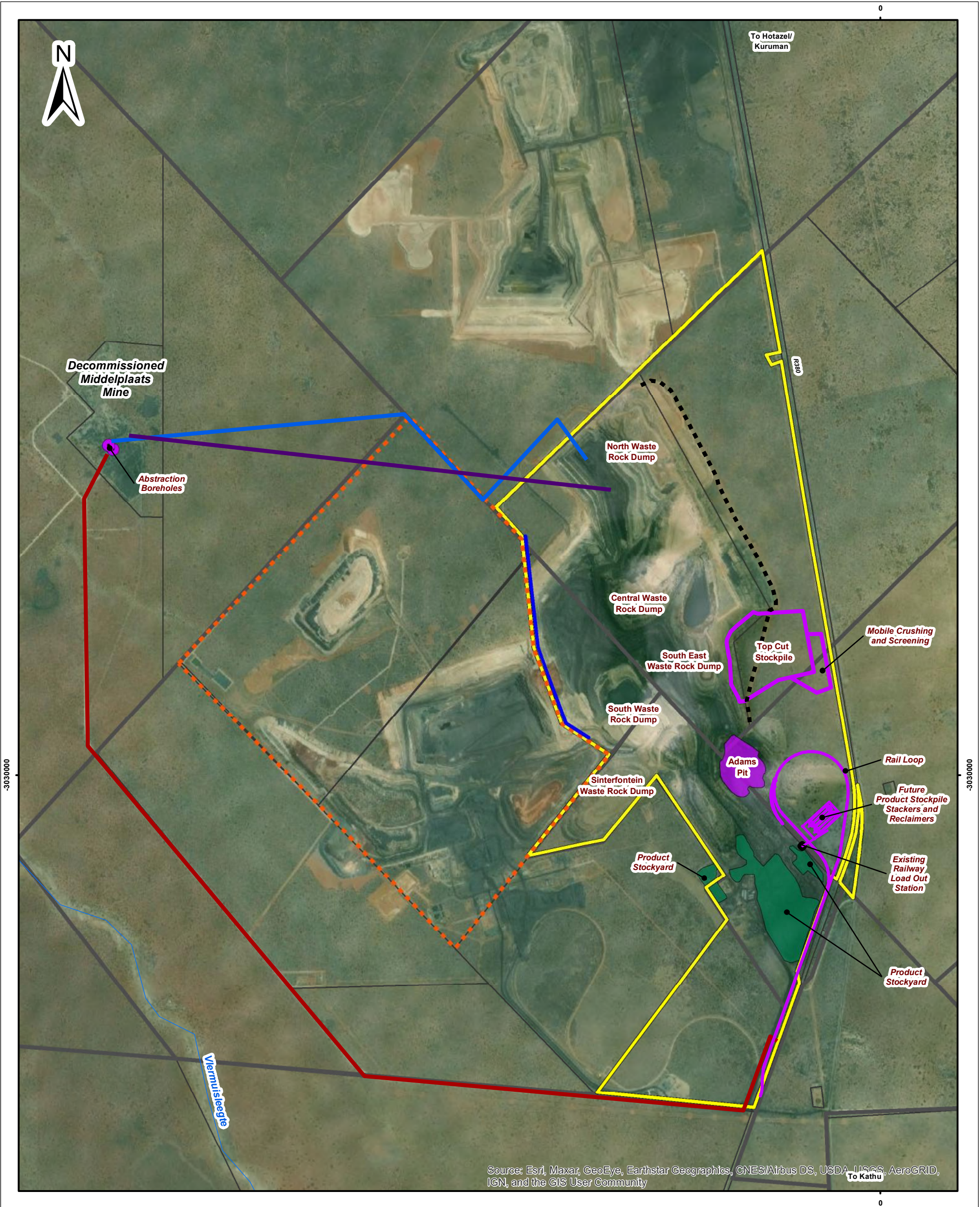
The activities applied for within this application are supporting facilities to the existing MMT. Therefore, the activities and infrastructure need to be located within the existing mine layout in order to best accommodate the current mining infrastructure, access roads and conducts. The alternatives for this project focus on the linear infrastructure. All of the activities that are being applied for will be carried out within the existing MR area and within the mine footprint.

The route for the water pipeline included three options. Figure 7-1 below provides the alignment of the alternatives and the preferred layout.

The alternatives were assessed to minimise watercourse and road crossings and disturbance of any other surface environmental sensitivities or infrastructure. For this reason, Option 3 was selected as this route is in alignment with, and within the reserve of, an existing access road. While option 3 is the longer route, it will generate a lesser impact to the receiving environment.

One alternative, in addition to the preferred alternative, was considered for the rail loop route. Figure 7-2 below provides the alignment of these alternatives. Option 1 required a longer loop which extended past both stockpiles to the east of Adams Pit. This alignment was then optimised to produce Option 1 which provides a smaller loop around only one stockpile and supports the existing railway LOS and includes future product stockpile stackers and reclaimers.





**Legend**

- Mamatwan Mining Right Area
- Layout Changes Already Taken Place
- Proposed Layout Changes
- Proposed Dewatering Boreholes
- Expansion of Existing Road
- Farm Boundaries
- Farm Portions
- Tshipi Mining Right Area
- Barrier Pillar

**Alternatives**

- Alternative Pipeline Route 1 - Preferred Route
- Alternative Pipeline Route 2
- Alternative Pipeline Route 3

0 300 600 Meters  
Scale: 1:30 000 @ A3  
Projection: Transverse Mercator  
Datum: WGS1984, Lo23

Mamatwan Mine

**Figure 7-1**  
**Alternative Routes for the Water Pipeline**

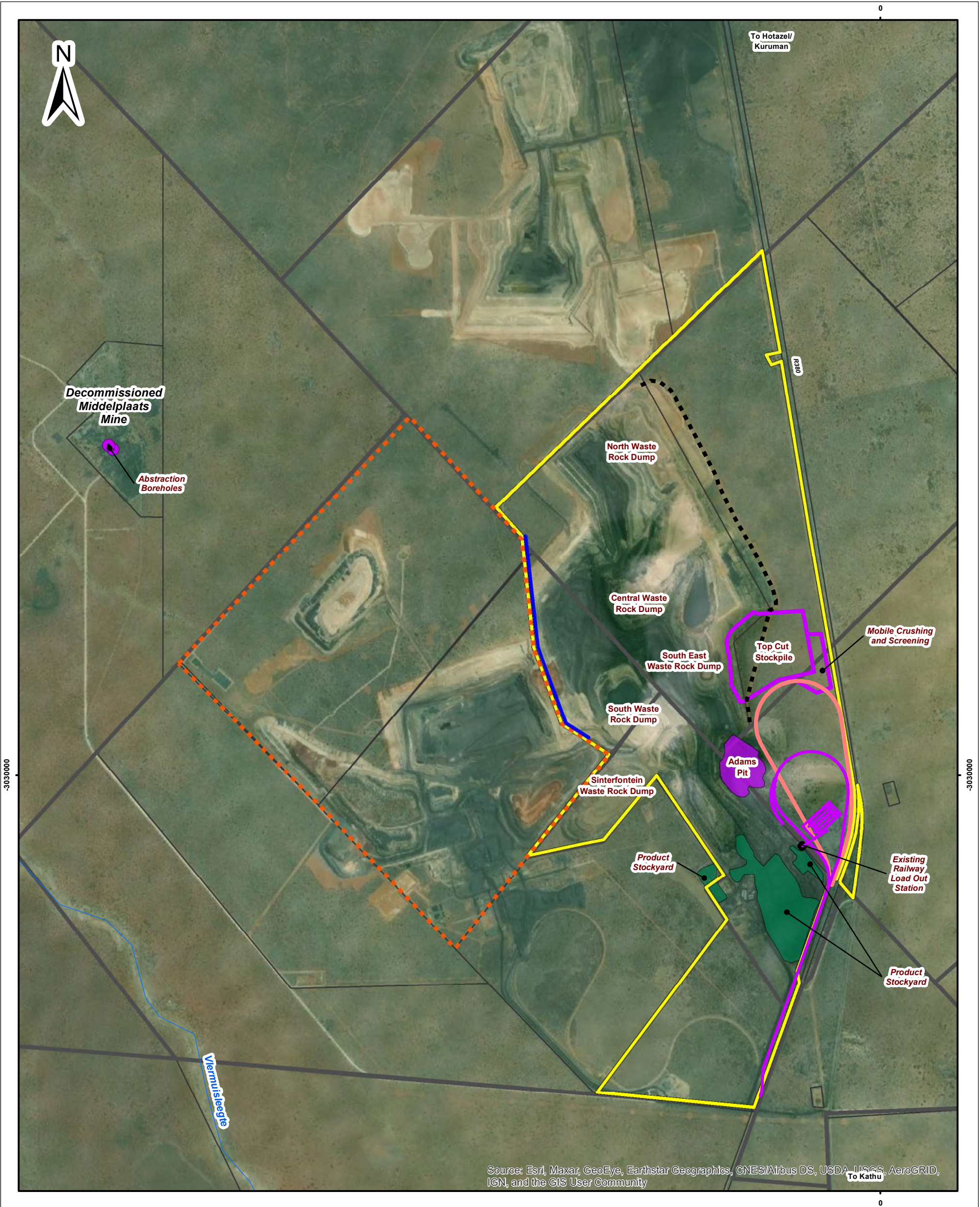


SLR Consulting (Africa) (Pty) Ltd  
P O Box 1596, Cramerville, 2060, South Africa  
Tel: +27 (11) 467-0945 Fax: +27 (11) 467-0978

710.20008.00072

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**Legend**

- Mamatwan Mining Right Area
- Layout Changes Already Taken Place
- Proposed Layout Changes
- Proposed Dewatering Boreholes
- Expansion of Existing Road
- Farm Boundaries
- Farm Portions
- Tshipi Mining Right Area
- Barrier Pillar

**Alternatives**

- Alternative Rail Loop Option 1
- Alternative Rail Loop Option 2 - Preferred

0 300 600 Meters  
Scale: 1:30 000 @ A3  
Projection: Transverse Mercator  
Datum: WGS1984, Lo23

Mamatwan Mine

**Figure 7-2**

**Alternative Alignment for the Railway Loop**



SLR Consulting (Africa) (Pty) Ltd  
P O Box 1596, Cramerville, 2060, South Africa  
Tel: +27 (11) 467-0945 Fax: +27 (11) 467-0978

710.20008.00072

2022/02/10



## 7.2 DETAILS OF THE PUBLIC PARTICIPATION PROCESS FOLLOWED

This section describes the public participation process undertaken in line with Chapter 6 of the EIA Regulations (GNR 982 of 2014), as amended. The aim of the public consultation process is to co-ordinate a process through which I&APs are informed of the proposed project and EIA process. I&APs broadly refers to landowners, land users, , surrounding landowners and land users, commenting authorities, the competent authority, surrounding mines, industries, parastatals and any other I&APs who may have interested in the project. I&APs are provided with an opportunity to provide input into the project plan, the assessment and proposed mitigation measures. An overview of the public participation process undertaken to date is outlined in the section below.

### 7.2.1 Scoping Phase Public Participation

Due to the COVID-19 Lockdown, the public participation process for the Scoping phase (in support of the proposed project) was put on hold on 27 March 2020. On 5 June 2020, the DFFE issued GN 650, which provided direction on how to proceed with licensing processes and public participation processes. In this regard, the following is noted in GN 650:

- Reports may not be made available at any public places or premises closed to the public; and
- Hard copies or electronic versions of reports may be made accessible through websites, zero-data portals, and provided at identified public places.

Taking the above into consideration, the planned public participation plan for the project was adjusted and submitted to the DMRE for consideration. The public participation plan was approved by the DMRE on 13 July 2020. The distribution of the Scoping Report, as outlined in Table 7-1, was aligned with the approved public participation plan.

**Table 7-1: Overview of the scoping phase public participation process**

| Task   |                                       | Description   |
|--|---------------------------------------|---|
| <b>Notification – I&amp;APs</b>                |                                       |   |
| <b>Public participation undertaken to date</b> | DMRE application                      | Submission of the application form to the DMRE via the SAMRAD system.   |
|  | Land claims commissioner consultation | The Land Claims Commissioner was consulted to verify if any land claims have been lodged on the farms within the MMT MR area and on the portion 4 of the farm Middelplaats 332. See Appendix C1 for a copy of the correspondence received from the Land Claims Commissioner in November 2019 and August 2020.   |
|  | A desktop social scan                 | A desktop social scan was undertaken as part of the EA process to verify details of the existing I&AP database for MMT. The desktop social scan therefore included the following: <ul style="list-style-type: none"> <li>• The verification of the relevant surrounding landowners, land occupiers, relevant ward councillor, municipalities, organs of state, commenting authorities and other I&amp;APs;</li> <li>• Verification of contact details for I&amp;APs on the existing database; and</li> <li>• Verification of appropriate communication structures.</li> </ul> A copy of the project database is included in Appendix C4. This database has been updated on an on-going basis throughout the EA process. |
| <b>Public participation</b>                    | BID                                   | A BID has been compiled by SLR and was distributed to I&APs and commenting authorities registered on the project database. The BID provided: <ul style="list-style-type: none"> <li>• Information about the proposed project and ED process;</li> <li>• Information about the baseline environment of the proposed project area;</li> <li>• Information pertaining to project alternatives that will be considered as part of the EA process;</li> </ul>  |



| Task                                      | Description  |
|---|--|
|   | <ul style="list-style-type: none"> <li>• Information regarding possible biophysical, heritage/cultural and social impacts associated with the proposed project activities;</li> <li>• Details pertaining to the public participation process; and</li> <li>• Information on how I&amp;APs can have input into the S&amp;EIA process.</li> </ul> <p>A registration and response form was attached to the BID, which provided I&amp;APs with an opportunity to submit comments on the proposed project. The BID was made available in English, Afrikaans and Setswana. A copy of the BID including the proof of distribution is included in Appendix C3.</p>   |
| Site notices                              | <p>SLR placed laminated A2 site notices (in English, Afrikaans and Setswana) at key conspicuous positions in and around MMT, the decommissioned Middelplaats Mine as well as nearby towns in March 2020.</p> <p>Given the time that passed since the initial I&amp;AP notifications, re-engagement site notices were placed at key conspicuous positions in and around the MMT, the decommissioned Middelplaats Mine as well as nearby towns in March 2021. Copies of the site notices, photographic proof and a map illustrating the location of the site notice placements (those placed in 2020 and 2021) are provided in Appendix C. Copies of the site notices, photographic proof and a map illustrating the location of the site notice placement are also provided in Appendix C2.</p>   |
| Newspaper advertisements                  | <p>Block advertisements were placed in two local newspapers. In this regard, advertisements were placed in the Kathu Gazette on 7 March 2020 and in the Kalahari Bulletin on 5 March 2020.</p> <p>Given the time that has past since the publication of the initial advertisements, re-engagement advertisements were published in the Kathu Gazette on 26 March 2021 and the Noordkaap Bulletin on 25 March 2021. See Appendix C2 for a copy of the advertisements placed in 2020 and 2021.</p>   |
| Public and commenting authorities meeting | <p>A public and commenting authorities meeting was held as part of the public participation process at the Hotazel Recreational Club on 12 March 2020. The purpose of the meeting was to provide:</p> <ul style="list-style-type: none"> <li>• Information about the proposed project;</li> <li>• Information about the baseline environment of the proposed project area;</li> <li>• Information about the environmental authorisation process;</li> <li>• Information pertaining to project alternatives that will be considered as part of the environmental authorisation process;</li> <li>• Information regarding possible biophysical, heritage/cultural and social impacts associated with the proposed project activities;</li> <li>• Details pertaining to the public participation process; and</li> <li>• Information on how I&amp;APs and commenting authorities can have input into the environmental assessment process.</li> </ul> <p>No I&amp;APs attended the meeting.</p> |

| Task  |   | Description  |
|---|---|--|
| Public participation process undertaken to date | Review of the Scoping Report                        | The Scoping Report was made available for public review for 30 calendar days. I&APs were notified when the Scoping Report was available for review via email and SMS notifications. Full copies of the Scoping Report were uploaded onto the SLR website and the SLR data-free website. The link to this website was distributed to all I&APs via email and SMS notifications.<br><br>A Non-Technical Summary of the Scoping Report, available in English, Afrikaans and Setswana, was also made available to all I&APs via email. A copy of the Non-Technical Summary is included in Appendix C3 together with the proof of distribution. |
|   | Submission of the Scoping Report to the DMRE        | The Scoping Report was updated to include any comments received by I&APs during the public review period. This updated Scoping Report was uploaded onto SAMRAD for DMRE decision-making purposes and subsequently approved on 27 <sup>th</sup> October 2021. Approval is provided in Appendix XXX,   |
|   | Notification of DMRE decision of the Scoping Report | All I&APs were notified via email and SMS notifications of the DMRE's decision of the Scoping Report. Once the Scoping Report was accepted, the EIA phase was initiated.   |

## 7.2.2 EIA Public Participation

### 7.2.2.1 Notification of I&APS

All registered I&APs included on the project database were involved in the EIA process of the project. Notifications were in the form of emails and bulk SMS notifications. The relevant I&APs identified for the project are listed below:

- Competent authority:
  - DMRE
- Commenting authorities:
  - DWS;
  - DENC;
  - SAHRA;
  - Department of Agriculture and Land Affairs ;
  - DFFE;
  - The Northern Cape DRDRL ;
  - Department of Public Works, Roads and Transport;
  - JTGDm;
  - JMLM; and
  - Ward councillor (Ward 4).
- Parastatals:
  - Telkom;
  - Transnet; and
  - Eskom.
- Non-government organisation

- Kalagadi Water User Forum.
- Others:
  - Landowners and land users; and
  - Surrounding mines and industries.

### 7.2.2.2 Details of the Public Participation Process followed for the EIA Phase

The table below outlines the details of the public participation process that will be followed during the EIA phase of the project. This process is aligned with the public participation plan approved by the DMRE.

**Table 7-2: Details of the public participation process followed during the EIA phase**

| Task   | Description  |
|--|--|
| <b>Review of the EIA and EMPR</b>            |  |
| I&APs review of the EIAR and EMPR            | The EIAR and EMPR was made available for public review for 30 calendar days. I&APs were notified that the EIA and EMPR was available for review via email and SMS notifications. Full copies of the EIA and EMPR were also uploaded onto the SLR website and data-free website. The link to this website was distributed to all I&APs via email and SMS notifications. |
| Submission of the EIAR and EMPR to the DMRE. | The EIAR and EMPR has been updated to include any comments received during the review of the report by I&APs. The updated reports will be uploaded onto SAMRAD for consideration by the DMRE.  |

Once a decision on the project has been received from the DMRE, this will be circulated to I&APs.

### 7.3 SUMMARY OF ISSUES RAISED BY I&APS

A summary of the issues and concerns raised by I&APs to date as part of the Scoping Phase public participation process are tabulated below.

**Table 7-3: Summary of issues raised by I&APs and commenting authorities during the scoping phase**

| Interested and affected party       | Date comment received                                 | Issues raised  | Response provided  | Section and paragraph reference in this report where the issues and or responses were incorporated |
|-------------------------------------|---|--|--|--|
| <b>Initial public participation</b> |   |  |  |  |
| <b>Other I&amp;APs</b>              |   |  |  |  |
| Khahliso Makale                     | Eskom, email correspondence received on 17 March 2020 | <p>This notice affects the existing Eskom Distribution's power lines, Adams/Umtu 1 132 kV Overhead Line, Adams/Umtu 1 132 kV Overhead Line, Umk/Milner 1 132 kV Overhead Line, Adams/Umtu 1 132 kV Overhead Line, Adams/Kalbas 1 132 kV Overhead Line, Riries/Dougnor 1 11 kV Overhead Line, Milner/Dougnor 1 132 kV Overhead Line, Dougnor Substation and Hotazel/Middelplaats 1 66 kV Overhead Line which traverses the proposed mining area. The approximate positions of these services are indicated on the attached locality Map.</p> <p>Eskom Distribution will raise no objection to the proposed Mining operations on the above mentioned properties provided Eskom's rights and services are acknowledged and respected at all times. Eskom's rights are protected by Wayleave Agreements and Servitudes. The approximate positions of these services are indicated on the attached.</p> <p>Further to the above the following conditions must be adhered to and accepted in writing before any development and or construction:</p> | <p>The numerous powerlines located to east of the MMT Mining Right boundary will not be influenced by the proposed project. The powerlines located near the decommissioned Middelplaats Mine which follow a portion of the D3457 to the South of the MMT will be in close proximity to the proposed dewatering pipeline from the decommissioned Middelplaats Mine to the MMT . South32 is aware of the requirements of Eskom, which will be adhered to prior to any construction related activities.</p> | <p>See Figure 4-1 for the location of the Eskom lines.</p> <p>Section 7.4.2– Land use baseline</p> |



| Interested and affected party | Date comment received | Issues raised   | Response provided | Section and paragraph reference in this report where the issues and or responses were incorporated |
|-------------------------------|-----------------------|---|-------------------|--|
|                               |                       | <p><b>A.1 Access and egress</b><br/>Eskom shall at all times retain unobstructed access to and egress from its servitudes and services.</p> <p><b>A.2 Approvals</b><br/>A.2.1 Eskom's consent doesn't relieve the applicant from obtaining the necessary statutory, landowner or municipal approvals.<br/>A.2.2 The applicant will adhere to all relevant environmental legislation. Any cost incurred by Eskom as a result of non-compliance will be charged to the applicant.</p> <p><b>A.3 Eskom Cables</b><br/>Eskom's underground cables affected must be placed in sleeves encased in concrete across the width of the servitude, at the applicant's expense. Materials to be used and relevant dimensions shall be determined as required.</p> <p><b>A.4 Dimensions</b><br/>No construction or excavation work shall be executed within 11 metres from any Eskom power line structure, and/or within 11 metres from any stay wire.</p> <p><b>A.5 Earthing</b><br/>All work within Eskom's servitude areas shall comply with the relevant Eskom standards in force at the time.</p> <p><b>A.6 Expenditure</b><br/>If Eskom has to incur any expenditure in order to comply with statutory clearances or other regulations as a result of the applicant's activities or because of the presence of his equipment or installation within the servitude or wayleave area, the applicant shall pay such costs to Eskom on demand.</p> |                   |  |

| Interested and affected party | Date comment received | Issues raised  | Response provided | Section and paragraph reference in this report where the issues and or responses were incorporated |
|-------------------------------|-----------------------|--|-------------------|--|
|                               |                       | <p><b>A.7 Ground level variations</b><br/>Changes in ground level may not infringe statutory ground to conductor clearances or statutory visibility clearances. After any changes in ground level, the surface shall be rehabilitated and stabilised so as to prevent erosion. The measures taken shall be to Eskom's requirements.</p> <p><b>A.8 Indemnity</b><br/>Eskom shall not be liable for the death of or injury to any person or for the loss of or damage to any property whether as a result of the encroachment or of the use of the servitude area by the applicant, his/her agent, contractors, employees, successors in title, and assigns. The applicant indemnifies Eskom against loss, claims or damages including claims pertaining to consequential damages by third parties and whether as a result of damage to or interruption of or interference with Eskom's services or apparatus or otherwise. Eskom will not be held responsible for damage to the applicant's equipment. The applicant's attention is drawn to the Electricity Act, 1987, (Act 41 of 1987, as amended in 1994), Section 27(3), which stipulates that the applicant can be fined and/or imprisoned as a result of damage to Eskom's apparatus.</p> <p><b>A.9 Machinery</b><br/>No mechanical equipment, including mechanical excavators or high lifting machinery, shall be used in the vicinity of Eskom's apparatus and/or services, without prior written permission having been granted by Eskom. If such permission is granted the applicant must give at least seven working days prior notice of the commencement of work The Eskom's authorised area representative for the Kathu CNC: Victor Andreas 053 723 6902/083 789 0770,</p> |                   |  |

| Interested and affected party | Date comment received | Issues raised  | Response provided | Section and paragraph reference in this report where the issues and or responses were incorporated |
|-------------------------------|-----------------------|--|-------------------|--|
|                               |                       | <p>email address: AndreVC@eskom.co.za. This allows time for arrangements to be made for supervision and/or precautionary instructions to be issued.</p> <p><b>A.10 Permission to do work</b></p> <p>A.10.1 No work shall commence unless Eskom has received the applicant's written acceptance of the conditions specified in the letter of consent and/or permit.</p> <p>A.10.2 Eskom's rights and duties in the servitude shall be accepted as having prior right at all times and shall not be obstructed or interfered with. Note: Where an electrical outage is required, at least fourteen workdays is required to arrange same.</p> <p>A.11 Remedial action Under no circumstances shall rubble, earth or other material be dumped within the servitude or Way Leave restriction area. The applicant shall maintain the area concerned to Eskom's satisfaction. The applicant shall be liable to Eskom for the cost of any remedial action which has to be carried out by Eskom.</p> <p><b>A.12 Safety</b></p> <p>A.12.1 The clearances between Eskom's live electrical equipment and the proposed construction work shall be observed as stipulated by Regulation 15 of the Electrical Machinery Regulations of the Occupational Health and Safety Act, 1993 (Act 85 of 1993).</p> <p>A.12.2 Equipment shall be regarded electrically live and therefore dangerous at all times.</p> <p>A. 12.3 In spite of the restrictions stipulated by Regulation 15 of the Electrical Machinery Regulations of the Occupational Health and Safety Act, 1993 (Act 85</p> |                   |  |

| Interested and affected party | Date comment received | Issues raised   | Response provided | Section and paragraph reference in this report where the issues and or responses were incorporated |
|-------------------------------|-----------------------|---|-------------------|--|
|                               |                       | <p>of 1993), as additional safety precaution, Eskom will not approve the erection of Houses, or structures occupied or frequented by human beings under the power lines and only after consideration of all alternatives, within the servitude area.</p> <p>A. 12.4 Eskom may stipulate any additional requirements to illuminate any possible exposure to Customers or Public to coming into contact or be exposed to any dangers of Eskom plant.</p> <p>A. 12.5 It is required of the applicant to familiarize him/herself with all safety hazards related to Electrical plant.</p> <p><b>B.1 Blasting, opencast mining and undermining</b></p> <p>B.1.1 A specific document of permission in respect of the blasting or mining activity as issued by the Inspector of Mines must be submitted to Eskom before commencement of operations. [refer to the Minerals Act, 1991 (Act 50 of 1991) Regulation 9.33.5 – Permission to fire more than one shot hole at a time within 500m from surface structures]</p> <p>B.1.2 Blasting in close proximity to Eskom’s overhead power lines or substations is prohibited unless the following precautions are met [refer to the Mine Health and Safety Act, 1996 (Act 29 of 1996) Regulation 17.6 (a) - 100m and above</p> <ul style="list-style-type: none"> <li>• a blasting plan submitted with the document of permission referred to in B.1.1 above,</li> <li>• a Peak Particle Velocity (PPV) to be kept below 75 mm/s, for lines and 50 mm/s for buildings,</li> </ul> |                   |  |



| Interested and affected party | Date comment received | Issues raised   | Response provided | Section and paragraph reference in this report where the issues and or responses were incorporated |
|-------------------------------|-----------------------|---|-------------------|--|
|                               |                       | <ul style="list-style-type: none"> <li>a seismic control device is set up to record the readings, ensure fly rock and air blast control by means of adequate matting, in the interest of air blast control, only single shot blasting shall be allowed.</li> <li>Permission for blasting will be strictly as stipulated in the Blasting Design by the Blasting Consultants and blasting should be done away from the power lines.</li> </ul> <p>B.1.3 The applicant will be held liable for damage to Eskom's towers or substation equipment, as a result of blasting activities.</p> <p>B.1.4 Costs incurred by Eskom to comply with statutory requirements in terms of an applicant's (or his contractors) works, equipment or plant in the servitude area, shall be paid to Eskom on demand.</p> <p>B.1.5 Eskom may charge the applicant appropriately for time on site during blasting operations.</p> <p>B.1.6 Eskom reserves the right to withdraw its consent if the blasting process becomes hazardous and likely to result in power interruptions.</p> <p>B.1.7 If and whenever the applicant applies and if permission for the blasting process is granted the applicant must give at least fourteen workdays prior notice of the commencement of blasting to The Eskom's authorised area representative for Kathu CNC: Victor Andreas 053 723 6902/083 789 0770, email address: AndreVC@eskom.co.za. This allows time for arrangements to be made for supervision of and/or precautionary instructions to be issued in terms of the blasting operation.</p> <p><b>B.1.8 General Conditions</b></p> |                   |  |

| Interested and affected party | Date comment received | Issues raised   | Response provided | Section and paragraph reference in this report where the issues and or responses were incorporated |
|-------------------------------|-----------------------|---|-------------------|--|
|                               |                       | <p>B.1.8.1 Firing near the power lines should be along a free face, facing away from the power lines, as the Mine has suggested.</p> <p>B.1.8.2 The Mine should prepare a proper analysis of the rock structure and any geological anomalies prior to blasting.</p> <p>B.1.8.3 The “safe distance of 25m” from Eskom pylons should be indicated on the blasting plan. Existing geological faults, decomposed zones and fractured rock structures could have destabilising effects on founding material as a result of the firing, especially when developing an open face next foundations and below founding level. These conditions should be considered when deciding on the method and plan of blasting near the Eskom power line pylons.</p> <p>B.1.8.4 Eskom retains the right to appoint any specialist at any time on behalf of the Mine, to inspect Eskom structures for deformation.</p> <p>B.1.8.5 The mining depth near Eskom pylons should carefully be controlled for stability and adjustments being made when so instructed by Eskom.</p> <p>B.1.8.6 Upon receiving the letter of consent from the inspector of the mine to blast below 100m, the applicant must present to Eskom Technical Evaluation Forum L3 the blasting philosophy for final approval.</p> <p>Should the applicant or his contractor damage any of Eskom services during commencement of any work whatsoever, then Eskom’s 24 hour Contact Centre Tel: 08600 37566 must be dialled immediately to report the incident.</p> <p>Any relocation of Eskom’s services, due to this undermining, will be for the account of the Applicant. The Applicant will also be responsible for granting</p> |                   |  |

| Interested and affected party                                    | Date comment received                             | Issues raised  | Response provided  | Section and paragraph reference in this report where the issues and or responses were incorporated              |
|--|---|--|--|---|
|  |   | Eskom an alternative route for the power line. The Eskom Customer Contact Centre at 08600 37566 must be contacted in connection with any line deviation and costs.   |  |   |
| <b>Comments received during the review of the Scoping Report</b> |   |  |  |   |
| <b>SAHRA - Commenting authority</b>                              |   |  |  |   |
| Natasha Higgitt  | 23 April 2021 – Interim comments (Case ID: 16265) | <p>SLR Consulting has been appointed by Hotazel Manganese Mines (Pty) Ltd to conduct an Environmental Authorisation (EA) Amendment Application for proposed changes to the infrastructure layout and activities at the Mamatwan Mine, near Hotazel, Northern Cape Province (NC-00198-MR/102).</p> <p>A draft Scoping Report (DSR) has been submitted in terms of the National Environmental Management Act, 1998 (NEMA) and the 2017 EIA Regulations for activities that trigger the Mineral and Petroleum Resources Development Act, 2002 (MPRDA)(As amended). The proposed change in layout and activities includes the following: establishment of top-cut stockpile and associated mobile crushing and screening plant, establishment of stormwater management infrastructure, establishment of pipelines, and upgrading the railway and railway loadout station.</p> <p>The DSR notes that a Heritage and Palaeontological Study will be compiled for the project as part of the EIA phase.</p> | A Heritage/cultural and Palaeontological Studies were compiled for the project. These are included in Appendix O and Appendix P. The findings of these studies are outlined in Section 7.4.1.12. | Section 7.4.1.12– baseline environment Appendix O (Heritage Study) Appendix P (Palaeontological desktop review) |

| Interested and affected party | Date comment received | Issues raised  | Response provided  | Section and paragraph reference in this report where the issues and or responses were incorporated |
|-------------------------------|-----------------------|--|--|--|
|                               |                       | <p>The SAHRA Archaeology, Palaeontology and Meteorites (APM) Unit notes the pending Heritage Impact Assessment and Palaeontological Impact Assessment. The HIA must comply with section 38(3) of the National Heritage Resources Act, Act 25 of 1999 (NHRA).</p> <p>The archaeological component of the HIA must comply with the 2007 Minimum Standards: Archaeological and Palaeontological Components for Impact Assessments. Additionally, as the proposed development application area is located in an area of moderate sensitivity for palaeontological resources as per the SAHRIS Palaeo Sensitivity map, a desktop Palaeontological Impact Assessment (PIA) must be required to be undertaken by a qualified palaeontologist.</p> <p>(See <a href="https://www.palaeosa.org/heritage-practitioners.html">https://www.palaeosa.org/heritage-practitioners.html</a> for a list of qualified palaeontologists). The report must comply with the 2012 Minimum Standards: Palaeontological Components of Heritage Impact Assessments.</p> <p>Further comments will be issued upon receipt of the above requested reports and the Draft EIA documents. Should you have any further queries, please contact the designated official using the case number quoted above in the case header.</p> |  |  |
| <b>Other I&amp;APs</b>        |                       |  |  |  |
| Judy Behr                     | Allmar Engineering,   | Our company would like to enquire more information regarding the published advertisement in the Noordkaap Bulletin 25 March 2021. We are an active vendor on Mamatwan mine. Proposed Layouts – Establishment of pipeline to  | Vendor related aspects have been submitted to South32 for consideration. | Not applicable   |



| Interested and affected party | Date comment received   | Issues raised   | Response provided   | Section and paragraph reference in this report where the issues and or responses were incorporated |
|-------------------------------|---|---|---|--|
|                               | email received on 25 March 2021   | transfer water from the decommissioned Middelplaats Mine to MMT. Would you be so kind as to let us know the way forward regarding the above mentioned?  |   |  |
| Moses                         | I&AP, email received on 03 May 2021   | I hereby request to register as an interested party in Mamatwan new expansion and other related developments. Feel free to update me with any developments which are taking place in Mamatwan, especially from an environmental point of view in the mine.  | The stakeholder database for the project was updated to include this I&AP. It follows that this I&AP was involved in the environmental assessment process.  | Appendix C– Stakeholder Database   |
| BB Andrews                    | Harambee Social Justice, powered by Allen and Ovary Project 03 May 2021, received via email | <p>Thank you for the opportunity to comment on changes to the infrastructure layout and activities at the Mamatwan mine. We are The Harambee Social Justice Project.</p> <p>We would like to bring to the agency's attention to alternative options that are highly relevant for the decision-making process regarding the proposed activity changes for the Mamatwan Mine (MMT) with specific reference to the re-processing of material located in Adams Pit. The alternative option proposed suggest that the actual socio-economic impact of the regulatory actions will empower social justice and socio-economic upliftment in local communities. This resource would develop BBEEE suppliers to the mine, provide additional educational and training opportunities and go a long way to addressing some of the Mine's Social and Labour plan commitments.</p> <p>Please consider what this proposed alternative approach implies regarding the effectiveness of this project in achieving its stated purpose.</p> | <p>Material within Adams pit will be re-processed. The re-processing of material within Adams pit forms part of rehabilitation activities, which is in line with the mine's commitments. The removal of materials from Adams pit for re-processing should also reduce the risk to groundwater contamination, as a potential contamination source will be removed.</p> <p>The re-processing of the material within Adams pit is considered the preferred method of management.</p> | Section 7  |

| Interested and affected party | Date comment received | Issues raised  | Response provided   | Section and paragraph reference in this report where the issues and or responses were incorporated |
|-------------------------------|-----------------------|--|---|--|
|                               |                       | <p>We are grateful for the opportunity to review the subject documentation. As an interested and/or affected party (I&amp;AP) we would like to be informed about the proposed project and have input into the IRP processes and reports. We also welcome the opportunity to provide input at the public meeting and to review and comment on any further reports. As such, we offer the following comments for consideration and incorporation in the IRP.</p> <p><b>Reprocessing of material located in</b></p> <p>Mamatwan Mine (MMT) is making an application to the DMRE for an integrated Environmental Authorisation and to update of the mine's EMPR to address a number of proposed layout and activity changes. Within this list of activity changes is the proposed re-processing of material located in.</p> <p>We understand the DMRE to have issued HMM with a Notice of Intention (September 2019) specifying that the storage of sinter de-dust bags in Adams Pit could not continue. We acknowledge that the re-processing of the material located in Adams Pit is the only feasible operational option given that identifying a new storage area is constrained by existing infrastructure and activities at the mine and would require the disturbance of additional undisturbed areas. We note that MMT did not consider any alternative options for the re-processing of the material in Adams Pit which would provide for industrialisation, supplier development or community impact projects.</p> | <p>It should be noted that the re-processing of material within Adams pit is not the only project component that could provide procurement opportunities. The establishment of the top cut stockpile, the establishment of stormwater management infrastructure, establishing dewatering infrastructure from Middelplaats and upgrading the existing railway line all present procurement opportunities. This has been identified as a potential positive socio-economic impact for the proposed project (refer to Appendix D).</p> |  |

| Interested and affected party | Date comment received | Issues raised  | Response provided | Section and paragraph reference in this report where the issues and or responses were incorporated |
|-------------------------------|-----------------------|--|-------------------|--|
|                               |                       | <p>We would like to bring to the agency's attention alternative options for the re-processing of the material located in Adams for the implementation of community benefit projects.</p> <p><b>Project Social Impact</b></p> <p>We believe that mining entities play a significant role in improving the socio-economic conditions of the communities in which they operate. However, there is often a disconnect between the good intentions of the social and labour plans and the poor socio-economic development levels that exist in the mining communities. In this respect we would like to echo Minister Gwede Mantashe's remarks in that while <i>"... there is a noticeable improvement in the levels of compliance. However, overall transformation of the mining industry remains unacceptably low;</i></p> <ul style="list-style-type: none"> <li><i>- The spirit of the Mining Charter was not fully embraced, and compliance was generally thought of as means to protect "the "social license to operate";</i></li> <li><i>- The majority of mining communities continue to live in abject poverty despite the State, being the custodian of the Country's mineral wealth on behalf of the nation."</i></li> </ul> <p>As a result, every opportunity should be made to establish real partnerships between the mining companies and the surrounding communities.</p> <p>We understand that while the project will support and enable continuation of current operations of the MMT, which will in turn sustain economic and social</p> |                   |  |

| Interested and affected party | Date comment received                            | Issues raised  | Response provided  | Section and paragraph reference in this report where the issues and or responses were incorporated |
|-------------------------------|--|--|--|--|
|                               |  | <p>development, we wish to enhance the transformative socio-economic benefits of the MMT project by addressing:</p> <ol style="list-style-type: none"> <li>1. Skills Development</li> <li>2. Local Procurement</li> <li>3. Supplier Development</li> <li>4. Enterprise Development</li> <li>5. Social Economic Development</li> </ol> <p>At the local level, the host community is increasingly resistant to project development because they feel the costs of mining activities on their livelihoods and environment are higher than the benefits they derive from those activities. In addition to receiving direct revenues and employment, there is increasing demand to access procurement opportunities.</p> <p>Core to Harambee approach is their belief that the Minerals Industry can play a leading role in advancing government development outcomes by supporting strategic solutions from the private sector regarding resource recovery and social impact management.</p> |  |  |
| Natasha Higgit                | 20 January 2022 (CaseID: 16265) – Final comments | <p>Hotazel Manganese Mines (Pty) Ltd (HMM), a subsidiary of South32, is the holder of a Mining Right (MR) (Ref No.: NC 256 MR) for the Mamatwan Mine (MMT). The MMT is bordered to the West by the Tshipi Borwa Mine, and to the North by the United Manganese of Kalahari (UMK) Mine. The mine is operated by South32 and is located 25 km to the south of the town Hotazel, in the John Taolo Gaetsewe District Municipality and Joe</p>   | The EMPr developed for the mine makes provision for a chance find procedure. As part of the environmental process, both the interim and final comments from SAHRA have been incorporated as part | Refer to Section 28.   |



| Interested and affected party | Date comment received | Issues raised   | Response provided  | Section and paragraph reference in this report where the issues and or responses were incorporated |
|-------------------------------|-----------------------|---|--|--|
|                               |                       | <p>Morolong Local Municipality in the Northern Cape Province.SLR Consulting has been appointed by Hotazel Manganese Mines (Pty) Ltd to conduct an Environmental Authorisation (EA) Amendment Application for proposed changes to the infrastructure layout and activities at the Mamatwan Mine, near Hotazel, Northern Cape Province (NC-00198-MR/102).</p> <p>A draft Scoping Report (DSR) has been submitted in terms of the National Environmental Management Act, 1998 (NEMA) and the 2017 EIA Regulations for activities that trigger the Mineral and Petroleum Resources Development Act, 2002 (MPRDA)(As amended). The proposed change in layout and activities includes thefollowing: establishment of top-cut stockpile and associated mobile crushing and screening plant, establishment of stormwater management infrastructure, establishment of pipelines, and upgrading the railway and railway loadout station. The DSR notes that a Heritage and Palaeontological Study will be compiled for the project as part of the EIA phase.</p> <p>In an Interim Comment issued on the 23/04/2021 (<a href="https://sahris.sahra.org.za/node/570238">https://sahris.sahra.org.za/node/570238</a>), SAHRA noted the pending Heritage Impact Assessment and Palaeontological Impact Assessment. Since the issuing of the Interim Comment, the HIA and PIA have been submitted to the case along with the Final EIA (09/12/2021).</p> | <p>of this document. SAHRA will be informed of the final submission of the EIA and EMPr to the DMRE and proof thereof will be uploaded onto SAHRIS. In addition to this, SAHRIS will be notified when a decision has been made by the department and a copy of the authorisation will be uploaded onto SAHRIS.</p> |  |

| Interested and affected party | Date comment received | Issues raised   | Response provided | Section and paragraph reference in this report where the issues and or responses were incorporated |
|-------------------------------|-----------------------|---|-------------------|--|
|                               |                       | <p>Butler, E. 2020. Palaeontological Exemption Report of the Mamatwan Mine – Changes to Infrastructure Layout and Activities, near Hotazel, Northern Cape Province.</p> <p>The proposed development is underlain at depth by the Griqualand West Basin Rocks which are overlain by the Cenozoic Kalahari Group. Stromatolites may be present in the Griqualand West Basin Rocks, while poorly preserved fossils may be present in the Kalahari Group sands. No recommendations were provided.</p> <p>Fourie, W. 2021. Heritage Impact Assessment: Mamatwan Mine – Changes to Infrastructure Layout and Activities, near Hotazel, Northern Cape Province. No heritage resources were identified within the proposed development footprint area. A Chance Finds Procedure is recommended to be implemented.</p> <p>The following comments are made as a requirement in terms of section 3(4) of the NEMA Regulations and section 38(8) of the NHRA in the format provided in section 38(4) of the NHRA and must be included in the Final EMPr:</p> <p>38(4)a – The SAHRA Archaeology, Palaeontology and Meteorites (APM) Unit has no objections to the proposed development;</p> <p>38(4)b – The recommendations of the specialists are supported and must be adhered to. No further additional specific conditions are provided for the development;</p> <p>38(4)c(i) – If any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich</p> |                   |  |

| Interested and affected party | Date comment received | Issues raised   | Response provided | Section and paragraph reference in this report where the issues and or responses were incorporated |
|-------------------------------|-----------------------|---|-------------------|--|
|                               |                       | <p>eggshell fragments, charcoal and ash concentrations), fossils or other categories of heritage resources are found during the proposed development, SAHRA APM Unit (Natasha Higgitt/Phillip Hine 021 462 5402) must be alerted as per section 35(3) of the NHRA. Non-compliance with section of the NHRA is an offense in terms of section 51(1)e of the NHRA and item 5 of the Schedule;</p> <p>38(4)c(ii) – If unmarked human burials are uncovered, the SAHRA Burial Grounds and Graves (BGG) Unit (Thingahangwi Tshivhase/Ngqalabutho Madida 012 320 8490), must be alerted immediately as per section 36(6) of the NHRA. Non-compliance with section of the NHRA is an offense in terms of section 51(1)e of the NHRA and item 5 of the Schedule;</p> <p>38(4)d – See section 51(1) of the NHRA regarding offences;</p> <p>38(4)e – The following conditions apply with regards to the appointment of specialists:</p> <p>i) If heritage resources are uncovered during the course of the development, a professional archaeologist or palaeontologist, depending on the nature of the finds, must be contracted as soon as possible to inspect the heritage resource. If the newly discovered heritage resources prove to be of archaeological or palaeontological significance, a Phase 2 rescue operation may be required subject to permits issued by SAHRA.</p> <p>As the Final EIA has been finalised without including SAHRA comments, this comment must be forwarded directly to the competent authority for their</p> |                   |  |

| Interested and affected party | Date comment received | Issues raised   | Response provided | Section and paragraph reference in this report where the issues and or responses were incorporated |
|-------------------------------|-----------------------|---|-------------------|--|
|                               |                       | <p>consideration during the decision-making process. Proof of delivery and receipt thereof must be provided.</p> <p>The Final EMPr must be submitted to SAHRA for record purposes. The decision regarding the EA Application must be communicated to SAHRA and uploaded to the SAHRIS Case application.</p> |                   |  |



## 7.4 ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE SITE AND PROJECT ALTERNATIVES

### 7.4.1 Baseline environment affected by the proposed project

The baseline information provided in the following section is aimed at giving the reader perspective of the biophysical, cultural/heritage and socio-economic context and sensitivity prior to the commencement of the project activities. This is important in understanding the potential impacts of the project. This section provides a description of these attributes in the receiving environment of the proposed project footprint and the project alternatives.

The information provided within this section is based on the specialist reports compiled for this project. Each section will reference the applicable specialist report.

#### 7.4.1.1 Geology

##### Introduction

Geology and associated structural features provide a basis from which to understand:

- The potential for sterilisation of mineral reserves;
- The geochemistry and related potential for the pollution of water from mineralised waste facilities and stockpiles (tailings dam and waste rock dumps); and
- The potential for geological lineaments such as faults and dykes. Faults, dykes and other lineaments can act as preferential flow paths of groundwater, which can influence both the dispersion of potential pollution plumes and the inflow of water into mine workings.

##### Data sources

The information in this section was sourced from the Waste Assessment and Geochemical Characterisation Report (SLR, 2020) and the Geohydrological report for MMT (GHT, 2018).

##### Description

###### Regional geology

The MMT is located on the southwestern outer rim of the Kalahari Manganese Field (KMF). The general stratigraphic column of the KMF is presented in the table below.

**Table 7-4: Geological description**

| Supergroup / Group / Subgroup / Formation |                   |  | Geological Description                        |
|---|-------------------|--|---|
| Kalahari Group                            |                   |  | Kalahari sands, calcrete, clays & gravel beds |
| <i>Kalahari unconformity</i>              |                   |  |   |
| Karoo Supergroup                          |                   |  | Dwyka tillite                                 |
| <i>Dwyka unconformity</i>                 |                   |  |   |
| Olifantshoek Supergroup                   | Lucknow Formation |  | White ortho-quartzite                         |

|                                  |                    |                    |                     |   |
|----------------------------------|--------------------|--------------------|---------------------|---|
|                                  |                    |                    | Mapedi Formation    | Green, maroon and black shales and quartzites |
| <i>Olifantshoek unconformity</i> |                    |                    |                     |   |
| Transvaal Supergroup             | Postmansburg Group | Voelwater Subgroup | Mooidraai Formation | Dolomite, Chert                               |
|                                  |                    |                    | Hotazel Formation   | Banded ironstone (upper)                      |
|                                  |                    |                    |                     | Upper Manganese Ore Body                      |
|                                  |                    |                    |                     | Banded Ironstone (middle)                     |
|                                  |                    |                    |                     | Middle Manganese Ore Body                     |
|                                  |                    |                    |                     | Banded Ironstone (middle)                     |
|                                  |                    |                    |                     | Lower Manganese Ore Body                      |
|                                  |                    |                    |                     | Banded Ironstone (lower)                      |
|                                  |                    |                    | Ongeluk Formation   | Andesitic Lava                                |

Three beds of manganese ore are interbedded with the Banded Iron Formation (BIF) of the Hotazel Formation (Transvaal Supergroup). The BIF of the Hotazel Formation typically consists of repeated thin layers of black iron oxides (magnetite or hematite) alternating with bands of iron-poor shales and cherts.

#### *Local and operational geology*

MMT mines the manganese ore from the Hotazel Formation (within the Transvaal Supergroup), which is underlain by basaltic lava of the Ongeluk Formation (Transvaal Supergroup) and directly overlain by dolomite of the Mooidraai Formation (Transvaal Supergroup). The Transvaal Supergroup is overlain unconformably by the Olifantshoek Supergroup which consists of arenaceous sediments, typically interbedded shale, quartzite and lavas overlain by coarser quartzite and shale. The different formations present in the project area include the Mapedi and Lucknow units. The whole Supergroup has been deformed into a succession with an east-verging dip.

The Olifantshoek Supergroup is overlain by Dwyka Formation which forms the basal part of the Karoo Supergroup. At the mine, this consists of tillite (diamictite) which is covered by sands, claystone and calcrete of the Kalahari Group.

According to the GHT report (2018) the Hotazel formation is structurally confined within the Dimoten Syncline, a north-westerly plunging basin containing more than 80% of global land-based manganese reserves within an area of approximately 525 km<sup>2</sup>. It is this basin that defines the extent of the KMF.

The Hotazel Formation includes a Banded Iron Formation (BIF). The ore is contained within a 30 to 40-meter-thick mineralised zone which occurs along the entire area and is made up of three manganese-rich zones:

- Upper Manganese Ore Body (UMO);
- Middle Manganese Ore Body (MMO); and
- Lower Manganese Ore Body (LMO).

The UMO is 10cm to 15cm thick and comprises moderate deposits of manganese. The poorly mineralised MMO is approximately 1m thick and not economically efficient. The LMO is a highly mineralised unit consisting of six important mineralised zones (X, Y, Z, M, C and N).

According to the GHT report (2018), the manganese ore dips in a south to south-westerly direction at approximately six degrees, has a lower grade at MMT, and is characterised by laminated, carbonate bearing, braunite rich mudstone. Exposed ore is typically massive in character, with minor vertical fracturing and bedding parting observed.

#### *Faults and dykes*

The GHT report (2018) reports a sill on the Smartt-Rissik prospect adjacent to the MMT. The full extent of this sill is apparently unknown at this stage and would require further exploration drilling, however GHT notes that this sill is known to also sub-crop, presumably continuously and with relative constant thickness, on the MMT and Middelplaats mine properties. According to the GHT report (2018), sill material appears to have similar characteristics to the older Ongeluk Formation, although it can sometimes be distinguished on the basis of colour, feldspar shape, and the apparent absence of augite. When drilled using rotary air percussion equipment, the sill was generally found to be resistant to drilling, and in most instances, fresh throughout. Observed core obtained from diamond drilling was typically un-fractured, with those rare fractures typically filled with secondary minerals.

The GHT report (2018) reports a second sill during mining at the Hotazel Pit further to the north and was easily distinguished from adjacent sub-crops of sub-vertical to vertical dykes and Ongeluk Lavas due to its fibrous appearance, a consequence of the predominance of plagioclase lathes.

Various intrusive structures are close to and around MMT. These include doleritic dykes. It is expected that vertical displacement of the Hotazel Formation and the sill that intrudes it has occurred along the trend of many of these structures. It is further noted that many of the permeable voids that developed in response to faulting would have been filled during a later magmatic phase (GHT, 2018).

#### *Geochemistry analysis – Acid base accounting (ABA)*

Acid Base Accounting (ABA) is an internationally accepted analytical procedure that screens the acid-producing and acid-neutralizing potential of a sample. Net Acid Generation (NAG) tests directly determine the acid generating potential of sulphur minerals in a rock sample. The final NAG pH after complete oxidation of the sample is used as a screening criterion for the acid generation potential.

The acid base accounting results are shown in Table 7-5. Due to the low sulphide and high neutralisation potential all the samples are classified as non-PAG. The total sulphur concentration in the sinter de-dust material (MMT-AP01) is above the 0.3% threshold. The sulphur that is found is in sulphate form and does not pose a risk of acid production.

**Table 7-5: Acid Base Accounting (SLR, 2020)**

| Lab ID       | Sample ID | Description                           | S<br>(sulphate) | Paste<br>pH | Total<br>Sulphur | S<br>(Sulphide) | Acid<br>Potential<br>(AP)  | Neutralisation<br>Potential (NP) | Nett<br>Neutralisation<br>Potential<br>(NNP) | Neutralising<br>Potential<br>Ratio (NPR)<br>(NP : AP) | Total<br>Carbon | Organic<br>Carbon | Inorganic<br>Carbon |
|--------------|-----------|---------------------------------------|-----------------|-------------|------------------|-----------------|----------------------------|----------------------------------|--|---|-----------------|-------------------|---------------------|
| Non-PAG      |           |                                       |                 | >5.5        | <0.3             | <0.3            | -                          | -                                | >20  | >4  |                 |                   |                     |
| Inconclusive |           |                                       |                 | 3.5-<br>5.5 | -                | -               | -                          | -                                | -20 to 20                                    | 1-4   |                 |                   |                     |
| PAG          |           |                                       |                 | <3.5        | >0.3             | >0.3            | -                          | -                                | <-20   | <1  |                 |                   |                     |
| Unit         |           |                                       | %               | %           | %                | %               | kg<br>CaCO <sub>3</sub> /t | kg CaCO <sub>3</sub> /t          | kg CaCO <sub>3</sub> /t                      | NP:AP   | %               | %                 | %                   |
| PRODUCT      |           |                                       |                 |             |                  |                 |                            |                                  |  |   |                 |                   |                     |
| 656445       | MMT-06    | Top Cut                               | 0.011           | nd          | 0.0135           | 0.001           | 0.422                      | nd                               | nd   | nd  | 6.19            | 0.0767            | 6.11                |
| 656446       | MMT-07    | MMT Lumpy stockpile (M1L1)            | 0.007           | nd          | 0.0114           | 0.002           | 0.356                      | nd                               | nd   | nd  | 4.68            | 0.0655            | 4.61                |
| 656447       | MMT-08    | MMT High grade Sinter Stockpile (MHS) | 0.011           | nd          | 0.0138           | 0.002           | 0.431                      | nd                               | nd   | nd  | 0.0357          | 0.0338            | 0.0019              |
| 656448       | MMT-09    | MMT Standard Sinter Stockpile (MSS)   | 0.033           | nd          | 0.0394           | 0.001           | 1.231                      | nd                               | nd   | nd  | 0.23            | 0.0508            | 0.18                |
| ADAM'S PIT   |           |                                       |                 |             |                  |                 |                            |                                  |  |   |                 |                   |                     |
| 656440       | MMT-AP01  | Adam's Pit - Sinter de-dust           | 0.761           | 12.37       | 0.779            | 0.006           | 24.34                      | 335                              | 311  | 13.8  | 3.5             | 2.2245            | 1.28                |
| 656440 QC    | MMT-AP01  | Adam's Pit - Sinter de-dust           | 0.757           | 12.36       | 0.77             | 0.006           | 24.06                      | 337                              | 312  | 14.0  | 3.5             | 2.3745            | 1.13                |
| 656441       | MMT-AP02  | Adam's Pit - DMS grit                 | 0.006           | 9.28        | 0.00885          | 0.002           | 0.277                      | 396                              | 396  | 1433  | 4.51            | 0.1605            | 4.35                |
| 656442       | MMT-AP03  | Adam's Pit – Tailings (M2FT)          | 0.004           | 8.61        | 0.007            | 0.001           | 0.219                      | 484                              | 484  | 2213  | 5.6             | 0.1355            | 5.46                |
| 656443       | MMT-AP04  | Adam's Pit - Slimes                   | 0.107           | 8.66        | 0.114            | 0.002           | 3.56                       | 136                              | 132  | 38  | 4.74            | 0.1395            | 4.60                |
| WASTE ROCK   |           |                                       |                 |             |                  |                 |                            |                                  |  |   |                 |                   |                     |
| 656449       | MMT-WR01  | Core Yard - Calcrete-top line         | 0.013           | 9.06        | 0.015            | <0.001          | 0.469                      | 384                              | 384  | 820   | 4.61            | 0.1055            | 4.50                |
| 656450       | MMT-WR02  | Core Yard - Calcrete-middle line      | 0.008           | 8.44        | 0.01             | <0.001          | 0.313                      | 408                              | 408  | 1305  | 4.92            | 0.0985            | 4.82                |
| 656450 QC    | MMT-WR02  | Core Yard - Calcrete-middle line      | nd              | 8.47        | 0.01             | nd              | 0.313                      | 406                              | 406  | 1300  | nd              | nd                | nd                  |
| 656451       | MMT-WR03  | Core Yard - Calcrete-bottom line      | 0.009           | 8.62        | 0.012            | 0.002           | 0.375                      | 575                              | 574  | 1533  | 6.91            | 0.0915            | 6.82                |
| 656452       | MMT-WR04  | Core Yard - Pebble bed                | 0.006           | 8.35        | 0.011            | 0.003           | 0.344                      | 149                              | 149  | 435   | 1.77            | 0.1135            | 1.66                |
| 656444       | MMT-WR05  | Core Yard - Clay                      | 0.009           | 8.09        | 0.013            | 0.002           | 0.406                      | 214                              | 213  | 526   | 2.56            | 0.2075            | 2.35                |
| 656454       | MMT-WR06  | Core Yard - Clay transition           | 0.004           | 8.42        | 0.005            | 0.001           | 0.156                      | 401                              | 401  | 2569  | 4.81            | 0.0985            | 4.71                |
| 656454 QC    | MMT-WR06  | Core Yard - Clay transition           | 0.004           | nd          | nd               | nd              | nd                         | nd                               | nd   | nd  | 4.82            | 0.1075            | 4.71                |
| 656455       | MMT-WR07  | Core Yard - BIF1                      | 0.004           | 8.8         | 0.008            | 0.003           | 0.250                      | 386                              | 386  | 1546  | 4.68            | 0.081             | 4.60                |
| 656456       | MMT-WR08  | Core Yard - BIF2                      | 0.01            | 8.85        | 0.019            | 0.008           | 0.594                      | 230                              | 229  | 387   | 2.63            | 0.1245            | 2.51                |
| 656457       | MMT-WR09  | Core Yard - BIF3                      | 0.005           | 8.25        | 0.007            | 0.001           | 0.219                      | 437                              | 437  | 1997  | 5.23            | 0.0806            | 5.15                |
| 666416       | MMT-WR10  | Composite WR                          | 0.006           | 8.59        | 0.0132           | 0.001           | 0.413                      | 362                              | 361  | 877   | 4.98            | 0.242             | 4.74                |
| 666416 QC    | MMT-WR10  | Composite WR                          | 0.006           | nd          | nd               | nd              | nd                         | nd                               | nd   | nd  | 4.98            | 0.205             | 4.78                |



### Geochemistry analysis – Leachate

Synthetic Precipitation Leaching Procedure (SPLP) leach tests are a laboratory extraction method designed to provide an indication of the metals and salt that could be leached from the waste products. The procedure makes an assessment where rainfall is the only external factor influencing leachate generation. The pH value of the extraction value can be altered to allow the evaluation of the leachate quality under potential acid rock (pH 3) or neutral (pH 7) conditions. Leach test results are not a direct indicator of drainage quality as the conditions of the test, especially the liquid-to-solid ratio, do not represent actual field conditions. Therefore, leachate concentrations are not representative of seepage or run-off that could emanate from site.

The findings of the leachate tests undertaken as part of the project indicate (SLR, 2020):

- Barium exceeded the SANS 241 (2015) Chronic Health and WHO Standard for Drinking Water (2017) guideline in sample MMT-09;
- pH exceeded the SANS 241 (2015) Operational and IFC Mining Effluent (2007) guidelines. Sample MMT-09 exceeded both SANS 241 (2015) Operational and IFC Mining Effluent (2007) guidelines and sample MMT-AP02 exceeded only the IFC Mining Effluent (2007) guideline;
- Total suspended solids (TSS) exceeded the IFC Mining Effluent (2007) in samples MMT-06, MMT-07, MMT-08 and MMT-09; and
- The main CoCs identified in the product samples were Ba, pH and TSS in the MMT standard sinter stockpile (MSS) and pH in the DMS grit located in Adam's Pit.
- The concentrations in the Adam's Pit waste samples exceeded the following screening guidelines for the assessed constituents:
- Boron exceeded the SANS 241 (2015) Chronic Health and WHO Standard for Drinking Water (2017) guidelines in sample MMT-AP01;
- pH exceeded the SANS 241 (2015) Operational and IFC Mining Effluent (2007) guidelines in sample MMT-AP01;
- Total dissolved solids (TDS) exceeded the SANS 241 (2015) Aesthetic guideline in sample MMT-AP01;
- Electrical conductivity (EC) exceeded the SANS 241 (2015) Aesthetic guideline in sample MMT-AP01;
- Sulphate (SO<sub>4</sub>) exceeded the SANS 241 (2015) Acute Health guideline in sample in MMT-AP01; and
- The main CoCs identified in the Adam's Pit waste samples were B, pH, TDS, EC, Cl and SO<sub>4</sub> in the sinter de-dust. No leachable CoCs were identified in the MMT floats/discard or tailings samples.

The waste rock samples concentrations exceeded the following screening guidelines for the assessed constituents:

- Aluminium exceeded the SANS 241 (2015) Operational guideline in sample MMT-WR02;
- Barium SANS 241 (2015) Chronic Health and WHO Standard for Drinking Water (2017) guidelines in sample MMT-WR01;
- Iron exceeded the SANS 241 (2015) Aesthetic guideline in sample MMT-WR02;
- pH exceeded the SANS 241 (2015) Operational and IFC Mining Effluent (2007) guidelines. Sample MMT-WR01 exceeded both SANS 241 (2015) Operational and IFC Mining Effluent (2007) guidelines and sample MMT-WR01 exceeded only the IFC Mining Effluent (2007) guideline;
- TSS exceeded the IFC Mining Effluent (2007) guideline in samples MMT-WR01 and MMT-WR06; and

- In summary, CoCs were identified in three (3) waste rock lithologies, Ba, pH and TSS in calcrete-top line (MT-WR01), Al, Fe, pH and TSS in calcrete-middle line (MMT-WR02) and TSS in the clay transition lithology (MMT-WR06).

**Table 7-6: Leachate results (SLR, 2020)**

| Lab ID                                 | Sample ID | Description                                | Ag     | Al    | As     | Au     | B     | Ba    | Be     | Bi     | Ca   | Cd      | Ce     | Co     | Cr     | Cs     | Cu     | Fe    | Ga     | Ge     | Hf     | Hg      | Ho     | Ir     | K    |  |
|--|-----------|--|--------|-------|--------|--------|-------|-------|--------|--------|------|---------|--------|--------|--------|--------|--------|-------|--------|--------|--------|---------|--------|--------|------|--|
| Unit                                   |           |  | mg/l   | mg/l  | mg/l   | mg/l   | mg/l  | mg/l  | mg/l   | mg/l   | mg/l | mg/l    | mg/l   | mg/l   | mg/l   | mg/l   | mg/l   | mg/l  | mg/l   | mg/l   | mg/l   | mg/l    | mg/l   | mg/l   | mg/l |  |
| SANS 241 (2015) Operational            |           |  | N/A    | 0.3   | N/A    | N/A    | N/A   | N/A   | N/A    | N/A    | N/A  | N/A     | N/A    | N/A    | N/A    | N/A    | N/A    | N/A   | N/A    | N/A    | N/A    | N/A     | N/A    | N/A    | N/A  |  |
| SANS 241 (2015) Aesthetic              |           |  | N/A    | N/A   | N/A    | N/A    | N/A   | N/A   | N/A    | N/A    | N/A  | N/A     | N/A    | N/A    | N/A    | N/A    | N/A    | 0.3   | N/A    | N/A    | N/A    | N/A     | N/A    | N/A    | N/A  |  |
| SANS 241 (2015) Acute Health           |           |  | N/A    | N/A   | N/A    | N/A    | N/A   | N/A   | N/A    | N/A    | N/A  | N/A     | N/A    | N/A    | N/A    | N/A    | N/A    | N/A   | N/A    | N/A    | N/A    | N/A     | N/A    | N/A    | N/A  |  |
| SANS 241 (2015) Chronic Health         |           |  | N/A    | N/A   | 0.01   | N/A    | 2.4   | 0.7   | N/A    | N/A    | N/A  | 0.003   | N/A    | N/A    | 0.1    | N/A    | 2.0    | 2.0   | N/A    | N/A    | N/A    | 0.006   | N/A    | N/A    | N/A  |  |
| WHO Standard for Drinking Water (2017) |           |  | N/A    | N/A   | 0.01   | N/A    | 2.4   | 0.7   | N/A    | N/A    | N/A  | 0.003   | N/A    | N/A    | 0.1    | N/A    | 2.0    | N/A   | N/A    | N/A    | N/A    | 0.006   | N/A    | N/A    | N/A  |  |
| IFC Mining Effluent (2007)             |           |  | N/A    | N/A   | 0.1    | N/A    | N/A   | N/A   | N/A    | N/A    | N/A  | 0.05    | N/A    | N/A    | N/A    | N/A    | 0.3    | 2.0   | N/A    | N/A    | N/A    | 0.002   | N/A    | N/A    | N/A  |  |
| PRODUCT                                |           |  |        |       |        |        |       |       |        |        |      |         |        |        |        |        |        |       |        |        |        |         |        |        |      |  |
| 658,090                                | MMT-06    | Top Cut                                    | <0.001 | 0.024 | 0.002  | <0.001 | 0.053 | 0.192 | <0.001 | <0.001 | 7.72 | <0.0001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.022 | <0.001 | <0.001 | <0.001 | 0.0005  | <0.001 | <0.001 | 2.48 |  |
| 658,091                                | MMT-07    | Mamatwan Lumpy stockpile (M1L1)            | <0.001 | 0.023 | <0.001 | <0.001 | 0.060 | 0.115 | <0.001 | <0.001 | 10.5 | <0.0001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.001  | 0.004 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.001 | <0.001 | 0.32 |  |
| 658,092                                | MMT-08    | Mamatwan High grade Sinter Stockpile (MHS) | <0.001 | 0.019 | <0.001 | <0.001 | 0.052 | 0.424 | <0.001 | <0.001 | 9.49 | <0.0001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.003 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.001 | <0.001 | 0.36 |  |
| 658,093                                | MMT-09    | Mamatwan Standard Sinter Stockpile (MSS)   | <0.001 | 0.038 | 0.003  | <0.001 | 1.333 | 0.904 | <0.001 | <0.001 | 92.6 | <0.0001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.007 | <0.001 | <0.001 | <0.001 | 0.0001  | <0.001 | <0.001 | 0.46 |  |
| ADAM'S PIT                             |           |  |        |       |        |        |       |       |        |        |      |         |        |        |        |        |        |       |        |        |        |         |        |        |      |  |
| 658,086                                | MMT-AP01  | Adams pit - Sinter de-dust                 | <0.001 | 0.054 | <0.001 | <0.001 | 3.853 | 0.216 | <0.001 | <0.001 | 577  | <0.0001 | <0.001 | 0.001  | 0.007  | <0.001 | 0.001  | 0.004 | <0.001 | <0.001 | <0.001 | 0.0002  | <0.001 | <0.001 | 11.9 |  |
| 658086 QC                              | MMT-AP01  | Adams pit - Sinter de-dust                 | <0.001 | 0.054 | <0.001 | <0.001 | 3.824 | 0.221 | <0.001 | <0.001 | 575  | <0.0001 | <0.001 | 0.001  | 0.007  | <0.001 | <0.001 | 0.009 | <0.001 | <0.001 | <0.001 | 0.0002  | <0.001 | <0.001 | 11.8 |  |
| 658,087                                | MMT-AP02  | Adams pit - DMS grit                       | <0.001 | 0.035 | <0.001 | <0.001 | 0.090 | 0.121 | <0.001 | <0.001 | 8.23 | <0.0001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.005 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.001 | <0.001 | 0.26 |  |
| 658,088                                | MMT-AP03  | Adams pit - Tailings (M2FT)                | <0.001 | 0.025 | <0.001 | <0.001 | 0.104 | 0.040 | <0.001 | <0.001 | 10.4 | <0.0001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.002 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.001 | <0.001 | 0.40 |  |
| 658,089                                | MMT-AP04  | Slimes                                     | <0.001 | 0.015 | <0.001 | <0.001 | 0.193 | 0.348 | <0.001 | <0.001 | 11.4 | <0.0001 | <0.001 | <0.001 | 0.002  | <0.001 | <0.001 | 0.002 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.001 | <0.001 | 0.38 |  |
| WASTE ROCK                             |           |  |        |       |        |        |       |       |        |        |      |         |        |        |        |        |        |       |        |        |        |         |        |        |      |  |
| 658,094                                | MMT-WR01  | Core Yard - Calcrete-top line              | <0.001 | 0.033 | 0.001  | <0.001 | 1.466 | 1.563 | <0.001 | <0.001 | 120  | <0.0001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.004 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.001 | <0.001 | 1.02 |  |
| 658,095                                | MMT-WR02  | Core Yard - Calcrete-middle line           | <0.001 | 0.625 | 0.001  | <0.001 | 0.058 | 0.188 | <0.001 | <0.001 | 8.42 | <0.0001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.001  | 0.541 | <0.001 | <0.001 | <0.001 | 0.0007  | <0.001 | <0.001 | 1.72 |  |
| 658,096                                | MMT-WR03  | Core Yard - Calcrete-bottom line           | <0.001 | 0.026 | 0.001  | <0.001 | 0.029 | 0.074 | <0.001 | <0.001 | 7.91 | <0.0001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.024 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.001 | <0.001 | 1.55 |  |
| 658096 QC                              | MMT-WR03  | Core Yard - Calcrete-bottom line           | <0.001 | 0.028 | 0.001  | <0.001 | 0.027 | 0.074 | <0.001 | <0.001 | 8.00 | <0.0001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.023 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.001 | <0.001 | 1.51 |  |
| 658,097                                | MMT-WR04  | Core Yard - Pebble bed                     | <0.001 | 0.007 | <0.001 | <0.001 | 0.022 | 0.059 | <0.001 | <0.001 | 7.64 | <0.0001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.004 | <0.001 | <0.001 | <0.001 | 0.0002  | <0.001 | <0.001 | 1.03 |  |
| 658,098                                | MMT-WR05  | Core Yard - Clay                           | <0.001 | 0.016 | 0.002  | <0.001 | 0.021 | 0.056 | <0.001 | <0.001 | 6.79 | <0.0001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.008 | <0.001 | <0.001 | <0.001 | 0.0001  | <0.001 | <0.001 | 1.48 |  |
| 658,099                                | MMT-WR06  | Core Yard - Clay transition                | <0.001 | 0.008 | 0.001  | <0.001 | 0.028 | 0.066 | <0.001 | <0.001 | 7.11 | <0.0001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.005 | <0.001 | <0.001 | <0.001 | 0.0001  | <0.001 | <0.001 | 0.90 |  |
| 658,100                                | MMT-WR07  | Core Yard - BIF1                           | <0.001 | 0.020 | 0.001  | <0.001 | 0.022 | 0.230 | <0.001 | <0.001 | 7.28 | <0.0001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.002 | <0.001 | <0.001 | <0.001 | 0.0001  | <0.001 | <0.001 | 0.54 |  |
| 658,101                                | MMT-WR08  | Core Yard - BIF2                           | <0.001 | 0.029 | <0.001 | <0.001 | 0.035 | 0.051 | <0.001 | <0.001 | 7.54 | <0.0001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.007 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.001 | <0.001 | 0.31 |  |
| 658,102                                | MMT-WR09  | Core Yard - BIF3                           | <0.001 | 0.007 | <0.001 | <0.001 | 0.022 | 0.034 | <0.001 | <0.001 | 7.30 | <0.0001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.003 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.001 | <0.001 | 1.03 |  |
| 666417                                 | MMT-WR10  | Composite WR                               | <0.001 | 0.014 | 0.001  | <0.001 | 0.041 | 0.193 | <0.001 | <0.001 | 8.93 | <0.0001 | <0.001 | <0.001 | 0.001  | <0.001 | 0.005  | 0.024 | <0.001 | <0.001 | <0.001 | 0.0001  | <0.001 | <0.001 | 1.19 |  |
| 666417 QC                              | MMT-WR10  | Composite WR                               | <0.001 | 0.014 | <0.001 | <0.001 | 0.039 | 0.194 | <0.001 | <0.001 | 8.80 | <0.0001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.004  | 0.026 | <0.001 | <0.001 | <0.001 | 0.0001  | <0.001 | <0.001 | 1.17 |  |

| Lab ID                                 | Sample ID | Description                                | La     | Li     | Mg   | Mn     | Mo     | Na   | Nb     | Nd     | Ni     | Pb     | Pt     | Rb     | Sb     | Sc     | Se     | Si   | Sn     | Sr    | Ta     | Te     | Th      | Ti     | Tl     |
|--|-----------|--|--------|--------|------|--------|--------|------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|--------|-------|--------|--------|---------|--------|--------|
| Unit                                   |           |  | mg/l   | mg/l   | mg/l | mg/l   | mg/l   | mg/l | mg/l   | mg/l   | mg/l   | mg/l   | mg/l   | mg/l   | mg/l   | mg/l   | mg/l   | mg/l | mg/l   | mg/l  | mg/l   | mg/l   | mg/l    | mg/l   | mg/l   |
| SANS 241 (2015) Operational            |           |  | N/A    | N/A    | N/A  | N/A    | N/A    | N/A  | N/A    | N/A    | N/A    | N/A    | N/A    | N/A    | N/A    | N/A    | N/A    | N/A  | N/A    | N/A   | N/A    | N/A    | N/A     | N/A    | N/A    |
| SANS 241 (2015) Aesthetic              |           |  | N/A    | N/A    | N/A  | 0.1    | N/A    | 200  | N/A    | N/A    | N/A    | N/A    | N/A    | N/A    | N/A    | N/A    | N/A    | N/A  | N/A    | N/A   | N/A    | N/A    | N/A     | N/A    | N/A    |
| SANS 241 (2015) Acute Health           |           |  | N/A    | N/A    | N/A  | N/A    | N/A    | N/A  | N/A    | N/A    | N/A    | N/A    | N/A    | N/A    | N/A    | N/A    | N/A    | N/A  | N/A    | N/A   | N/A    | N/A    | N/A     | N/A    | N/A    |
| SANS 241 (2015) Chronic Health         |           |  | N/A    | N/A    | N/A  | 0.4    | N/A    | N/A  | N/A    | N/A    | 0.07   | 0.01   | N/A    | N/A    | 0.02   | N/A    | 0.04   | N/A  | N/A    | N/A   | N/A    | N/A    | N/A     | N/A    | N/A    |
| WHO Standard for Drinking Water (2017) |           |  | N/A    | N/A    | N/A  | N/A    | N/A    | N/A  | N/A    | N/A    | 0.07   | 0.01   | N/A    | N/A    | 0.02   | N/A    | 0.04   | N/A  | N/A    | N/A   | N/A    | N/A    | N/A     | N/A    | N/A    |
| IFC Mining Effluent (2007)             |           |  | N/A    | N/A    | N/A  | N/A    | N/A    | N/A  | N/A    | N/A    | 0.5    | 0.2    | N/A    | N/A    | N/A    | N/A    | N/A    | N/A  | N/A    | N/A   | N/A    | N/A    | N/A     | N/A    | N/A    |
| PRODUCT                                |           |  |        |        |      |        |        |      |        |        |        |        |        |        |        |        |        |      |        |       |        |        |         |        |        |
| 658,090                                | MMT-06    | Top Cut                                    | <0.001 | 0.001  | 4.70 | 0.002  | <0.001 | 6.82 | <0.001 | <0.001 | 0.001  | 0.003  | <0.001 | <0.001 | <0.001 | 0.002  | <0.001 | 2.65 | <0.001 | 0.031 | <0.001 | <0.001 | <0.0001 | 0.001  | <0.001 |
| 658,091                                | MMT-07    | Mamatwan Lumpy stockpile (M1L1)            | <0.001 | 0.001  | 3.66 | 0.005  | <0.001 | 1.55 | <0.001 | <0.001 | <0.001 | 0.003  | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 1.39 | <0.001 | 0.042 | <0.001 | <0.001 | <0.0001 | <0.001 | <0.001 |
| 658,092                                | MMT-08    | Mamatwan High grade Sinter Stockpile (MHS) | <0.001 | <0.001 | 4.98 | <0.001 | <0.001 | 1.33 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.97 | <0.001 | 0.038 | <0.001 | <0.001 | <0.0001 | <0.001 | <0.001 |
| 658,093                                | MMT-09    | Mamatwan Standard Sinter Stockpile (MSS)   | <0.001 | <0.001 | 0.14 | <0.001 | <0.001 | 1.06 | <0.001 | <0.001 | 0.003  | <0.001 | <0.001 | <0.001 | <0.001 | 0.005  | <0.001 | 27.5 | <0.001 | 0.137 | <0.001 | <0.001 | <0.0001 | 0.003  | <0.001 |
| ADAM'S PIT                             |           |  |        |        |      |        |        |      |        |        |        |        |        |        |        |        |        |      |        |       |        |        |         |        |        |
| 658,086                                | MMT-AP01  | Adams pit - Sinter de-dust                 | <0.001 | 0.002  | 0.05 | 0.002  | 0.007  | 5.23 | <0.001 | <0.001 | 0.020  | 0.006  | <0.001 | 0.029  | <0.001 | <0.001 | 0.001  | 1.52 | <0.001 | 1.192 | <0.001 | <0.001 | <0.0001 | 0.005  | <0.001 |
| 658086 QC                              | MMT-AP01  | Adams pit - Sinter de-dust                 | <0.001 | 0.001  | 0.05 | 0.001  | 0.007  | 5.28 | <0.001 | <0.001 | 0.020  | 0.006  | <0.001 | 0.028  | <0.001 | <0.001 | 0.001  | 1.54 | <0.001 | 1.125 | <0.001 | <0.001 | <0.0001 | 0.004  | <0.001 |
| 658,087                                | MMT-AP02  | Adams pit - DMS grit                       | <0.001 | <0.001 | 2.80 | <0.001 | <0.001 | 1.12 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 1.56 | <0.001 | 0.022 | <0.001 | <0.001 | <0.0001 | <0.001 | <0.001 |
| 658,088                                | MMT-AP03  | Adams pit - Tailings (M2FT)                | <0.001 | <0.001 | 4.14 | <0.001 | <0.001 | 1.40 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 1.78 | <0.001 | 0.015 | <0.001 | <0.001 | <0.0001 | <0.001 | <0.001 |
| 658,089                                | MMT-AP04  | Slimes                                     | <0.001 | <0.001 | 6.71 | 0.009  | 0.004  | 2.68 | <0.001 | <0.001 | 0.001  | 0.001  | <0.001 | <0.001 | <0.001 | <0.001 | 0.001  | 2.22 | <0.001 | 0.045 | <0.001 | <0.001 | <0.0001 | <0.001 | <0.001 |
| WASTE RICK                             |           |  |        |        |      |        |        |      |        |        |        |        |        |        |        |        |        |      |        |       |        |        |         |        |        |
| 658,094                                | MMT-WR01  | Core Yard - Calcrete-top line              | <0.001 | <0.001 | 0.12 | <0.001 | <0.001 | 1.35 | <0.001 | <0.001 | 0.004  | <0.001 | <0.001 | 0.002  | <0.001 | 0.003  | <0.001 | 17.2 | <0.001 | 0.201 | <0.001 | <0.001 | <0.0001 | 0.002  | <0.001 |
| 658,095                                | MMT-WR02  | Core Yard - Calcrete-middle line           | <0.001 | <0.001 | 5.00 | 0.005  | <0.001 | 2.55 | <0.001 | <0.001 | <0.001 | 0.001  | <0.001 | <0.001 | <0.001 | 0.003  | <0.001 | 1.6  | <0.001 | 0.035 | <0.001 | <0.001 | <0.0001 | 0.003  | <0.001 |
| 658,096                                | MMT-WR03  | Core Yard - Calcrete-bottom line           | <0.001 | <0.001 | 4.18 | <0.001 | <0.001 | 5.04 | <0.001 | <0.001 | 0.001  | <0.001 | <0.001 | <0.001 | <0.001 | 0.002  | <0.001 | 1.0  | <0.001 | 0.026 | <0.001 | <0.001 | <0.0001 | 0.002  | <0.001 |
| 658096 QC                              | MMT-WR03  | Core Yard - Calcrete-bottom line           | <0.001 | <0.001 | 4.16 | <0.001 | <0.001 | 4.96 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.002  | <0.001 | 1.8  | <0.001 | 0.026 | <0.001 | <0.001 | <0.0001 | 0.002  | <0.001 |
| 658,097                                | MMT-WR04  | Core Yard - Pebble bed                     | <0.001 | <0.001 | 4.31 | <0.001 | <0.001 | 2.85 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.002  | 0.002  | 1.9  | <0.001 | 0.025 | <0.001 | <0.001 | <0.0001 | <0.001 | <0.001 |
| 658,098                                | MMT-WR05  | Core Yard - Clay                           | <0.001 | <0.001 | 3.57 | <0.001 | <0.001 | 3.77 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.001  | <0.001 | 1.50 | <0.001 | 0.023 | <0.001 | <0.001 | <0.0001 | <0.001 | <0.001 |
| 658,099                                | MMT-WR06  | Core Yard - Clay transition                | <0.001 | <0.001 | 4.25 | <0.001 | 0.001  | 3.49 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.001  | 1.22 | <0.001 | 0.023 | <0.001 | <0.001 | <0.0001 | <0.001 | <0.001 |
| 658,100                                | MMT-WR07  | Core Yard - BIF1                           | <0.001 | <0.001 | 2.87 | 0.005  | <0.001 | 2.50 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 2.05 | <0.001 | 0.055 | <0.001 | <0.001 | <0.0001 | <0.001 | <0.001 |
| 658,101                                | MMT-WR08  | Core Yard - BIF2                           | <0.001 | <0.001 | 3.12 | 0.004  | <0.001 | 1.78 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.005  | 2.54 | <0.001 | 0.034 | <0.001 | <0.001 | <0.0001 | <0.001 | <0.001 |
| 658,102                                | MMT-WR09  | Core Yard - BIF3                           | <0.001 | <0.001 | 4.82 | <0.001 | 0.002  | 3.66 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 3.02 | <0.001 | 0.011 | <0.001 | <0.001 | <0.0001 | <0.001 | <0.001 |
| 666417                                 | MMT-WR10  | Composite WR                               | <0.001 | <0.001 | 4.29 | <0.001 | <0.001 | 7.09 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.001  | <0.001 | 0.003  | 0.001  | 1.61 | <0.001 | 0.045 | <0.001 | <0.001 | <0.0001 | 0.003  | <0.001 |
| 666417 QC                              | MMT-WR10  | Composite WR                               | <0.001 | <0.001 | 4.23 | <0.001 | <0.001 | 6.60 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.003  | 0.001  | 1.47 | <0.001 | 0.043 | <0.001 | <0.001 | <0.0001 | 0.003  | <0.001 |



| Lab ID                                 | Sample ID | Description                                | U       | V      | W      | Y      | Zn     | Zr     | pH      | pH Temp | TDS  | EC   | TDS by Sum | TDS by EC | P Alk.        | M Alk.        | F    | Cl    | NO <sub>2</sub> | NO <sub>3</sub> | NO <sub>3</sub> as N | SO <sub>4</sub> | CN (Total) | Cr <sup>6+</sup> | TSS  |     |
|--|-----------|--|---------|--------|--------|--------|--------|--------|---------|---------|------|------|------------|-----------|---------------|---------------|------|-------|-----------------|-----------------|----------------------|-----------------|------------|------------------|------|-----|
| Unit                                   |           |  | mg/l    | mg/l   | mg/l   | mg/l   | mg/l   | mg/l   | -       | Deg C   | mg/l | mS/m | mg/l       | mg/l      | mg/l<br>CaCO3 | mg/l<br>CaCO3 | mg/l | mg/l  | mg/l            | mg/l            | mg/l                 | mg/l            | mg/l       | mg/l             | mg/l |     |
| SANS 241 (2015) Operational            |           |  | N/A     | N/A    | N/A    | N/A    | N/A    | N/A    | 5 - 9.7 | N/A     | N/A  | N/A  | N/A        | N/A       | N/A           | N/A           | N/A  | N/A   | N/A             | N/A             | N/A                  | N/A             | N/A        | N/A              | N/A  | N/A |
| SANS 241 (2015) Aesthetic              |           |  | N/A     | N/A    | N/A    | N/A    | 5.0    | N/A    | N/A     | N/A     | 1200 | 170  | N/A        | N/A       | N/A           | N/A           | N/A  | 300   | N/A             | N/A             | N/A                  | 250             | N/A        | N/A              | N/A  |     |
| SANS 241 (2015) Acute Health           |           |  | N/A     | N/A    | N/A    | N/A    | N/A    | N/A    | N/A     | N/A     | N/A  | N/A  | N/A        | N/A       | N/A           | N/A           | N/A  | N/A   | 0.9             | N/A             | 11                   | 500             | N/A        | N/A              | N/A  |     |
| SANS 241 (2015) Chronic Health         |           |  | 0.03    | N/A    | N/A    | N/A    | N/A    | N/A    | N/A     | N/A     | N/A  | N/A  | N/A        | N/A       | N/A           | N/A           | N/A  | 1.5   | N/A             | N/A             | N/A                  | N/A             | N/A        | N/A              | N/A  |     |
| WHO Standard for Drinking Water (2017) |           |  | 0.03    | N/A    | N/A    | N/A    | N/A    | N/A    | N/A     | N/A     | N/A  | N/A  | N/A        | N/A       | N/A           | N/A           | N/A  | 1.5   | 5               | N/A             | N/A                  | 50              | N/A        | N/A              | N/A  |     |
| IFC Mining Effluent (2007)             |           |  | N/A     | N/A    | N/A    | N/A    | 0.5    | N/A    | 6 - 9   | N/A     | N/A  | N/A  | N/A        | N/A       | N/A           | N/A           | N/A  | N/A   | N/A             | N/A             | N/A                  | N/A             | 1.0        | 0.1              | 50   |     |
| PRODUCT                                |           |  |         |        |        |        |        |        |         |         |      |      |            |           |               |               |      |       |                 |                 |                      |                 |            |                  |      |     |
| 658,090                                | MMT-06    | Top Cut                                    | <0.0001 | 0.027  | 0.012  | <0.001 | 0.013  | <0.001 | 8.46    | 23.0    | 60.0 | 10.6 | 63.6       | 73.9      | 2.70          | 37.8          | 0.11 | 3.25  | <0.2            | 4.42            | 1.00                 | 3.83            | <0.01      | <0.05            | 179  |     |
| 658,091                                | MMT-07    | Mamatwan Lumpy stockpile (M1L1)            | <0.0001 | <0.001 | <0.001 | <0.001 | 0.014  | <0.001 | 8.71    | 23.0    | 50.0 | 8.53 | 49.5       | 59.7      | 3.90          | 40.0          | <0.1 | 0.67  | <0.2            | 1.07            | 0.24                 | 3.64            | <0.01      | <0.05            | 48.0 |     |
| 658,092                                | MMT-08    | Mamatwan High grade Sinter Stockpile (MHS) | <0.0001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 8.86    | 23.2    | 48.0 | 9.24 | 48.4       | 64.7      | 4.60          | 38.8          | <0.1 | 0.62  | <0.2            | 1.35            | 0.30                 | 3.80            | <0.01      | <0.05            | 149  |     |
| 658,093                                | MMT-09    | Mamatwan Standard Sinter Stockpile (MSS)   | <0.0001 | 0.004  | 0.003  | <0.001 | 0.003  | <0.001 | 11.42   | 23.2    | 270  | 47.5 | 303        | 332       | 177           | 214           | 0.11 | 0.66  | <0.2            | 0.63            | 0.14                 | 1.17            | <0.01      | <0.05            | 15.0 |     |
| ADAMS PIT WASTE                        |           |  |         |        |        |        |        |        |         |         |      |      |            |           |               |               |      |       |                 |                 |                      |                 |            |                  |      |     |
| 658,086                                | MMT-AP01  | Adams pit - Sinter de-dust                 | <0.0001 | <0.001 | 0.004  | <0.001 | 0.010  | <0.001 | 12.18   | 22.5    | 1530 | 243  | 1641       | 1699      | 788           | 817           | 0.29 | 10.94 | <0.2            | 1.37            | 0.31                 | 534             | <0.01      | <0.05            | 24.0 |     |
| 658086 QC                              | MMT-AP01  | Adams pit - Sinter de-dust                 | <0.0001 | <0.001 | 0.004  | <0.001 | 0.011  | <0.001 | 12.18   | 22.7    | 1538 | 241  | 1646       | 1688      | 788           | 820           | 0.28 | 10.88 | <0.2            | 1.35            | 0.30                 | 540             | <0.01      | <0.05            | 24.0 |     |
| 658,087                                | MMT-AP02  | Adams pit - DMS grit                       | <0.0001 | <0.001 | <0.001 | <0.001 | 0.005  | <0.001 | 9.22    | 22.8    | 24.0 | 6.07 | 39.2       | 42.5      | 6.10          | 28.6          | <0.1 | 0.73  | <0.2            | 1.65            | 0.37                 | 2.71            | <0.01      | <0.05            | 78.5 |     |
| 658,088                                | MMT-AP03  | Adams pit - Tailings (M2FT)                | <0.0001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 8.80    | 22.9    | 46.0 | 7.95 | 51.4       | 55.7      | 4.40          | 40.6          | <0.1 | 0.91  | <0.2            | 1.77            | 0.40                 | 2.91            | <0.01      | <0.05            | 14.5 |     |
| 658,089                                | MMT-AP04  | Slimes                                     | <0.0001 | <0.001 | <0.001 | <0.001 | 0.006  | <0.001 | 8.78    | 23.0    | 62.0 | 12.4 | 70.9       | 86.7      | 4.50          | 39.5          | 0.22 | 4.30  | <0.2            | 7.91            | 1.79                 | 6.90            | <0.01      | <0.05            | 6.00 |     |
| WASTE ROCK                             |           |  |         |        |        |        |        |        |         |         |      |      |            |           |               |               |      |       |                 |                 |                      |                 |            |                  |      |     |
| 658,094                                | MMT-WR01  | Core Yard - Calcrete-top line              | <0.0001 | 0.002  | 0.001  | <0.001 | 0.004  | <0.001 | 11.41   | 23.3    | 280  | 46.6 | 310        | 326       | 175           | 215           | 0.12 | 0.75  | <0.2            | 0.75            | 0.17                 | 6.58            | <0.01      | <0.05            | 121  |     |
| 658,095                                | MMT-WR02  | Core Yard - Calcrete-middle line           | <0.0001 | 0.004  | 0.020  | <0.001 | <0.001 | <0.001 | 9.2     | 23.6    | 56.0 | 8.88 | 54         | 62.2      | 7.00          | 40.6          | 0.08 | 1.69  | <0.2            | 2.54            | 0.57                 | 2.16            | <0.01      | <0.05            | 22.5 |     |
| 658,096                                | MMT-WR03  | Core Yard - Calcrete-bottom line           | <0.0001 | 0.009  | <0.001 | <0.001 | 0.055  | <0.001 | 8.94    | 25.0    | 52.0 | 8.63 | 50.7       | 60.4      | 5.30          | 42.2          | 0.15 | 0.92  | <0.2            | 1.37            | 0.31                 | 1.23            | <0.01      | <0.05            | 18.5 |     |
| 658096 QC                              | MMT-WR03  | Core Yard - Calcrete-bottom line           | <0.0001 | 0.009  | <0.001 | <0.001 | <0.001 | <0.001 | 8.91    | 25.1    | 46.0 | 8.82 | 52.2       | 61.7      | 6.50          | 40.7          | 0.13 | 0.96  | <0.2            | 1.43            | 0.32                 | 1.43            | <0.01      | <0.05            | 18.5 |     |
| 658,097                                | MMT-WR04  | Core Yard - Pebble bed                     | <0.0001 | 0.011  | 0.003  | <0.001 | 0.003  | <0.001 | 8.91    | 25.2    | 50.0 | 7.49 | 45.7       | 52.4      | 5.90          | 35.6          | 0.11 | 0.87  | <0.2            | 1.13            | 0.26                 | 1.11            | <0.01      | <0.05            | 20.5 |     |
| 658,098                                | MMT-WR05  | Core Yard - Clay                           | <0.0001 | 0.024  | 0.002  | <0.001 | <0.001 | <0.001 | 8.87    | 25.4    | 40.0 | 7.53 | 43.8       | 52.7      | 5.00          | 32.8          | 0.13 | 1.25  | <0.2            | 1.70            | 0.38                 | 1.20            | <0.01      | <0.05            | 26.0 |     |
| 658,099                                | MMT-WR06  | Core Yard - Clay transition                | <0.0001 | 0.019  | 0.001  | <0.001 | <0.001 | <0.001 | 8.90    | 25.5    | 48.0 | 8.14 | 45.1       | 57.0      | 5.00          | 32.4          | 0.25 | 2.03  | <0.2            | 2.77            | 0.63                 | 1.43            | <0.01      | <0.05            | 121  |     |
| 658,100                                | MMT-WR07  | Core Yard - BIF1                           | <0.0001 | <0.001 | <0.001 | <0.001 | 0.001  | <0.001 | 8.97    | 25.4    | 42.0 | 6.97 | 42.3       | 48.8      | 4.90          | 33.4          | <0.1 | 0.77  | <0.2            | 0.66            | 0.15                 | 1.70            | <0.01      | <0.05            | 405  |     |
| 658,101                                | MMT-WR08  | Core Yard - BIF2                           | <0.0001 | <0.001 | <0.001 | <0.001 | 0.001  | <0.001 | 8.92    | 25.2    | 38.0 | 6.93 | 41.3       | 48.5      | 4.90          | 31.5          | 0.18 | 0.62  | <0.2            | 0.76            | 0.17                 | 1.08            | <0.01      | <0.05            | 208  |     |
| 658,102                                | MMT-WR09  | Core Yard - BIF3                           | 0.0001  | 0.002  | <0.001 | <0.001 | 0.003  | <0.001 | 8.94    | 25.2    | 53.0 | 8.51 | 55.9       | 59.6      | 4.00          | 46.6          | 0.13 | 0.69  | <0.2            | 0.92            | 0.21                 | 1.15            | <0.01      | <0.05            | 141  |     |
| 666417                                 | MMT-WR10  | Composite WR                               | 0.0003  | 0.021  | 0.008  | <0.001 | 0.001  | <0.001 | 8.99    | 22.9    | 60.0 | 9.05 | 62.3       | 63.4      | 5.30          | 37.4          | 0.19 | 1.77  | <0.2            | 2.28            | 0.52                 | 9.38            | <0.01      | <0.05            | 236  |     |
| 666417 QC                              | MMT-WR10  | Composite WR                               | 0.0003  | 0.021  | 0.008  | <0.001 | <0.001 | <0.001 | 9.03    | 22.9    | 62.0 | 9.06 | 62.1       | 63.4      | 5.80          | 37.9          | 0.17 | 1.77  | <0.2            | 2.30            | 0.52                 | 10.0            | <0.01      | <0.05            | 236  |     |

## Conclusion

A sill is reported to sub crop on the MMT Mine property, while a second one was reported during mining at the Hotazel Pit further to the north. There are other various intrusive structures close to and around MMT, including doleritic dykes. With regards to geochemistry, it was concluded that the MMT does not pose a risk of Acid Mine Drainage. Leachate results indicate that various parameters can be exceeded for various waste streams. It follows that pollution control measures must be considered for the MMT.

### 7.4.1.2 Topography

#### Introduction and link to impact

The presence of project infrastructure and mining activities has the potential to change the natural topography. A change in topography has the potential to impact on visual amenity (Section 7.4.1.10) and surface water drainage (Section 7.4.1.6) and may be harmful to third parties and animals. To understand the basis of these potential impacts in the context of the project activities, a baseline situational analysis is described below.

#### Data sources

Information in this section was sourced from site visits undertaken by the SLR project team and the review of topographical data and satellite imagery.

#### Description

In general, the area surrounding the MMT is relatively flat with a gentle slope towards the north and north-west. The elevation varies from 1 087 m to 1 107 m above mean sea level (mamsl). The majority of the natural topography within the project area has been disturbed as a result of the existing mining infrastructure and mining activities associated with the Tshipi Borwa Mine, the decommissioned Middelplaats Mine, the United Manganese of Kalahari (UMK) Mine and the Adams Solar Farm. The mine pits and WRDs at the MMT have had the most influence on topography. The highest topographical features surrounding the MMT are the UMK and Tshipi Borwa Mine WRDs (see Figure 1-2).

## Conclusion

The natural topography has been altered as a result of existing mining infrastructure and activities. The project activities present infrastructure that may pose a significant risk to third parties and have impacts on the visual character, water resources, and the surrounding land users. It is therefore vital that the design of the infrastructure should be such that any changes to topography results in stable topographic features which do not have a detrimental impact. This also needs to be considered within the context of the existing altered natural topography due to MMT's infrastructure and mining activities.

### 7.4.1.3 Climate

#### Introduction and link to impact

Climate can influence the potential for environmental impacts and related mine design. Specific issues include:

- Rainfall could influence erosion, evaporation, vegetation growth, rehabilitation planning, dust suppression and surface water management planning;

- Temperature could influence air dispersion through impacts on atmospheric stability and mixing layers, vegetation growth, and evaporation which could influence rehabilitation planning; and
- Wind could influence erosion, the dispersion of potential atmospheric pollutants and rehabilitation planning.

To understand the basis of these potential impacts, a baseline situational analysis is described below.

### Data sources

Information in this section was sourced from previous studies undertaken for MMT (SLR, 2019) as well as the Air Quality Study undertaken by Airshed (2019) in support of the MMT Section 24G Environmental Impact Assessment Report (SLR, 2020).

Rainfall data, rainfall depths and evaporation data were sourced from the nearest weather station (Milner weather station located 7 km east from the MMT). Temperature and wind data were sourced from the Kuruman weather station, located 42 km from the MMT. Wind speed, wind direction and temperature are not recorded at the Milner weather station and as such the Kuruman weather station is the closest weather station to the MMT that provides this data. The locations of the weather stations are illustrated in Figure 1-1.

### Description

#### *Regional climate*

The project area falls within the Northern Steppe Climatic Zone, as defined by the South African Weather Bureau. This is a semi-arid region characterised by seasonal rainfall, hot temperatures in summer, and colder temperatures in winter (SLR, 2019).

#### *Rainfall, evaporation and rainfall depths*

Monthly rainfall and evaporation data for the Milner weather station is summarised in Table 7-7 below. Rainfall depth frequency data is summarised in the table below. The average rainfall at the Milner weather station is 372 mm per annum. Given that the Milner weather station is only 7 km from the MMT, similar rainfall levels can be expected at the mine. The average evaporation rates recorded at the Milner weather station are 2 351 mm per annum for S-Pan and 1 972 mm per annum for open water (see Table 7-8).

**Table 7-7: Summary of average monthly and annual rainfall and evaporation data (SLR, June 2019)**

| Month    | Rainfall (mm)<br>Milner (393083 W) | WR2005<br>S-Pan Evaporation | WR2005<br>Open Water Evaporation |
|----------|------------------------------------|-----------------------------|----------------------------------|
| January  | 59.8                               | 276.9                       | 232.6                            |
| February | 63.0                               | 209.9                       | 184.8                            |
| March    | 72.3                               | 193.3                       | 170.1                            |
| April    | 39.9                               | 144.1                       | 126.8                            |
| May      | 19.2                               | 114.7                       | 99.8                             |
| June     | 9.1                                | 91.0                        | 77.3                             |
| July     | 1.3                                | 106.0                       | 88.0                             |
| August   | 5.4                                | 153.8                       | 124.5                            |

| Month         | Rainfall (mm)<br>Milner (393083 W) | WR2005<br>S-Pan Evaporation | WR2005<br>Open Water Evaporation |
|---------------|------------------------------------|-----------------------------|----------------------------------|
| September     | 6.4                                | 213.0                       | 172.5                            |
| October       | 19.2                               | 269.7                       | 218.4                            |
| November      | 31.5                               | 248.0                       | 232.9                            |
| December      | 44.5                               | 294.6                       | 244.5                            |
| <b>Annual</b> | <b>372.0</b>                       | <b>2351.0</b>               | <b>1972.0</b>                    |

**Table 7-8: Rainfall depth frequency (SLR, JUNE 2019)**

| Storm<br>Duration<br>(m/h/d) | Return Period (years) |       |       |       |       |       |       |
|------------------------------|-----------------------|-------|-------|-------|-------|-------|-------|
|                              | 2                     | 5     | 10    | 20    | 50    | 100   | 200   |
| 15 m                         | 15.0                  | 21.3  | 25.7  | 30.2  | 36.3  | 41.2  | 46.2  |
| 30 m                         | 19.8                  | 28.1  | 34.0  | 40.0  | 48.0  | 54.4  | 61.1  |
| 45 m                         | 23.3                  | 33.1  | 40.1  | 47.1  | 56.6  | 64.1  | 71.9  |
| 1 hr                         | 26.1                  | 37.2  | 45.0  | 52.8  | 63.5  | 72.0  | 80.7  |
| 1.5 hr                       | 30.8                  | 43.8  | 53.0  | 62.2  | 74.8  | 84.7  | 95.1  |
| 2 hr                         | 34.6                  | 49.2  | 59.5  | 69.9  | 84.0  | 95.2  | 106.8 |
| 4 hr                         | 40.0                  | 56.9  | 68.8  | 80.7  | 97.0  | 110.0 | 123.4 |
| 6 hr                         | 43.5                  | 61.9  | 74.9  | 87.9  | 105.6 | 119.7 | 134.3 |
| 8 hr                         | 46.2                  | 65.7  | 79.5  | 93.3  | 112.1 | 127.1 | 142.6 |
| 10 hr                        | 48.4                  | 68.8  | 83.3  | 97.8  | 117.5 | 133.1 | 149.4 |
| 12 hr                        | 50.3                  | 71.5  | 86.5  | 101.5 | 122.0 | 138.3 | 155.2 |
| 16 hr                        | 53.4                  | 75.9  | 91.9  | 107.8 | 129.6 | 146.9 | 164.8 |
| 20 hr                        | 55.9                  | 79.6  | 96.2  | 113.0 | 135.8 | 153.9 | 172.6 |
| 24 hr                        | 58.1                  | 82.6  | 100.0 | 117.3 | 141.0 | 159.8 | 179.3 |
| 1 d                          | 46.7                  | 66.5  | 80.5  | 94.5  | 113.5 | 128.6 | 144.3 |
| 2 d                          | 56.8                  | 80.8  | 97.7  | 114.7 | 137.9 | 156.2 | 175.3 |
| 3 d                          | 63.6                  | 90.5  | 109.5 | 128.5 | 154.4 | 175.0 | 196.3 |
| 4 d                          | 68.2                  | 97.1  | 117.4 | 137.8 | 165.7 | 187.7 | 210.6 |
| 5 d                          | 72.0                  | 102.5 | 124.0 | 145.5 | 174.9 | 198.2 | 222.4 |
| 6 d                          | 75.3                  | 107.2 | 129.6 | 152.1 | 182.9 | 207.2 | 232.5 |
| 7 d                          | 78.2                  | 111.3 | 134.6 | 158.0 | 189.9 | 215.1 | 241.4 |

### Temperature

The area experiences hot temperatures during summer, with the highest record of 42.6°C during the month of January. Winter temperatures are relatively low especially in the months of June to August. Daily maximum



temperatures range between 43°C in January to 25°C in June, with daily minimum temperatures between -4.2°C in August to 10°C in January. Table 7-9 below provides the minimum, average and maximum temperature obtained from the Kumaran South African Weather Station for the period 2015 to 2017.

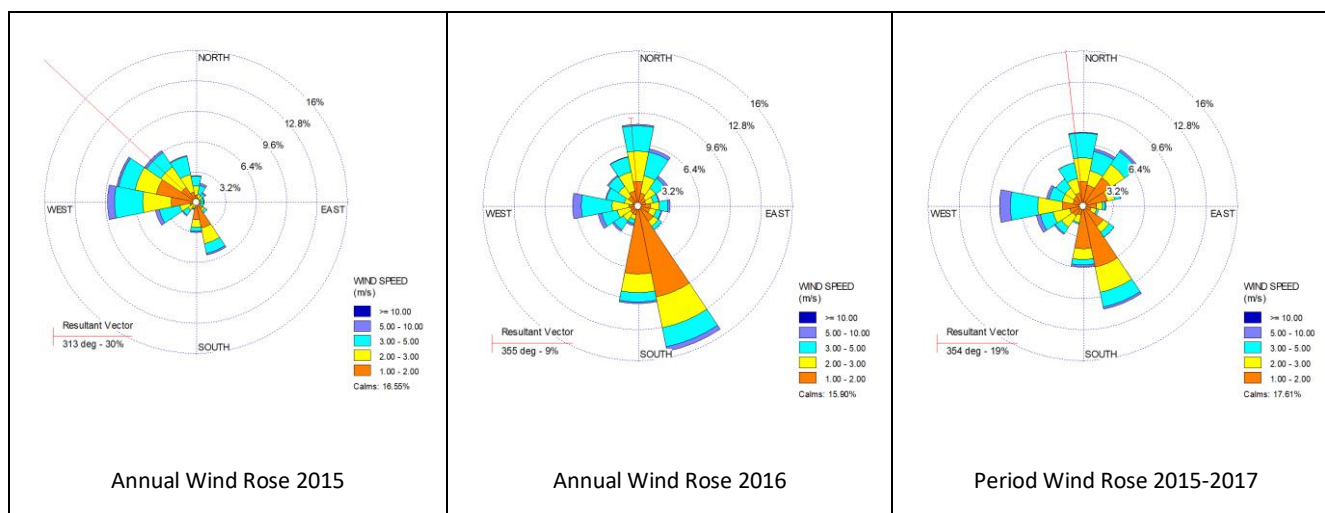
**Table 7-9: Minimum, average and maximum temperatures (AIRSHED, 2019)**

|            | Jan  | Feb  | March | April | May  | June | July | Aug  | Sep  | Oct  | Nov  | Dec  |
|------------|------|------|-------|-------|------|------|------|------|------|------|------|------|
| <b>Min</b> | 10.1 | 10   | 6.4   | 3.3   | 2    | -3.2 | -3.9 | -4.2 | 2.2  | 2.7  | 4.3  | 9.6  |
| <b>Ave</b> | 25.1 | 24.3 | 22.2  | 17.9  | 14.0 | 10.7 | 10.8 | 13.8 | 18.5 | 21.7 | 23.5 | 26.4 |
| <b>Max</b> | 42.6 | 38.8 | 35.6  | 35.3  | 28.8 | 25.3 | 27.1 | 31.3 | 34.7 | 38.5 | 39.5 | 39.9 |

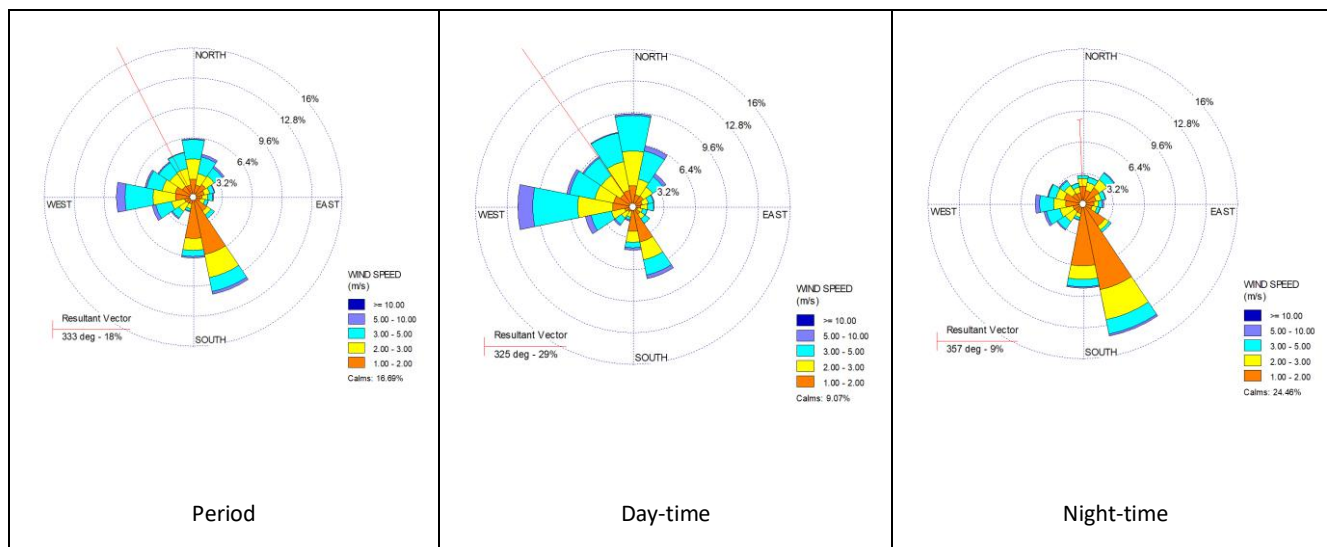
### Wind

The annual average wind roses for the Kuruman Weather Station (located approximately 43 km to the west of MMT) for the years 2015, 2016 and 2017 are shown in Figure 7-3: Period and annual wind roses (airshed, 2019) with the period average wind field (2015-2017) and diurnal variability in the wind field provided in Figure 7-4. The predominant wind direction is from the south-south-east and south with most of strong winds from the west. Frequent winds also occur from the north. Over the three-year period (2015 – 2017), the frequency of occurrence of south-south-easterly wind was between 12% and 17%, with winds with a westerly component occurring approximately 15% of the time. Winds occur less frequently from the easterly sector. During the day winds are more frequent from the westerly and the northerly sectors, with the strongest winds directly from the west. The wind shifts during the night-time to dominantly south-south-easterly and southerly winds. Day-time calms occurred for 9% of the time, with night-time calms for 24% of the time.

According to the Beaufort wind force scale, wind speeds between 6-8 m/s equates to a moderate breeze, with wind speeds between 14-17 m/s near gale force winds. Based on the three years of SAWS data (2015-2017), wind speeds exceeding 6 m/s occurred for only 1% of the time, with a maximum wind speed of 10 m/s. The average wind speed over the three years was 2.06 m/s. Calm conditions (wind speeds < 1 m/s) occurred for 17% of the time. The United States Environmental Protection Agency (US EPA) indicates a friction velocity of 5.4 m/s to initiate erosion from a coal storage piles (US EPA, 2006). Thus, the likelihood exists for wind erosion to occur from open and exposed surfaces, with loose fine material, when the wind speed exceeds at least 5.4 m/s. Wind speeds exceeding 5.4 m/s occurred only for 2% over the three years (2015 -2017).



**Figure 7-3: Period and annual wind roses (airshed, 2019)**



**Figure 7-4: Period, day-time and nigh-time wind roses (airshed, 2019)**

### Atmospheric Stability

During the daytime, the atmospheric boundary layer is characterised by thermal turbulence due to the heating of the earth's surface and the predominance of an unstable layer. During unstable conditions, ground level pollution is readily dispersed thereby reducing ground level concentrations. Night-times are characterised by weak vertical mixing and the predominance of a stable layer. These conditions are normally associated with low wind speeds and less dilution potential. During windy and/or cloudy conditions, the atmosphere is normally neutral (which causes sound scattering in the presence of mechanical turbulence).

For low level releases, such as activities associated with mining operations, the highest ground level concentrations would occur during weak wind speeds and stable (night-time) atmospheric conditions. However, windblown dust is likely to occur under high winds (neutral conditions).

### Conclusion

The MMT is characterised by hot to very hot summers and cool to warm winters with rain generally occurring in the form of localised thunderstorms that last for short periods at a time during rainy periods. High evaporation rates reduce infiltration, while rainfall events can increase the erosion potential and the formation of erosion gullies. The presence of vegetation does, however, reduce the effects of erosion. The mixing of layers resulting in the formation of temperature inversions, and the presence of cloud cover limits the dispersion of pollutants. Wind significantly affects the amount of material that is suspended from exposed surface and wind speed determines the distance of downward transport as well as the rate of dilution of pollutants in the atmosphere. The likelihood exists for wind erosion to occur from open and exposed surfaces, with loose fine material, when the wind speed exceeds at least 5.4 m/s. These climatic aspects need to be taken into consideration during operational planning.

#### 7.4.1.4 Soils and Land capability

This section is based on the specialist study that was completed by Scientific Aquatic Services, dated 2019 and updated in October 2021.

##### Introduction

Based on observations during the site assessment and local knowledge (Mamatwan Mine Management), the dominant land uses within the focus areas are wildlife/wilderness and grazing land uses. It should be noted that no cultivated commercial agricultural activities were observed within 3km radius of the focus study area. The focus areas resemble Oxidic and Anthropic catena topo sequences. Oxidic soils are characterised by strong pigmentation effects of iron in the form of hematite and goethite. These soils drain freely and are well aerated. These attributes make soils ideal for cultivation. Oxidic soils constitute approximately 66% of the total investigation area and these soils include Ermelo and Hutton soil forms.

Some areas were previously subjected to extensive disturbance due to historic mining support infrastructure such as roads and an old waste rock dump. Areas along the existing roads and within the zone of influence showed evidence of disturbance where proposed pipeline route (preferred alignment) with traverse the landscape. These areas are largely dominated by the Anthropic soils which include Witbank soil form. Anthropic soils include all soils which have been subjected to the alteration from their natural state by human-related interventions such that no recognizable diagnostic soil morphological characteristics could be identified. The Witbank and Cullinan soil forms constitute about 32% of the total surveyed area.

##### Data Source

The soils and land capability study was carried out as a desktop and field investigation for all proposed project areas including alternatives. The desktop assessment took the following data sources into account and reviewed these in terms of the study area:

- The Mean Annual Precipitation (MAP) ranges between 201 and 400mm per annum, which means that the MAP of the surrounding area is not ideal for crop growth under rainfed conditions due to high risk of crop failure;
- According to the Geology 2001 and the 1:250 000 geological map of South Africa, the majority of the focus areas is underlain by clastic sedimentary rock formations (i.e. Tillite) while the remaining portions are underlain by Eoleon rock formations, of the Kalahari geological groups;
- The desktop assessment indicates that the focus areas have a very low land capability. The entire focus area is considered only suitable for livestock grazing (Class VII);
- According to the AGIS database, the livestock grazing capacity potential is estimated to be approximately 11 hectares per large animal unit (Morgenthal et al., 2005). This area is therefore not considered ideal for commercial livestock farming due to sparsity of vegetation, extreme temperatures and scarcity of water sources which might cause harm to livestock and subsequent loss of profit;
- The natural soil pH is estimated to range between 6.5 and 7.4, indicating that the soils are slightly acidic to neutral, as interpolated from topsoil pH values obtained from the National Soil Profile Database (AGIS database);
- According to the Soils 2001 Layer the focus areas is situated within an area where the soils are classified as red-yellow apedal freely drained soils with a high base status and < 15% clay; and

- The soils within the focus areas have a low to moderate water or wind erosion hazard/potential, and the area is generally level to gently sloping land. The soils therefore have low to very high erodibility due to the sandy soil texture of the dominant soils within the focus areas.

The field assessment included sampling of soils to assess the profile of the soil and confirm the soil form.

## Conclusion

The land capability of the proposed development sites is Arable Class I with a Moderate land potential. The overall impact of the proposed mining support infrastructure on the land capability and land potential of these soils is anticipated to be very low and be effectively managed by implementing effective housekeeping and management measures throughout construction, operation and decommissioning. It is important to note, that there is no variation in soil forms and land capability type between the project alternatives (railway and dewatering pipeline) as the site is homogenous in nature.

### 7.4.1.5 Biodiversity

As a baseline, this section provides an outline of the biodiversity occurring on site and the status of the fauna and flora, highlights the occurrence of sensitive ecological environments including sensitive/endangered species (if present) that require protection and/or additional management actions should they be disturbed.

## Data source

Desktop vegetation type information and the associated conservational status were extracted from the South African National Vegetation Map. Information on plant and animal species recorded for the Quarter Degree Squares (QDS), was extracted from the SABIF/SIBIS database hosted by SANBI. Numerous national and provincial databases were utilised to determine the conservational sensitivity of the project areas. These databases included: The National Environmental Management: Biodiversity Act (No. 10 of 2004) (NEM: BA) list of threatened ecosystems (2011):

- Important catchments and protected expansion areas in terms of the NPAES;
- The South Africa Conservation Areas Database (SACAD, 2017);
- The South Africa Protected Area Database (SAPAD, 2017);
- The Mining and Biodiversity Guidelines (2013);
- The Northern Cape critical biodiversity areas (CBAs) (2016); and
- IBAs (2015).

In order to determine the Present Ecological State (PES) of the study area, the following methodology was employed:

- Maps and digital satellite images were consulted prior to the field investigation in order to determine broad habitats, vegetation types and potentially sensitive sites. An initial visual on -site assessment of the study area was made in order to confirm assumptions made from the maps;
- A literature review was conducted for habitats, vegetation types and species distribution;
- Relevant databases were considered during the assessment of the footprint area including:
  - The Important Bird and Biodiversity Areas (IBA, 2015);
  - South African Bird Atlas Project 2 (SABAP2);



- International Union for Conservation of Nature (IUCN); and
- The Northern cape Critical Biodiversity Areas (2016).

## Description

### Terrestrial characteristics

The terrestrial characteristics of the project area, derived from desktop information, is summarised in the section below. The table also provides information on the sensitivity of the project areas in accordance with existing national and provincial databases. It is important to note, that although all data sources used provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the actual site characteristics. This information is however considered to be useful as background information.

The project areas do not fall within any protected or priority areas and the Kathu Bushveld vegetation is considered a Least Threatened Vegetation type, per the National Biodiversity Assessment (2020). The project areas do however fall within the Griqualand West Centre of Endemism. A centre of plant endemism is an area with high concentrations of plant species with very restricted distributions, known as endemics. Centres of endemism are important because it is these areas, which if conserved, would safeguard the greatest number of plant species. The Griqualand West Centre of Endemism is considered a priority in the Northern Cape, as the number of threats to the area is increasing rapidly and it is poorly understood. Furthermore, this centre of endemism is extremely poorly conserved, and is a national conservation priority.

**Table 7-10: Conservation characteristics of the MMT**

| Details in terms of Mucina and Rutherford (2006)   |  | Description of the vegetation type(s) (Mucina and Rutherford 2006)   |  |
|--|--|--|--|
| Biome  | The project activities are located within the Savanna Biome.   | Vegetation Type  | Kathu Bushveld   |
|  |  | Climate  | Summer and autumn rainfall, very dry winters   |
| Bioregion  | The project activities are situated within the Eastern Kalahari Bushveld Bioregion.  | Distribution   | Northern Cape Province   |
|  |  | Conservation   | Least threatened. Target 16%. Not conserved in statutory parks   |
| Vegetation Type  | The project activities fall within the Kathu Bushveld vegetation type.   | Vegetation and landscape features  | Medium-tall tree layer with <i>Acacia erioloba</i> in places, but mostly open and including <i>Boscia albitrunca</i> as the prominent trees. Shrub layer generally most important with, for example, <i>A. mellifera</i> , <i>Diospyros lycioides</i> and <i>Lycium hirsutum</i> . Grass layer is variable in cover.<br><br><b>Biogeographically Important Taxa (Kalahari endemics)</b><br><u>Small Tree</u> : <i>Vachellia luederitzii</i> var. <i>luederitzii</i> . <u>Graminoids</u> : <i>Antheophora argentea</i> , <i>Megaloprotachne albescens</i> , <i>Panicum kalaharensis</i> . <u>Herb</u> : <i>Neuradopsis bechuanensis</i> . |
| Conservation details pertaining to the study area (Various databases)  |  |  |  |
| National Biodiversity Assessment (2011)  | Ecosystem types are categorised as “not protected”, “poorly protected”, “moderately protected” and “well protected” based on the proportion of each ecosystem type that occurs within a protected area recognised in the Protected Areas Act, 2003 (Act 57 of 2003), and compared with the biodiversity target for that ecosystem type. The project activities are located within an area that is currently not protected. |  |  |
| National Threatened Ecosystems (2011)  | The project activities are not located in an ecosystem that is listed as threatened.   | Northern Cape Critical Biodiversity Areas (2016)   |  |
| NPAES (2009), SACAD (2017) and SAPAD (2017)  | According to the NPAES database, the SAPAD, 2019 and the SACAD, the project activities do not fall within a protected or conservation area or nature reserve, nor is it situated within 10km of a formal protected area.   | The Northern Cape CBA Map identifies biodiversity priority areas, called CBAs and Ecological Support Areas, which, together with protected areas, are important for the persistence of a viable representative sample of all ecosystem types and species as well as the long-term ecological functioning of the landscape as a whole. According to the Northern Cape CBA database, the project activities fall outside of any CBAs. The immediate surrounding area includes natural areas with an Ecological Support Area situated within 5 km to the north-east and the south-west of the project activities. |  |
| IBA (2015)   | The project activities do not fall within an Important Bird and Biodiversity Area (IBA, 2015), nor is located within 10 km of an IBA.  |  |  |
| In terms of the Mining and Biodiversity Guidelines (2013) the project activities do not fall into any biodiversity priority areas and is therefore not deemed a risk for mining. |  | The project activities are situated within the Griqualand West Centre of Endemism.   |  |

### Terrestrial habitat units associated with the project areas

**Table 7-11: Habitat units within the project areas**

| Habitat Unit                   | Relevant project areas  | Description of vegetation community and sensitivity   |
|--------------------------------|---|---|
| Kathu Bushveld Habitat Unit    | <i>Senegalia mellifera</i> - <i>Vachellia haematoxylon</i> – <i>Grewia flava</i><br><i>Kathu Bushveld</i><br><br>Largely associated with the top-cut stockpile, crushing and screening plant, and all of the proposed pipeline alternatives.      | The Kathu Bushveld habitat unit is considered an open savanna and has well-developed tree/shrub layer with dominant trees such as <i>Senegalia (Acacia) mellifera</i> , scattered <i>Terminalia sericea</i> and <i>Acacia haematoxylon</i> . The shrub layer is developed and is dominated by species such as <i>Senegalia mellifera</i> , <i>Tarchonanthus camphoratus</i> , <i>Grewia flava</i> , and <i>A. hebeclada</i> . The grass layer is variable in cover, with bare soil patches notable throughout the habitat unit. In some areas denser bush clumps occur either consisting of the Protected Tree <i>Acacia (Vachellia) erioloba</i> or dense stands of <i>Acacia mellifera</i> . The Kathu Bushveld Habitat Unit is sub-divided into the <i>Senegalia mellifera</i> - <i>Vachellia haematoxylon</i> – <i>Grewia flava</i> Kathu Bushveld vegetation community and the <i>Senegalia mellifera</i> – <i>Stipagrostis</i> Open Kathu Bushveld vegetation community. The Kathu Bushveld is considered to have a medium sensitivity. |
|                                | <i>Senegalia mellifera</i> – <i>Stipagrostis</i><br>Open Kathu Bushveld<br>Largely associated with the railway loop.  |   |
| Transformed Habitat Unit       | Largely associated with , the expansion of an existing road and the existing product stockyard, stormwater management infrastructure, the existing loadout station, potable, process water storage facilities and pipeline alternatives, 2 and 3. | The Transformed Habitat Unit refers to areas that have been transformed as a result of historic and ongoing mining activities and infrastructure. These areas contain very little to no vegetation and where present it consists mainly of alien invasive species. This habitat unit has a low sensitivity.   |
| Degraded Bushveld Habitat Unit | Largely associated with the existing WRDs.  | The Degraded Bushveld Habitat Unit refers to areas that have been partially or largely transformed. The Degraded Bushveld was severely altered from the reference Kathu Bushveld as a result of mining activities and infrastructure. Also included are all mining areas associated with vegetated areas, such as the rehabilitated historic mine dumps, as well as the outer slopes of currently utilised dumps, where vegetation has managed to re-establish. These areas contain very little natural vegetation and consist mainly of alien invasive species. This habitat unit has a moderate sensitivity.  |

### Alien and invasive floral species

Alien and invasive floral species are floral species of exotic origin which are invading previously pristine areas or ecological niches. Disturbances of the ground through trampling, excavations or landscaping often leads to the dominance of exotic species that rapidly dominate the area. Under natural conditions, these exotic species are overtaken by sub-climax and climax species through natural veld succession. This process, however, takes many years to occur, with the natural vegetation never reaching the balanced, pristine species composition prior to the disturbance. Alien vegetation invasion causes degradation of the ecological integrity of an area, causing a decline in species diversity, local extinction of indigenous species and ecological imbalance.

Alien invasive species were mainly recorded in the Transformed Habitat Unit. See Table 7-12 for a list of AIS associated with the Transformed Habitat Unit in terms of the NEM: BA List of Alien and Invasive Species (2016). Limited AIS are associated with the *Acacia* Thornveld Habitat Unit.

**Table 7-12: Alien and invasive species in the project area**

| Scientific name                                     | Common name                  | Category*                           |
|---|------------------------------|-------------------------------------|
| Trees/ shrubs                                       |                              |                                     |
| <i>Nicotiana glauca</i>                             | Wild tobacco                 | NEMBA: Category 1b                  |
| <i>Prosopis glandulosa</i> var. <i>glandulosa</i>   | Honey mesquite               | NEMBA: Category 3 in Northern Cape. |
| Forbs   |                              |                                     |
| <i>Argemone ochroleuca</i> subsp. <i>ochroleuca</i> | White-flowered Mexican poppy | NEMBA: Category 1b                  |
| Graminoid   |                              |                                     |
| <i>Pennisetum setaceum</i>                          | Fountain grass               | NEMBA: Category 1b                  |

**Category 1b** – Invasive species that require control by means of an invasive species management programme.

**Category 3** – Ornamentally used plants that may no longer be planted; existing plants may remain, except within the flood line of watercourses and wetlands, as long as all reasonable steps are taken to prevent their spread.

### Floral Species of Conservational Concern

A number of protected floral species were observed, particularly in the Kathu Bushveld Habitat and include the National Forest Act, (Act 84 of 1998) (NFA) (amended in September 2011) protected trees *Vachellia erioloba* and *Vachellia haematoxylon*. Also observed were a number of Northern Cape Nature Conservation Act (Act 9 of 2009) (NCNCA) protected species, namely *Boophone disticha*, *Harpagophytum procumbens*, and *Tridentea* sp. *H. procumbens* is also considered a protected species in terms of NEM: BA Threatened or Protected Species (TOPS). It was observed that individuals of the *V. erioloba* and *V. haematoxylon*, as well as a single individual of the *B. disticha* were observed in the degraded Bushveld habitat unit.

In terms of the NCNCA, Schedule 2 protected species may not be picked, imported, exported, transported, cultivated or traded without a permit. It follows that the removal of any protected species in terms of the NCNCA requires a permit from the DENC. In terms of the NFA, protected tree species may not be cut, disturbed, damaged or destroyed and their products may not be possessed, collected, removed, transported, exported, donated, purchased or sold - except under licence granted by the DAFF.

### Faunal habitat and Species

#### Mammals

The project activities are unlikely to have a significant impact of mammal habitat or diversity since these areas are located directly adjacent to existing mining areas and these areas were noted to be predominantly occupied by commonly occurring species which do not have restricted ranges or habitat requirement. Furthermore, constant disturbances from current mining have likely ensured that any SCC refrain from entering the study area, remaining in the surrounding more suitable habitat available around the active mining areas.



### *Birds*

The avifaunal habitat sensitivity for the project area is considered to be intermediate. Although a large contingent of SCC are considered likely to utilise areas at the project areas for foraging, only one SCC was deemed to potentially utilise the site for breeding: the African Rock Pipit – utilising the available rocky and grassy hillslopes created by the mining activities. The large contingent of raptors, (all known to have wide ranging) are considered unlikely to breed within the study area due to the lack of tall trees which would be required to build their nests.

### *Herpetofauna*

The Kalahari Tree Skinks and Common Barking Geckos have been recorded at the MMT (NSS, October 2018). Additional reptile species known to occur in the project areas include the Spotted Bush Snake, Cape Cobra, Cape Gecko, Yellow-throated Plated Lizard, Bushveld Lizard, Spotted Sand Lizard, Mole Snake and Puff Adder. Suitable habitat for Common Flap-neck Chameleon and African Rock Python was observed and these species could occur within the study area.

### *Amphibians*

No amphibians were observed within the study area during the field assessment. Moreover, no pans or ephemeral streams transverse the study area making it unlikely that locations of standing or running surface water necessary for most amphibian species survival and breeding occur on the site. The amphibian habitat sensitivity within the study area is considered moderately low. The freshwater habitats which suit the amphibian lifestyle are absent from the study area and the habitat that is available is completely artificial and formed/created from mining processes.

### *Terrestrial macro invertebrates*

Butterfly species that have been recorded at the project areas (NSS, October 2018) included the Wandering Donkey Acraea, African Monarch, Painted Lady, Pea Blue, Broad-bordered Grass Yellow, African Migrant and Common Sandman. None of these butterfly species has a threatened or protected status.

The exoskeleton of the *Uroplectes carinatus* scorpion was recorded at the MMT. The highly venomous *Parabuthus raudus*, and *Opisthophthalmus carinatus*, are highly likely to also occur in the project areas. Other potentially occurring scorpion species include *Parabuthus granulatus*, *Opisthophthalmus wahlbergii* and *Parabuthus mossambicensis*. All *Opisthophthalmus* and *Opistacanthus* scorpion species are Protected Species in the Northern Cape. Remaining patches of natural vegetation at the MMT are dotted with the tangled bulbous nests of Community Nest Spiders (*Stegodyphus* sp.) and Banded Garden Spiders (*Argiope australis*).

The insect habitat sensitivity is considered moderately low to intermediate. The floral characteristics of the surrounding habitat types do not support a wide diversity of insect species yet offer suitable habitat for an abundant number of insects.

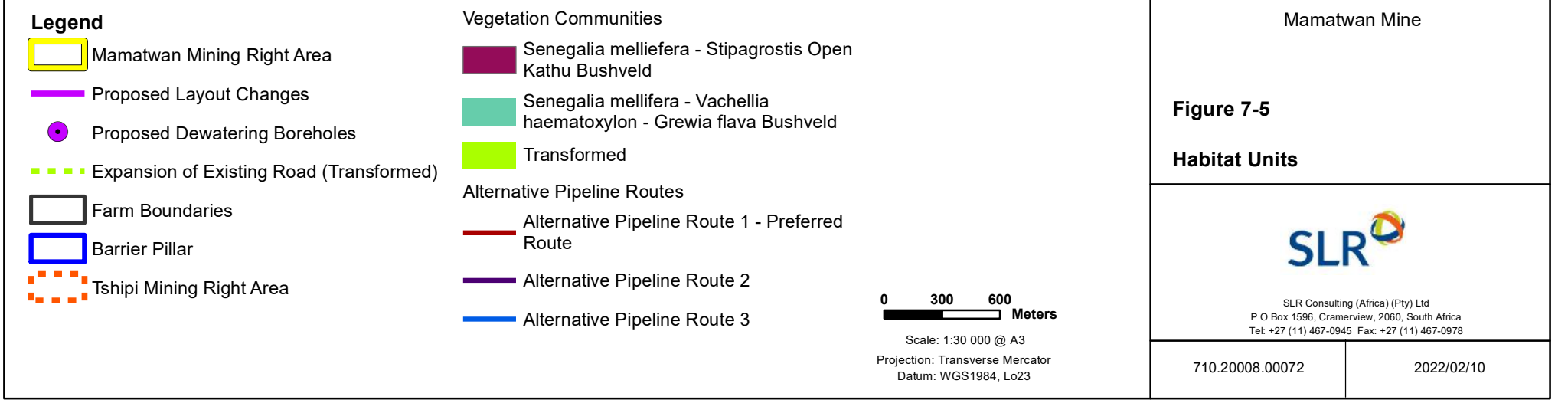
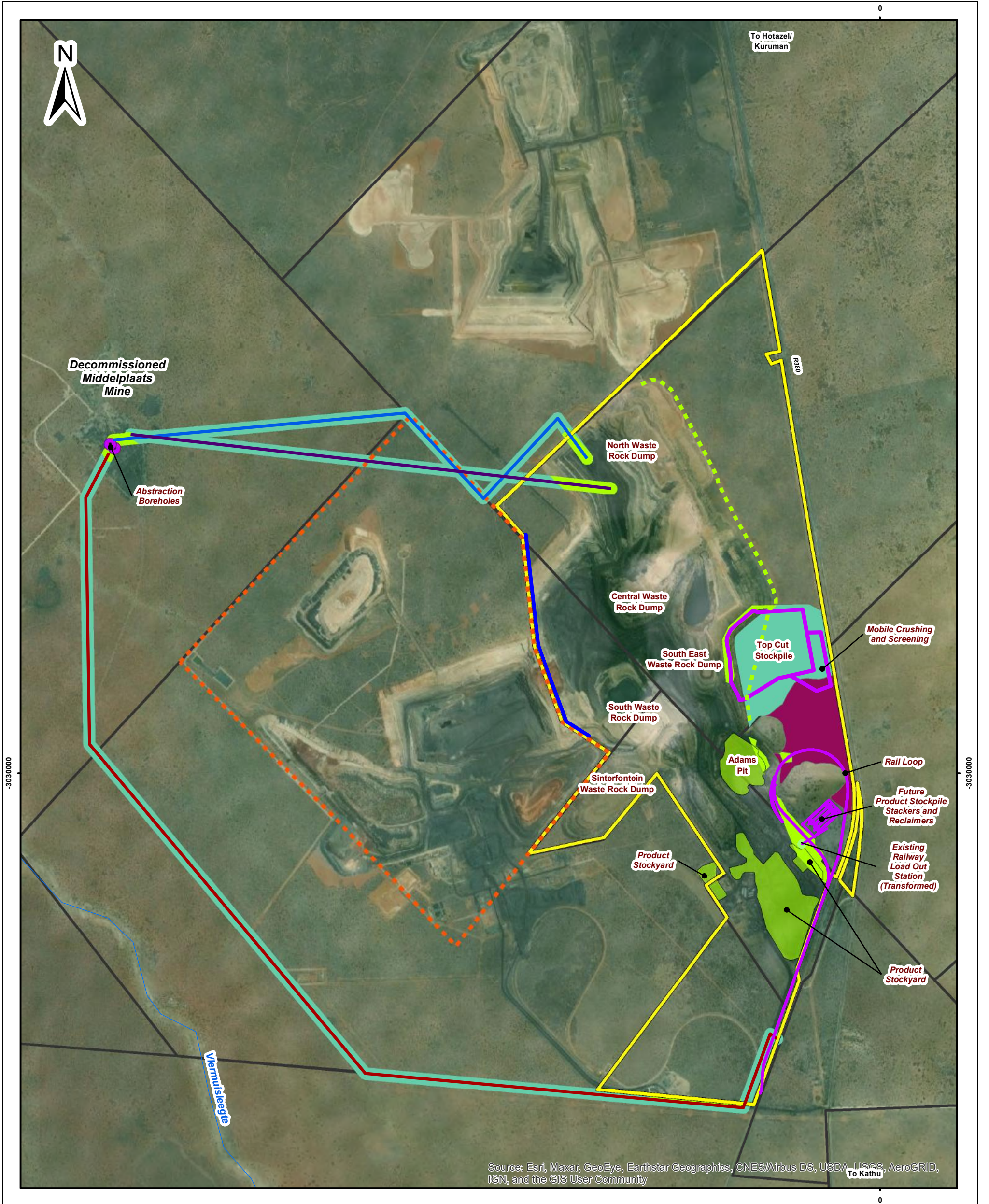
## **Faunal Species of Conservation Concern**

Only one SCC listed species, *Orycteropus afer* (Aardvark), was observed within the study area and its immediate surroundings. The Kathu Bushveld habitat unit is expected to support a number of faunal SCC. The following faunal SCC are considered to have a POC of 60% or higher and may occur within the study area, namely *Atelerix frontalis* (Southern African Hedgehog), *Felis nigripes* (Black-footed Cat), *Otocyon megalotis* (Bat-eared Fox), *Vulpes chama* (Cape Fox), *Mellivora capensis* (Honey Badger), *Aquila verreauxii* (Verreaux's eagle), *Anthus crenatus* (African Rock Pipit), *Ardeotis kori* (Kori Bustard) and *Sagittarius serpentarius* (Secretary bird. Three burrowing Scorpions (*Opisthophthalmus ater* (CR), *Opisthophthalmus carinatus* (NYBA) and *Opisthophthalmus*

*wahlbergii* (NYBA)) all have suitable habitat located within the study area and have distributions which overlap the study area. Suitable habitat for *Chamaeleo dilepis* (Common flap-neck chameleon) and *Python sebae* (African rock python) was observed and these species could occur within the study area.

Due to the highly degraded nature of the Transformed Habitat Unit resulting from mining activities, sufficient suitable habitat is not available to support faunal SCC.







### 7.4.1.6 Surface Water

#### Introduction and link to impact

Surface water resources include drainage patterns and paths of preferential flow of storm water runoff. The establishment of mining infrastructure and activities have the potential to alter the drainage of surface water and/or result in the contamination of the surface water resources through runoff. To understand the basis of these potential impacts in the context of the project activities, a baseline situational analysis is described below.

#### Data sources

Information in this section was sourced from previous studies undertaken for MMT (SLR, June 2019).

Information pertaining to catchments, mean annual runoff (MAR) and water management areas was sourced from the Water Resources of South Africa Manual WR2012 (WR 2012). Information regarding the relevant rivers surrounding MMT was sourced from the review of topographical data and on-site observations.

#### Catchments within the context of South Africa

The MMT is located within the Lower Vaal Water Management Area. The major rivers associated with this water management area include the Molopo River, Harts River and the Vaal River, which ultimately drain into the Orange River.

#### Regional hydrology

The MMT falls within the quaternary catchment D41K which has a gross total catchment area of 4 216 km<sup>2</sup>, with a net MAR of 6.53 million cubic meters.

The major river within quaternary catchment D41K is the Ga-Mogara drainage channel, which is located approximately 8 km north-west of MMT. The Ga-Mogara drainage channel forms a tributary of the Kuruman River. The Kuruman River flows west joining the Molopo River approximately 250 km from the confluence of the Ga-Mogara drainage channel and Kuruman River. The Molopo River drains in a southerly direction eventually joining the Orange River.

#### Local hydrology

The nearest watercourses to the MMT are the Vlermuisleegte River (located approximately 3 km west of MMT) and the Witleegte River (located approximately 4 km northeast of MMT). These rivers are ephemeral in nature and as such only flow after significant rainfall events for a short period of time. The last record flow in the Witleegte and Vlermuisleegte Rivers were in 1988. No watercourses are located at the MMT. Both the Vlermuisleegte and the Witleegte Rivers are tributaries of the Ga-Mogara River. The catchment characteristics of the Witleegte and the Vlermuisleegte Rivers are provided in Table 7-13 below. Any natural runoff from the MMT will drain in a north and northwest direction towards the Ga-Mogara River.



**Table 7-13: Catchment characteristics**

| Catchment                   | Catchment area<br>(km <sup>2</sup> ) | MAR (nett) (million<br>m <sup>3</sup> /annum) | Watercourse<br>length (km) | Drainage density<br>(km/km <sup>2</sup> ) |
|-----------------------------|--------------------------------------|---|----------------------------|---|
| Witleegte catchment         | 661                                  | 0.73  | 70 350                     | 106.4                                     |
| Vlermuisleegte<br>catchment | 487                                  | 0.54  | 47 250                     | 97  |

### Surface water quality

No water sampling has been conducted at MMT because there are no natural permanent surface water features at the MMT. It follows that, no surface water quality data is available.

### Surface water use

Due to the ephemeral nature of Witleegte and Vlermuisleegte Rivers, there is no third-party reliance on surface water.

### Floodlines

No floodlines were determined, as no watercourses are located at the MMT.

### Wetlands

No wetlands are located at the MMT. However, the site is within the Eastern Kalahari Bushveld Group 1 wetland vegetation group which is considered Least Threatened.

### Conclusion

The project presents infrastructure that has the potential to influence contributions of runoff to the catchment and related natural drainage patterns. The project activities also present a potential for the contamination of surface water resources. These potential impacts however need to be considered within the context of the distance of the project activities to watercourses, the sheet flow drainage patterns, the ephemeral nature of the catchment and that natural drainage patterns have already been disturbed as a result of the existing MMT infrastructure. It is important to note that none of the project alternatives (proposed dewatering pipeline and railway loop are located near any surface water resources).

### 7.4.1.7 Hydrogeology

#### Introduction and link to impact

Groundwater is a valuable resource and is defined as water which is located beneath the ground surface in soil/rock pore spaces and in the fractures of lithological formations. Geology and associated structural features provide a basis from which to understand:

- The geochemistry and related potential for the pollution of water from facilities that are likely to result from seepage of chemicals of concern; and
- The potential for geological lineaments such as faults and dykes. Faults, dykes and other lineaments can act as preferential flow paths of groundwater, which can influence both the dispersion of potential pollution plumes.

Mining activities and infrastructure has the potential to result in the loss of groundwater resources, both to the environment and third-party users, through contamination and, potentially, abstraction. To understand the basis of these potential impacts in the context of the project activities, a baseline situational analysis is described below.

#### Data sources

Information in this section was sourced from previous studies undertaken for MMT including the Section 24G EIA (SLR, September 2020), the Geochemistry Study (SLR, April 2020) (included in Appendix F) and the Groundwater Study (SLR, April 2021) compiled for the project (included in Appendix G).

Regional geology, local geology and lineament information was sourced from the review of available literature (SLR, April 2020b). For the geochemical assessment, samples were sourced from the sinter de-dust located in . Information pertaining to the regional aquifer characterisation, intrusions, groundwater flow and use in support of the Groundwater Study (SLR, April 2020b) was extrapolated from the Groundwater Study prepared for MMT by GHT Consulting in August 2018. Groundwater monitoring data was sourced from the 4<sup>th</sup> quarter monitoring report compiled by GHT in January 2020 (GHT, January 2020). Hydrocensus data was sourced from the hydrocensus undertaken by GHT in 2020 (GHT, 2020).

#### Description

##### *Regional geology*

The world's largest land based sedimentary manganese deposit is contained in the Kalahari Manganese Field, situated 47 km north-west of Kuruman in the Northern Cape. The general stratigraphic column of the Kalahari Manganese Field is included in Table 7-14 below. The Kalahari Manganese Field comprises five erosional, or structurally preserved, relics of the manganese bearing Hotazel Formation of the Paleoproterozoic Transvaal Supergroup. These include the Mamatwan-Wessels deposit (also known as the main Kalahari Basin), the Avontuur and Leinster deposits, and the Hotazel and Langdon Annex/Devon deposits. The MMT is located in the Hotazel Formation (Transvaal Supergroup) towards the southern end of the Kalahari Basin. The Hotazel Formation typically consists of repeated thin layers of black iron oxides (magnetite or hematite) alternating with bands of iron-poor shales and cherts – the so-called banded iron formations (SLR, September 2020).

**Table 7-14: General stratigraphic column for the Kalahari manganese field (SLR, September 2020)**

| Supergroup / Group / Subgroup / Formation |                   |                    |                     | Geological Description                        |
|---|-------------------|--------------------|---------------------|---|
| Kalahari Group                            |                   |                    |                     | Kalahari sands, calcrete, clays & gravel beds |
| Kalahari unconformity                     |                   |                    |                     |   |
| Karoo Supergroup                          |                   |                    |                     | Dwyka tillite                                 |
| Dwyka unconformity                        |                   |                    |                     |   |
| Olifantshoek Supergroup                   |                   | Lucknow Formation  |                     | White ortho-quartzite                         |
|   |                   | Mapedi Formation   |                     | Green, maroon and black shales and quartzites |
| Olifantshoek unconformity                 |                   |                    |                     |   |
| Transvaal Supergroup                      | Postmasburg Group | Voelwater Subgroup | Mooidraai Formation | Dolomite, Chert                               |
|   |                   |                    | Hotazel Formation   | Banded ironstone (upper)                      |
|   |                   |                    |                     | Upper Manganese Ore Body                      |
|   |                   |                    |                     | Banded Ironstone (middle)                     |
|   |                   |                    |                     | Middle Manganese Ore Body                     |
|   |                   |                    |                     | Banded Ironstone (middle)                     |
|   |                   |                    |                     | Lower Manganese Ore Body                      |
|   |                   |                    |                     | Banded Ironstone (lower)                      |
|   |                   | Ongeluk Formation  | Andesitic Lava      |   |

#### *Local and operational geology*

The Hotazel Formation is underlain by basaltic lava of the Ongeluk Formation (Transvaal Supergroup) and directly overlain by dolomite of the Mooidraai Formation (Transvaal Supergroup) as shown in Table 7-14.

The Transvaal Supergroup is overlain unconformably by the Olifantshoek Supergroup, which consists of arenaceous sediments, typically interbedded shale, quartzite and lavas overlain by coarser quartzite and shale. The different formations include the Mapedi and Lucknow units. The whole Supergroup has been deformed into a succession with an east-verging dip.

The Olifantshoek Supergroup is overlain by Dwyka Formation, which forms the basal part of the Karoo Supergroup. This consists of tillite (diamictite), which is covered by sands, claystone and calcrete of the Kalahari Group.

MMT is exploiting the manganese from the banded iron stones of the Hotazel Formation. The ore is contained within a 30 to 45 m thick mineralised zone which occurs along the entire extent of MMT and is made up of three manganese rich zones, namely the Upper Manganese Ore Body (UMO), the Middle Manganese Ore Body (MMO) and the Lower Manganese Ore Body (LMO). The UMO is 10 cm to 15 cm thick and comprises moderate deposits of manganese. The poorly mineralised MMO is approximately 1 m thick and not economically viable. The LMO is highly mineralised and makes up the bulk of the ore body. The ore layer dips gradually to the north-west at approximately five degrees.

### *Aquifer characterisation*

Four aquifer units occur in the region, namely the Ongeluk, Hotazel, Mooidraai, and Kalahari Formations. These formations are described as follows:

- **The Ongeluk Formation:** Older geological formation, the aquifer is primarily associated with weathered horizons and zones adjacent to regional scale structures, although the aquifer is generally not favoured as a potential water supply source because of its low yield characteristics;
- **Hotazel Formation:** Typically have higher yields with the groundwater stored in voids that developed following bed separation, within faults and periphery fractures, and along the dolerite dykes that have partially filled regional faults. The high number of dykes and fractures interpreted for the site suggest vertical hydraulic connection throughout much of the formation above an intrusive sill, with horizontal interconnection provided along bedding planes. The higher aquifer yields are associated with the preferentially fractured, brittle Banded Iron Formation adjacent to regional faults. With increasing depth, however, the Hotazel Formation aquifer can be confined, particularly when the overlying Kalahari Formation contains thick inter-beds of highly plastic red clay as observed along the southern edge of the MMT property;
- **Mooidraai Formation:** A dolomitic aquifer occurring in the southwest of the MMT in the vicinity of the now-derelict Middelplaats Mine. This aquifer is of significance locally due to its high yielding characteristics (>10 L/s); and
- **Kalahari Formation:** On a regional scale the Kalahari Formation behaves as a semi-confined aquifer, which is hydraulically connected with aquifers in underlying formations at those sites where extensive red clay or clay-bearing Dwyka Formation beds are absent. While the aquifer is generally more porous than other site aquifers, characteristics of the aquifer vary from site to site. Yields vary significantly spatially. A paleochannel deposit has been identified to the north of the MMT pit, containing significant quantities of groundwater, however this aquifer contains high nitrate concentrations and therefore it cannot be classed as an important groundwater resource.

With reference to the above list, aquifers underlying the MMT include the Hotazel and Kalahari formations. The Aquifer Classification Map of South Africa (DWS, 1999) indicates that the local aquifer at MMT is classified as minor (poor). A minor aquifer is described as a moderately-yielding aquifer system of variable water quality.

### *Regional recharge*

MMT lies within a semi-arid climate and has a relatively thick unsaturated zone (>25m deep on average) which is not conducive to active recharge. GHT (GHT, August 2018) therefore calculated regional recharge to be between 1% and 4% of the average annual rainfall. Groundwater is estimated to be up to 25,000 years old in deeper, confined aquifers, although surficial unconfined/semi-confined aquifers have been recharged in recent time. The aquifers at the MMT are believed to be recharged directly from rainfall, through the relatively permeable Kalahari Formation.

### *Geological lineaments*

Geological lineaments such as faults and dykes can act as preferential flow paths of groundwater. Various intrusive dolerite sills and dykes have intruded the Hotazel Formation which are relatively impermeable and create groundwater compartments regionally.

### *Groundwater flow*

The direction of groundwater flow is towards the north-west.



### *Groundwater use and levels*

GHT undertook a hydrocensus of privately-owned or third-party boreholes on three separate occasions, and the most recent hydrocensus was carried out in the broader area in 2018. A total of 41 third-party boreholes were identified. The 2018 hydrocensus of third-party boreholes included boreholes located between a 1 km and 15 km radius from the MMT. Results of the hydrocensus indicate that water levels ranged between 18 and 74 metres below ground level and are used for domestic use and livestock watering. This however applies to a radius of 15 km from the MMT. Third parties known to reside in close proximity to the MMT primarily utilise groundwater for livestock watering purposes only. Third-party drinking water is obtained from the Vaal Gamagara Pipeline.

### *Background groundwater quality*

The results, tabulated in Table 7-15 and Table 7-16, of the 2018 hydrocensus (GHT, August 2018) as documented by GHT includes:

- 25 of the boreholes sampled were unsuitable for lifetime human consumption in terms of SANS 241:2015 due to elevated concentrations of EC, Na, Cl, nitrite ( $\text{NO}_3\text{-N}$ ) and  $\text{NO}_3\text{-N}$ , iron (Fe) and Mn;
- The 2018 water quality results exceed the Water Quality Resource Objectives (WQROs) in 32 of the 41 boreholes sampled, for the following parameters: pH, Na, Calcium Ca, Mg, Cl,  $\text{SO}_4$ , Fluoride (F),  $\text{NO}_3\text{-N}$  and T.Alk.

The 2002 and 2005 hydrocensus water quality data shows elevated concentrations of EC, Na, Cl,  $\text{SO}_4$ , and  $\text{NO}_3\text{-N}$  which resulted in 48 out of 80 samples being unfit for lifetime human consumption in terms of SANS241:2015. GHT compared the background groundwater quality derived from the hydrocensus water quality sampling to that of the mine monitoring boreholes and found that EC, Na, Ca,  $\text{SO}_4$  and  $\text{NO}_3\text{-N}$  concentrations were higher at the MMT. With regard to  $\text{NO}_3\text{-N}$  concentrations, it should be noted that naturally occurring  $\text{NO}_3\text{-N}$  levels exceed the SANS241-1:2015 standard.

The hydrocensus undertaken by GHT does not compare water quality results against livestock watering limits. Given that groundwater is utilised for livestock watering purposes, SLR compared the 2018 hydrocensus results against the Department of Water Affairs and Forestry (DWAF): Target Water Quality Guideline (TWQG) for livestock watering (Table 7-16). The results conclude that in general groundwater had elevated concentrations of TDS and  $\text{NO}_3\text{-N}$  above the DWS Livestock Watering limits. TDS concentrations ranging between 1 000 mg/L – 2 000 mg/L is safe for sheep, beef, and horse consumption, however dairy animals, pigs, and poultry may show a reluctance of water intake. TDS concentrations ranging between 2 000 mg/L – 3 000 mg/L is safe for sheep consumption; however, beef and horses may show a reluctance of water intake. TDS concentrations above 3 000 mg/L will show a reluctance of water intake for all livestock but are unlikely to have significant detrimental effects. Elevated concentrations of  $\text{NO}_3\text{-N}$  are likely to be tolerated by cattle, sheep and goats without significant detrimental effects if feed concentration is normal, there is adequate carbohydrate intake; and exposure is short term. The hydrocensus results compared to the mine monitoring boreholes found that TDS and  $\text{NO}_3\text{-N}$  are higher at MMT.

**Table 7-15: Hydrocensus undertaken in 2018 water quality results (SLR, April 2020)**

| Borehole ID           |         | Date       | Quality   | pH   | EC      | TDS   | Na     | Ca      | Mg     | K     | Cl      | SO <sub>4</sub> | SO <sub>4</sub> (Ae) | F    | NO <sub>2</sub> -N | NO <sub>3</sub> -N | NH <sub>3</sub> -N/ NH4-N (Ae) | PO <sub>4</sub> | T.ALK   | T.Hard  | Fe   | Fe (Ae) | B    | Mn   | Mn (Ae) | Ionbal |
|-----------------------|---------|------------|-----------|------|---------|-------|--------|---------|--------|-------|---------|-----------------|----------------------|------|--------------------|--------------------|--------------------------------|-----------------|---------|---------|------|---------|------|------|---------|--------|
|                       |         |            | Class     | mS/m | mg/L    | mg/L  | mg/L   | mg/L    | mg/L   | mg/L  | mg/L    | mg/L            | mg/L                 | mg/L | mg/L               | mg/L               | mg/L                           | mg/L            | mg/L    | mg/L    | mg/L | mg/L    | mg/L | mg/L | mg/L    | mg/L   |
| HMM Hydrocensus Study | BH01    | 2018/07/16 | "ARS"     | 7.9  | 146.00  | 867   | 68.40  | 115.00  | 74.50  | 11.60 | 183.00  | 47.90           | 47.90                | 0.09 | 0.01               | 38.50              | 0.45                           | 0.03            | 325.00  | 593.95  | 0.01 | 0.01    | 0.22 | 0.01 | 0.01    | -0.27  |
|                       | HF/BH02 | 2018/07/16 | "ARS"     | 8.15 | 110.00  | 644   | 52.40  | 93.90   | 47.90  | 9.96  | 101.00  | 48.30           | 48.30                | 0.09 | 0.49               | 33.01              | 0.45                           | 0.03            | 237.00  | 431.72  | 0.01 | 0.01    | 0.12 | 0.01 | 0.01    | 0.22   |
|                       | HF/BH03 | 2018/07/17 | "Class 1" | 7.37 | 117.00  | 635   | 39.30  | 81.70   | 85.30  | 2.88  | 103.00  | 60.85           | 60.85                | 0.09 | 0.01               | 6.50               | 0.45                           | 0.03            | 387.60  | 555.27  | 0.01 | 0.01    | 0.06 | 0.01 | 0.01    | 0.54   |
|                       | HF/BH04 | 2018/07/17 | "Class 1" | 8.16 | 74.00   | 363   | 78.30  | 14.64   | 31.00  | 3.94  | 142.66  | 1.79            | 1.79                 | 0.42 | 0.01               | 0.35               | 0.45                           | 0.03            | 148.00  | 164.2   | 0.12 | 0.12    | 0.23 | 0.02 | 0.02    | -0.29  |
|                       | HF/BH05 | 2018/07/17 | "ARS"     | 7.56 | 353.00  | 1891  | 206.59 | 121.23  | 191.17 | 38.90 | 886.00  | 125.00          | 125.00               | 0.09 | 1.83               | 48.67              | 8.88                           | 0.03            | 144.00  | 1089.94 | 1.19 | 1.19    | 0.38 | 0.20 | 0.20    | -1.63  |
|                       | HF/BH06 | 2018/07/17 | "Class 1" | 7.84 | 134.00  | 741   | 70.20  | 96.30   | 78.50  | 11.10 | 139.00  | 73.00           | 73.00                | 0.16 | 0.01               | 5.60               | 0.45                           | 0.03            | 412.00  | 563.72  | 0.01 | 0.01    | 0.22 | 0.01 | 0.01    | 0.53   |
|                       | HF/BH07 | 2018/07/20 | "Class 1" | 7.71 | 108.00  | 572   | 42.30  | 50.00   | 85.80  | 4.72  | 88.32   | 13.70           | 13.70                | 0.09 | 0.01               | 0.35               | 5.51                           | 0.03            | 465.00  | 478.17  | 0.96 | 0.96    | 0.06 | 0.07 | 0.07    | -0.06  |
|                       | HF/BH08 | 2018/07/20 | "Class 1" | 7.54 | 94.80   | 532   | 45.50  | 69.20   | 51.60  | 10.80 | 97.70   | 30.00           | 30.00                | 0.15 | 0.01               | 0.35               | 2.59                           | 0.03            | 371.00  | 385.28  | 0.75 | 0.75    | 0.14 | 0.11 | 0.11    | -0.61  |
|                       | HF/BH10 | 2018/07/18 | "ARS"     | 7.24 | 69.50   | 399   | 46.70  | 55.50   | 28.20  | 6.80  | 36.50   | 37.80           | 37.80                | 0.24 | 0.01               | 7.17               | 0.45                           | 0.03            | 258.00  | 254.71  | 0.01 | 0.01    | 0.10 | 0.01 | 0.01    | -0.19  |
|                       | HF/BH11 | 2018/07/17 | "Class 1" | 7.51 | 86.60   | 503   | 48.70  | 71.70   | 35.90  | 8.47  | 95.90   | 40.30           | 40.30                | 0.09 | 0.01               | 13.00              | 0.45                           | 0.03            | 239.00  | 326.87  | 0.05 | 0.05    | 0.13 | 0.01 | 0.01    | -0.35  |
|                       | HF/BH12 | 2018/07/17 | "ARS"     | 8.16 | 292.00  | 1464  | 113.72 | 6.58    | 12.80  | 61.72 | 171.00  | 27.10           | 27.10                | 0.21 | 0.01               | 0.35               | 285.00                         | 1.30            | 1160.00 | 69.14   | 1.67 | 1.67    | 0.44 | 0.01 | 0.01    | -0.43  |
|                       | HF/BH13 | 2018/07/18 | "ARS"     | 7.55 | 111.00  | 640   | 55.80  | 90.80   | 48.20  | 11.30 | 163.00  | 48.30           | 48.30                | 0.09 | 0.01               | 11.70              | 3.65                           | 0.03            | 274.00  | 425.22  | 1.40 | 1.40    | 0.17 | 0.05 | 0.05    | -0.38  |
|                       | HF/BH14 | 2018/07/18 | "ARS"     | 7.54 | 117.00  | 656   | 66.10  | 88.90   | 48.70  | 11.40 | 193.00  | 47.30           | 47.30                | 0.09 | 0.01               | 9.37               | 0.45                           | 0.03            | 263.00  | 422.53  | 0.01 | 0.01    | 0.20 | 0.01 | 0.01    | -0.78  |
|                       | HF/BH15 | 2018/07/18 | "Class 1" | 7.89 | 68.50   | 400   | 55.40  | 48.60   | 25.40  | 9.96  | 33.60   | 36.30           | 36.30                | 0.34 | 0.02               | 7.47               | 0.45                           | 0.03            | 261.00  | 225.95  | 0.07 | 0.07    | 0.20 | 0.01 | 0.01    | -0.29  |
|                       | HF/BH16 | 2018/07/18 | "Class 1" | 7.46 | 120.00  | 758   | 68.70  | 105.00  | 53.70  | 12.40 | 71.60   | 161.00          | 161.00               | 0.09 | 0.01               | 22.30              | 0.45                           | 0.03            | 310.00  | 483.32  | 0.01 | 0.01    | 0.18 | 0.01 | 0.01    | -0.18  |
|                       | HF/BH17 | 2018/07/19 | "ARS"     | 7.12 | 1273.00 | 10689 | 128.00 | 1979.00 | 466.00 | 4.90  | 1371.00 | 38.00           | 38.00                | 0.09 | 0.24               | 1474.00            | 1.24                           | 0.03            | 281.00  | 6860.55 | 0.11 | 0.11    | 0.32 | 0.08 | 0.08    | -7.37  |
|                       | HF/BH19 | 2018/07/19 | "ARS"     | 7.65 | 441.00  | 2955  | 136.00 | 326.00  | 301.00 | 5.62  | 739.00  | 47.90           | 47.90                | 0.09 | 0.01               | 278.00             | 0.45                           | 0.03            | 278.00  | 2053.54 | 0.02 | 0.02    | 0.36 | 0.01 | 0.01    | -0.13  |
|                       | HF/BH21 | 2018/07/19 | "ARS"     | 7.64 | 232.00  | 1474  | 78.60  | 192.00  | 149.00 | 2.17  | 357.00  | 75.30           | 75.30                | 0.20 | 0.01               | 87.40              | 0.45                           | 0.03            | 385.00  | 1093.01 | 0.02 | 0.02    | 0.32 | 0.01 | 0.01    | -0.26  |
|                       | HF/BH22 | 2018/07/16 | "ARS"     | 7.57 | 117.00  | 699   | 42.90  | 111.00  | 63.70  | 2.24  | 96.20   | 48.00           | 48.00                | 0.21 | 0.01               | 18.00              | 0.45                           | 0.03            | 424.00  | 539.48  | 0.02 | 0.02    | 0.15 | 0.01 | 0.01    | -0.76  |
|                       | HF/BH23 | 2018/07/17 | "ARS"     | 7.53 | 117.00  | 681   | 43.20  | 112.00  | 64.80  | 2.28  | 96.20   | 32.70           | 32.70                | 0.20 | 0.01               | 17.80              | 0.45                           | 0.03            | 417.00  | 546.51  | 0.01 | 0.01    | 0.16 | 0.01 | 0.01    | -0.13  |
|                       | HF/BH24 | 2018/07/17 | "ARS"     | 7.48 | 103.00  | 592   | 60.70  | 85.90   | 57.10  | 0.62  | 67.70   | 63.88           | 63.88                | 0.20 | 0.12               | 5.12               | 0.45                           | 0.16            | 384.00  | 449.63  | 0.18 | 0.18    | 0.47 | 0.22 | 0.22    | 0.35   |
|                       | HF/BH25 | 2018/07/17 | "ARS"     | 7.84 | 142.00  | 835   | 42.90  | 142.00  | 79.80  | 0.27  | 100.00  | 72.79           | 72.79                | 0.34 | 0.13               | 36.19              | 0.45                           | 0.03            | 392.00  | 683.19  | 0.01 | 0.01    | 0.25 | 0.01 | 0.01    | 0.78   |
|                       | HF/BH26 | 2018/07/17 | "ARS"     | 7.38 | 166.00  | 972   | 71.40  | 146.00  | 77.50  | 2.37  | 206.96  | 55.50           | 55.50                | 0.29 | 0.01               | 45.62              | 0.45                           | 0.46            | 346.00  | 683.71  | 0.01 | 0.01    | 0.25 | 0.01 | 0.01    | -0.41  |
|                       | HF/BH28 | 2018/07/18 | "ARS"     | 8.65 | 204.00  | 1183  | 107.00 | 74.10   | 132.00 | 4.34  | 351.67  | 48.52           | 48.52                | 0.09 | 1.64               | 85.22              | 0.45                           | 0.10            | 136.00  | 728.60  | 0.01 | 0.01    | 0.26 | 0.01 | 0.01    | -0.43  |
|                       | HF/BH29 | 2018/07/18 | "ARS"     | 7.59 | 105.00  | 601   | 37.00  | 106.00  | 57.70  | 2.19  | 74.31   | 35.74           | 35.74                | 0.10 | 0.01               | 14.41              | 0.45                           | 0.08            | 372.00  | 502.29  | 0.08 | 0.08    | 0.14 | 0.01 | 0.01    | 0.41   |
|                       | HF/BH30 | 2018/07/19 | "Class 1" | 8.24 | 73.40   | 420   | 14.70  | 74.80   | 48.70  | 1.62  | 32.92   | 29.00           | 29.00                | 0.14 | 0.07               | 5.49               | 0.45                           | 0.03            | 322.00  | 387.32  | 0.01 | 0.01    | 0.05 | 0.01 | 0.01    | 0.09   |
|                       | HF/BH32 | 2018/07/19 | "ARS"     | 7.68 | 405.00  | 2634  | 70.00  | 426.00  | 220.00 | 5.89  | 776.00  | 46.32           | 46.32                | 0.09 | 0.61               | 209.39             | 0.45                           | 0.03            | 266.00  | 1969.68 | 0.03 | 0.03    | 0.10 | 0.01 | 0.01    | -0.60  |
|                       | HF/BH33 | 2018/07/19 | "ARS"     | 7.57 | 284.00  | 1791  | 157.00 | 153.00  | 192.00 | 9.25  | 452.00  | 105.11          | 105.11               | 0.09 | 0.01               | 107.36             | 0.45                           | 0.03            | 406.00  | 1172.70 | 0.01 | 0.01    | 0.80 | 0.01 | 0.01    | -0.26  |
|                       | HF/BH34 | 2018/07/18 | "ARS"     | 7.7  | 141.00  | 795   | 80.30  | 98.00   | 83.00  | 6.54  | 124.07  | 99.71           | 99.71                | 0.35 | 0.01               | 9.81               | 0.45                           | 0.03            | 429.00  | 586.5   | 0.01 | 0.01    | 0.44 | 0.01 | 0.01    | 0.51   |
|                       | HF/BH35 | 2018/07/18 | "ARS"     | 7.39 | 149.00  | 841   | 89.00  | 102.00  | 85.90  | 6.66  | 139.00  | 113.00          | 113.00               | 0.36 | 0.01               | 10.70              | 0.45                           | 0.03            | 426.00  | 608.43  | 0.01 | 0.01    | 0.47 | 0.01 | 0.01    | 0.63   |
|                       | HF/BH36 | 2018/07/18 | "ARS"     | 7.54 | 155.00  | 832   | 303.06 | 3.62    | 4.16   | 3.74  | 180.56  | 62.63           | 62.63                | 0.50 | 0.01               | 11.14              | 0.45                           | 0.03            | 371.20  | 26.17   | 0.01 | 0.01    | 0.38 | 0.01 | 0.01    | -0.95  |
|                       | HF/BH37 | 2018/07/18 | "ARS"     | 7.34 | 300.00  | 1594  | 144.00 | 247.00  | 142.00 | 11.80 | 717.00  | 134.00          | 134.00               | 0.09 | 0.01               | 1.14               | 0.45                           | 0.03            | 319.00  | 1201.52 | 0.02 | 0.02    | 0.38 | 0.01 | 0.01    | 0.97   |
|                       | HF/BH38 | 2018/07/19 | "ARS"     | 7.53 | 82.10   | 477   | 35.70  | 71.10   | 51.40  | 4.28  | 18.70   | 31.20           | 31.20                | 0.54 | 0.01               | 4.90               | 0.45                           | 0.03            | 402.00  | 389.2   | 0.01 | 0.01    | 0.17 | 0.01 | 0.01    | -0.12  |
|                       | HF/BH39 | 2018/07/19 | "Class 1" | 7.6  | 110.00  | 629   | 79.60  | 77.00   | 57.40  | 6.50  | 61.10   | 28.50           | 28.50                | 0.29 | 0.01               | 9.56               | 0.45                           | 0.03            | 458.00  | 428.64  | 0.01 | 0.01    | 0.40 | 0.01 | 0.01    | 0.03   |
|                       | HF/BH40 | 2018/07/19 | "Class 1" | 8.93 | 98.60   | 504   | 166.52 | 5.94    | 12.51  | 2.21  | 225.31  | 4.67            | 4.67                 | 1.40 | 0.01               | 0.35               | 0.45                           | 0.03            | 117.40  | 66.33   | 0.23 | 0.23    | 3.66 | 0.01 | 0.01    | -0.64  |
|                       | HF/BH41 | 2018/07/19 | "ARS"     | 7.65 | 81.60   | 469   | 36.70  | 67.20   | 49.30  | 5.22  | 39.00   | 34.30           | 34.30                | 0.60 | 0.01               | 6.34               | 0.45                           | 0.03            | 346.00  | 370.82  | 0.12 | 0.12    | 0.23 | 0.01 | 0.01    | -0.05  |

**SABS South Africa National Standard: Drinking Water, SANS 2411:2015 Edition 2**

|         |   |
|---------|---|
| Class 1 | Recommended standard limit- Suitable for lifetime use                       |
| ARS     | Above recommended standard limit- Unsuitable for lifetime human consumption |

**SABS South Africa National Standard: Drinking Water, SANS 241:2006 Edition 6.1**

|         |  |
|---------|--|
| Class 1 | Recommended operational limit - Suitable for lifetime use        |
| Class 2 | Maximum allowable limit - Suitable for limited duration use only |
| AMA     | Above maximum allowable limit - Unsuitable for human consumption |

\* (Ae) Aesthetic standards.

**Table 7-16: Hydrocensus undertaken in 2018 results in term of DWS WQRO (SLR, April 2020)**

| Site Name             | Date    | pH         | EC mS/m | Na mg/L | Ca mg/L | Mg mg/L | Cl mg/L | SO <sub>4</sub> mg/L | F mg/L | NO <sub>3</sub> -N mg/L | T.ALK mg/L |
|-----------------------|---------|------------|---------|---------|---------|---------|---------|----------------------|--------|-------------------------|------------|
| HMM Hydrocensus Study | HF/BH01 | 2018/07/16 | 7.90    | 146.00  | 68.40   | 115.00  | 74.50   | 183.00               | 47.90  | 0.09                    | 325.00     |
|                       | HF/BH02 | 2018/07/16 | 8.15    | 110.00  | 52.40   | 93.90   | 47.90   | 101.00               | 48.30  | 0.09                    | 237.00     |
|                       | HF/BH03 | 2018/07/17 | 7.37    | 117.00  | 39.30   | 81.70   | 85.30   | 103.00               | 60.85  | 0.09                    | 387.60     |
|                       | HF/BH04 | 2018/07/17 | 8.16    | 74.00   | 78.30   | 14.64   | 31.00   | 142.66               | 1.79   | 0.42                    | 148.00     |
|                       | HF/BH05 | 2018/07/17 | 7.56    | 353.00  | 206.59  | 121.23  | 191.17  | 886.00               | 125.00 | 0.09                    | 144.00     |
|                       | HF/BH06 | 2018/07/17 | 7.84    | 134.00  | 70.20   | 96.30   | 78.50   | 139.00               | 73.00  | 0.16                    | 412.00     |

| Site Name             |         | Date       | pH   | EC<br>mS/m | Na<br>mg/L | Ca<br>mg/L | Mg<br>mg/L | Cl<br>mg/L | SO <sub>4</sub><br>mg/L | F<br>mg/L | NO <sub>3</sub> -N<br>mg/L | T.ALK<br>mg/L |
|-----------------------|---------|------------|------|------------|------------|------------|------------|------------|-------------------------|-----------|----------------------------|---------------|
| HMM Hydrocensus Study | HF/BH07 | 2018/07/20 | 7.71 | 108.00     | 42.30      | 50.00      | 85.80      | 88.32      | 13.70                   | 0.09      | 0.35                       | 465.00        |
|                       | HF/BH08 | 2018/07/20 | 7.54 | 94.80      | 45.50      | 69.20      | 51.60      | 97.70      | 30.00                   | 0.15      | 0.35                       | 371.00        |
|                       | HF/BH10 | 2018/07/18 | 7.24 | 69.50      | 46.70      | 55.50      | 28.20      | 36.50      | 37.80                   | 0.24      | 7.17                       | 258.00        |
|                       | HF/BH11 | 2018/07/17 | 7.51 | 86.60      | 48.70      | 71.70      | 35.90      | 95.90      | 40.30                   | 0.09      | 13.00                      | 239.00        |
|                       | HF/BH12 | 2018/07/17 | 8.16 | 292.00     | 113.72     | 6.58       | 12.80      | 171.00     | 27.10                   | 0.21      | 0.35                       | 1160.00       |
|                       | HF/BH13 | 2018/07/18 | 7.55 | 111.00     | 55.80      | 90.80      | 48.20      | 163.00     | 48.30                   | 0.09      | 11.70                      | 274.00        |
|                       | HF/BH14 | 2018/07/18 | 7.54 | 117.00     | 66.10      | 88.90      | 48.70      | 193.00     | 47.30                   | 0.09      | 9.37                       | 263.00        |
|                       | HF/BH15 | 2018/07/18 | 7.89 | 68.50      | 55.40      | 48.60      | 25.40      | 33.60      | 36.30                   | 0.34      | 7.47                       | 261.00        |
|                       | HF/BH16 | 2018/07/18 | 7.46 | 120.00     | 68.70      | 105.00     | 53.70      | 71.60      | 161.00                  | 0.09      | 22.30                      | 310.00        |
|                       | HF/BH17 | 2018/07/19 | 7.12 | 1273.00    | 128.00     | 1979.00    | 466.00     | 1371.00    | 38.00                   | 0.09      | 1474.00                    | 281.00        |
|                       | HF/BH19 | 2018/07/19 | 7.65 | 441.00     | 136.00     | 326.00     | 301.00     | 739.00     | 47.90                   | 0.09      | 278.00                     | 278.00        |
|                       | HF/BH21 | 2018/07/19 | 7.64 | 232.00     | 78.60      | 192.00     | 149.00     | 357.00     | 75.30                   | 0.20      | 87.40                      | 385.00        |
|                       | HF/BH22 | 2018/07/16 | 7.57 | 117.00     | 42.90      | 111.00     | 63.70      | 96.20      | 48.00                   | 0.21      | 18.00                      | 424.00        |
|                       | HF/BH23 | 2018/07/17 | 7.53 | 117.00     | 43.20      | 112.00     | 64.80      | 96.20      | 32.70                   | 0.20      | 17.80                      | 417.00        |
|                       | HF/BH24 | 2018/07/17 | 7.48 | 103.00     | 60.70      | 85.90      | 57.10      | 67.70      | 63.88                   | 0.20      | 5.12                       | 384.00        |
|                       | HF/BH25 | 2018/07/17 | 7.84 | 142.00     | 42.90      | 142.00     | 79.80      | 100.00     | 72.79                   | 0.34      | 36.19                      | 392.00        |
|                       | HF/BH26 | 2018/07/17 | 7.38 | 166.00     | 71.40      | 146.00     | 77.50      | 206.96     | 55.50                   | 0.29      | 45.62                      | 346.00        |
|                       | HF/BH28 | 2018/07/18 | 8.65 | 204.00     | 107.00     | 74.10      | 132.00     | 351.67     | 48.52                   | 0.09      | 85.22                      | 136.00        |
|                       | HF/BH29 | 2018/07/18 | 7.59 | 105.00     | 37.00      | 106.00     | 57.70      | 74.31      | 35.74                   | 0.10      | 14.41                      | 372.00        |
|                       | HF/BH30 | 2018/07/19 | 8.24 | 73.40      | 14.70      | 74.80      | 48.70      | 32.92      | 29.00                   | 0.14      | 5.49                       | 322.00        |
|                       | HF/BH32 | 2018/07/19 | 7.68 | 405.00     | 70.00      | 426.00     | 220.00     | 776.00     | 46.32                   | 0.09      | 209.39                     | 266.00        |
|                       | HF/BH33 | 2018/07/19 | 7.57 | 284.00     | 157.00     | 153.00     | 192.00     | 452.00     | 105.11                  | 0.09      | 107.36                     | 406.00        |
|                       | HF/BH34 | 2018/07/18 | 7.70 | 141.00     | 80.30      | 98.00      | 83.00      | 124.07     | 99.71                   | 0.35      | 9.81                       | 429.00        |
|                       | HF/BH35 | 2018/07/18 | 7.39 | 149.00     | 89.00      | 102.00     | 85.90      | 139.00     | 113.00                  | 0.36      | 10.70                      | 426.00        |
|                       | HF/BH36 | 2018/07/18 | 7.54 | 155.00     | 303.06     | 3.62       | 4.16       | 180.56     | 62.63                   | 0.50      | 11.14                      | 371.20        |
|                       | HF/BH37 | 2018/07/18 | 7.34 | 300.00     | 144.00     | 247.00     | 142.00     | 717.00     | 134.00                  | 0.09      | 1.14                       | 319.00        |
|                       | HF/BH38 | 2018/07/19 | 7.53 | 82.10      | 35.70      | 71.10      | 51.40      | 18.70      | 31.20                   | 0.54      | 4.90                       | 402.00        |
|                       | HF/BH39 | 2018/07/19 | 7.60 | 110.00     | 79.60      | 77.00      | 57.40      | 61.10      | 28.50                   | 0.29      | 9.56                       | 458.00        |
|                       | HF/BH40 | 2018/07/19 | 8.93 | 98.60      | 166.52     | 5.94       | 12.51      | 225.31     | 4.67                    | 1.40      | 0.35                       | 117.40        |
|                       | HF/BH41 | 2018/07/19 | 7.65 | 81.60      | 36.70      | 67.20      | 49.30      | 39.00      | 34.30                   | 0.60      | 6.34                       | 346.00        |

#### DWS WRWS

|           |                                  |
|-----------|----------------------------------|
| Below RQO | Below Resource Quality Objective |
| Above RQO | Above Resource Quality Objective |

Table 7-17: Hydrocensus undertaken in 2018 results in term of livestock watering limits

| Borehole ID           |         |            | Date | pH   | EC      | TDS    | Na     | Ca     | Mg    | K      | Cl    | SO <sub>4</sub> | SO <sub>4</sub> (Ae) | F    | NO <sub>2</sub> -N | NO <sub>3</sub> -N | NH <sub>3</sub> -N/ NH <sub>4</sub> -N (Ae) | PO <sub>4</sub> | T <sub>ALK</sub> | T <sub>Hard</sub> | Fe   | Fe (Ae) | B    | Mn   | Mn (Ae) | Ionbal |
|-----------------------|---------|------------|------|------|---------|--------|--------|--------|-------|--------|-------|-----------------|----------------------|------|--------------------|--------------------|---|-----------------|------------------|-------------------|------|---------|------|------|---------|--------|
|                       |         |            |      | mS/m | mg/L    | mg/L   | mg/L   | mg/L   | mg/L  | mg/L   | mg/L  | mg/L            | mg/L                 | mg/L | mg/L               | mg/L               | mg/L  | mg/L            | mg/L             | mg/L              | mg/L | mg/L    | mg/L | mg/L | mg/L    | %      |
| Livestock Limits      |         |            |      | -    | -       | 1000   | 2000   | 1000   | 500   | -      | 1500  |                 | 1000                 | 2    |                    | 100                | -   | -               | -                | -                 | 10   | -       | -    | 10   | -       | -      |
| HMM Hydrocensus Study | HF/BH01 | 2018/07/16 | 7.9  | 146  | 867.00  | 68.4   | 115    | 74.5   | 11.6  | 183    | 47.9  | 47.9            | 0.09                 | 0.01 | 38.5               | 0.45               | 0.03  | 325             | 593.95           | 0.01              | 0.01 | 0.22    | 0.01 | 0.01 | -0.27   |        |
|                       | HF/BH02 | 2018/07/16 | 8.15 | 110  | 644.00  | 52.4   | 93.9   | 47.9   | 9.96  | 101    | 48.3  | 48.3            | 0.09                 | 0.49 | 33.01              | 0.45               | 0.03  | 237             | 431.72           | 0.01              | 0.01 | 0.12    | 0.01 | 0.01 | 0.22    |        |
|                       | HF/BH03 | 2018/07/17 | 7.37 | 117  | 635.00  | 39.3   | 81.7   | 85.3   | 2.88  | 103    | 60.85 | 60.85           | 0.09                 | 0.01 | 6.5                | 0.45               | 0.03  | 387.6           | 555.27           | 0.01              | 0.01 | 0.06    | 0.01 | 0.01 | 0.54    |        |
|                       | HF/BH04 | 2018/07/17 | 8.16 | 74   | 363.00  | 78.3   | 14.64  | 31     | 3.94  | 142.66 | 1.79  | 1.79            | 0.42                 | 0.01 | 0.35               | 0.45               | 0.03  | 148             | 164.2            | 0.12              | 0.12 | 0.23    | 0.02 | 0.02 | -0.29   |        |
|                       | HF/BH05 | 2018/07/17 | 7.56 | 353  | 1891.00 | 206.59 | 121.23 | 191.17 | 38.9  | 886    | 125   | 125             | 0.09                 | 1.83 | 48.67              | 8.88               | 0.03  | 144             | 1089.94          | 1.19              | 1.19 | 0.38    | 0.2  | 0.2  | -1.63   |        |
|                       | HF/BH06 | 2018/07/17 | 7.84 | 134  | 741.00  | 70.2   | 96.3   | 78.5   | 11.1  | 139    | 73    | 73              | 0.16                 | 0.01 | 5.6                | 0.45               | 0.03  | 412             | 563.72           | 0.01              | 0.01 | 0.22    | 0.01 | 0.01 | 0.53    |        |
|                       | HF/BH07 | 2018/07/20 | 7.71 | 108  | 572.00  | 42.3   | 50     | 85.8   | 4.72  | 88.32  | 13.7  | 13.7            | 0.09                 | 0.01 | 0.35               | 5.51               | 0.03  | 465             | 478.17           | 0.96              | 0.96 | 0.06    | 0.07 | 0.07 | -0.06   |        |
|                       | HF/BH08 | 2018/07/20 | 7.54 | 94.8 | 532.00  | 45.5   | 69.2   | 51.6   | 10.8  | 97.7   | 30    | 30              | 0.15                 | 0.01 | 0.35               | 2.59               | 0.03  | 371             | 385.28           | 0.75              | 0.75 | 0.14    | 0.11 | 0.11 | -0.61   |        |
|                       | HF/BH10 | 2018/07/18 | 7.24 | 69.5 | 399.00  | 46.7   | 55.5   | 28.2   | 6.8   | 36.5   | 37.8  | 37.8            | 0.24                 | 0.01 | 7.17               | 0.45               | 0.03  | 258             | 254.71           | 0.01              | 0.01 | 0.1     | 0.01 | 0.01 | -0.19   |        |
|                       | HF/BH11 | 2018/07/17 | 7.51 | 86.6 | 503.00  | 48.7   | 71.7   | 35.9   | 8.47  | 95.9   | 40.3  | 40.3            | 0.09                 | 0.01 | 13                 | 0.45               | 0.03  | 239             | 326.87           | 0.05              | 0.05 | 0.13    | 0.01 | 0.01 | -0.35   |        |
|                       | HF/BH12 | 2018/07/17 | 8.16 | 292  | 1464.00 | 113.72 | 6.58   | 12.8   | 61.72 | 171    | 27.1  | 27.1            | 0.21                 | 0.01 | 0.35               | 285                | 1.3   | 1160            | 69.14            | 1.67              | 1.67 | 0.44    | 0.01 | 0.01 | -0.43   |        |

| Borehole ID           |         | Date       | pH   | EC   | TDS      | Na     | Ca   | Mg    | K    | Cl     | SO <sub>4</sub> | SO <sub>4</sub> (Ae) | F    | NO <sub>2</sub> -N | NO <sub>3</sub> -N | NH <sub>3</sub> -N/ NH <sub>4</sub> -N (Ae) | PO <sub>4</sub> | T <sub>ALK</sub> | T <sub>Hard</sub> | Fe   | Fe (Ae) | B    | Mn   | Mn (Ae) | Ionbal |
|-----------------------|---------|------------|------|------|----------|--------|------|-------|------|--------|-----------------|----------------------|------|--------------------|--------------------|---|-----------------|------------------|-------------------|------|---------|------|------|---------|--------|
|                       |         |            |      | mS/m | mg/L     | mg/L   | mg/L | mg/L  | mg/L | mg/L   | mg/L            | mg/L                 | mg/L | mg/L               | mg/L               | mg/l  | mg/L            | mg/L             | mg/L              | mg/L | mg/L    | mg/L | mg/L | mg/L    | %      |
| Livestock Limits      |         |            | -    | -    | 1000     | 2000   | 1000 | 500   | -    | 1500   |                 | 1000                 | 2    |                    | 100                | -   | -               | -                | -                 | 10   | -       | -    | 10   | -       | -      |
| HMM Hydrocensus Study | HF/BH13 | 2018/07/18 | 7.55 | 111  | 640.00   | 55.8   | 90.8 | 48.2  | 11.3 | 163    | 48.3            | 48.3                 | 0.09 | 0.01               | 11.7               | 3.65  | 0.03            | 274              | 425.22            | 1.4  | 1.4     | 0.17 | 0.05 | 0.05    | -0.38  |
|                       | HF/BH14 | 2018/07/18 | 7.54 | 117  | 656.00   | 66.1   | 88.9 | 48.7  | 11.4 | 193    | 47.3            | 47.3                 | 0.09 | 0.01               | 9.37               | 0.45  | 0.03            | 263              | 422.53            | 0.01 | 0.01    | 0.2  | 0.01 | 0.01    | -0.78  |
|                       | HF/BH15 | 2018/07/18 | 7.89 | 68.5 | 400.00   | 55.4   | 48.6 | 25.4  | 9.96 | 33.6   | 36.3            | 36.3                 | 0.34 | 0.02               | 7.47               | 0.45  | 0.03            | 261              | 225.95            | 0.07 | 0.07    | 0.2  | 0.01 | 0.01    | -0.29  |
|                       | HF/BH16 | 2018/07/18 | 7.46 | 120  | 758.00   | 68.7   | 105  | 53.7  | 12.4 | 71.6   | 161             | 161                  | 0.09 | 0.01               | 22.3               | 0.45  | 0.03            | 310              | 483.32            | 0.01 | 0.01    | 0.18 | 0.01 | 0.01    | -0.18  |
|                       | HF/BH17 | 2018/07/19 | 7.12 | 1273 | 10689.00 | 128    | 1979 | 466   | 4.9  | 1371   | 38              | 38                   | 0.09 | 0.24               | 1474               | 1.24  | 0.03            | 281              | 6860.55           | 0.11 | 0.11    | 0.32 | 0.08 | 0.08    | -7.37  |
|                       | HF/BH19 | 2018/07/19 | 7.65 | 441  | 2955.00  | 136    | 326  | 301   | 5.62 | 739    | 47.9            | 47.9                 | 0.09 | 0.01               | 278                | 0.45  | 0.03            | 278              | 2053.54           | 0.02 | 0.02    | 0.36 | 0.01 | 0.01    | -0.13  |
|                       | HF/BH21 | 2018/07/19 | 7.64 | 232  | 1474.00  | 78.6   | 192  | 149   | 2.17 | 357    | 75.3            | 75.3                 | 0.2  | 0.01               | 87.4               | 0.45  | 0.03            | 385              | 1093.01           | 0.02 | 0.02    | 0.32 | 0.01 | 0.01    | -0.26  |
|                       | HF/BH22 | 2018/07/16 | 7.57 | 117  | 699.00   | 42.9   | 111  | 63.7  | 2.24 | 96.2   | 48              | 48                   | 0.21 | 0.01               | 18                 | 0.45  | 0.03            | 424              | 539.48            | 0.02 | 0.02    | 0.15 | 0.01 | 0.01    | -0.76  |
|                       | HF/BH23 | 2018/07/17 | 7.53 | 117  | 681.00   | 43.2   | 112  | 64.8  | 2.28 | 96.2   | 32.7            | 32.7                 | 0.2  | 0.01               | 17.8               | 0.45  | 0.03            | 417              | 546.51            | 0.01 | 0.01    | 0.16 | 0.01 | 0.01    | -0.13  |
|                       | HF/BH24 | 2018/07/17 | 7.48 | 103  | 592.00   | 60.7   | 85.9 | 57.1  | 0.62 | 67.7   | 63.88           | 63.88                | 0.2  | 0.12               | 5.12               | 0.45  | 0.16            | 384              | 449.63            | 0.18 | 0.18    | 0.47 | 0.22 | 0.22    | 0.35   |
|                       | HF/BH25 | 2018/07/17 | 7.84 | 142  | 835.00   | 42.9   | 142  | 79.8  | 0.27 | 100    | 72.79           | 72.79                | 0.34 | 0.13               | 36.19              | 0.45  | 0.03            | 392              | 683.19            | 0.01 | 0.01    | 0.25 | 0.01 | 0.01    | 0.78   |
|                       | HF/BH26 | 2018/07/17 | 7.38 | 166  | 972.00   | 71.4   | 146  | 77.5  | 2.37 | 206.96 | 55.5            | 55.5                 | 0.29 | 0.01               | 45.62              | 0.45  | 0.46            | 346              | 683.71            | 0.01 | 0.01    | 0.25 | 0.01 | 0.01    | -0.41  |
|                       | HF/BH28 | 2018/07/18 | 8.65 | 204  | 1183.00  | 107    | 74.1 | 132   | 4.34 | 351.67 | 48.52           | 48.52                | 0.09 | 1.64               | 85.22              | 0.45  | 0.1             | 136              | 728.6             | 0.01 | 0.01    | 0.26 | 0.01 | 0.01    | -0.43  |
|                       | HF/BH29 | 2018/07/18 | 7.59 | 105  | 601.00   | 37     | 106  | 57.7  | 2.19 | 74.31  | 35.74           | 35.74                | 0.1  | 0.01               | 14.41              | 0.45  | 0.08            | 372              | 502.29            | 0.08 | 0.08    | 0.14 | 0.01 | 0.01    | 0.41   |
|                       | HF/BH30 | 2018/07/19 | 8.24 | 73.4 | 420.00   | 14.7   | 74.8 | 48.7  | 1.62 | 32.92  | 29              | 29                   | 0.14 | 0.07               | 5.49               | 0.45  | 0.03            | 322              | 387.32            | 0.01 | 0.01    | 0.05 | 0.01 | 0.01    | 0.09   |
|                       | HF/BH32 | 2018/07/19 | 7.68 | 405  | 2634.00  | 70     | 426  | 220   | 5.89 | 776    | 46.32           | 46.32                | 0.09 | 0.61               | 209.39             | 0.45  | 0.03            | 266              | 1969.68           | 0.03 | 0.03    | 0.1  | 0.01 | 0.01    | -0.6   |
|                       | HF/BH33 | 2018/07/19 | 7.57 | 284  | 1791.00  | 157    | 153  | 192   | 9.25 | 452    | 105.11          | 105.11               | 0.09 | 0.01               | 107.36             | 0.45  | 0.03            | 406              | 1172.7            | 0.01 | 0.01    | 0.8  | 0.01 | 0.01    | -0.26  |
|                       | HF/BH34 | 2018/07/18 | 7.7  | 141  | 795.00   | 80.3   | 98   | 83    | 6.54 | 124.07 | 99.71           | 99.71                | 0.35 | 0.01               | 9.81               | 0.45  | 0.03            | 429              | 586.5             | 0.01 | 0.01    | 0.44 | 0.01 | 0.01    | 0.51   |
|                       | HF/BH35 | 2018/07/18 | 7.39 | 149  | 841.00   | 89     | 102  | 85.9  | 6.66 | 139    | 113             | 113                  | 0.36 | 0.01               | 10.7               | 0.45  | 0.03            | 426              | 608.43            | 0.01 | 0.01    | 0.47 | 0.01 | 0.01    | 0.63   |
|                       | HF/BH36 | 2018/07/18 | 7.54 | 155  | 832.00   | 303.06 | 3.62 | 4.16  | 3.74 | 180.56 | 62.63           | 62.63                | 0.5  | 0.01               | 11.14              | 0.45  | 0.03            | 371.2            | 26.17             | 0.01 | 0.01    | 0.38 | 0.01 | 0.01    | -0.95  |
|                       | HF/BH37 | 2018/07/18 | 7.34 | 300  | 1594.00  | 144    | 247  | 142   | 11.8 | 717    | 134             | 134                  | 0.09 | 0.01               | 1.14               | 0.45  | 0.03            | 319              | 1201.52           | 0.02 | 0.02    | 0.38 | 0.01 | 0.01    | 0.97   |
|                       | HF/BH38 | 2018/07/19 | 7.53 | 82.1 | 477.00   | 35.7   | 71.1 | 51.4  | 4.28 | 18.7   | 31.2            | 31.2                 | 0.54 | 0.01               | 4.9                | 0.45  | 0.03            | 402              | 389.2             | 0.01 | 0.01    | 0.17 | 0.01 | 0.01    | -0.12  |
|                       | HF/BH39 | 2018/07/19 | 7.6  | 110  | 629.00   | 79.6   | 77   | 57.4  | 6.5  | 61.1   | 28.5            | 28.5                 | 0.29 | 0.01               | 9.56               | 0.45  | 0.03            | 458              | 428.64            | 0.01 | 0.01    | 0.4  | 0.01 | 0.01    | 0.03   |
|                       | HF/BH40 | 2018/07/19 | 8.93 | 98.6 | 504.00   | 166.52 | 5.94 | 12.51 | 2.21 | 225.31 | 4.67            | 4.67                 | 1.4  | 0.01               | 0.35               | 0.45  | 0.03            | 117.4            | 66.33             | 0.23 | 0.23    | 3.66 | 0.01 | 0.01    | -0.64  |
|                       | HF/BH41 | 2018/07/19 | 7.65 | 81.6 | 469.00   | 36.7   | 67.2 | 49.3  | 5.22 | 39     | 34.3            | 34.3                 | 0.6  | 0.01               | 6.34               | 0.45  | 0.03            | 346              | 370.82            | 0.12 | 0.12    | 0.23 | 0.01 | 0.01    | -0.05  |

**Note:** Highlighted cells indicate which water quality standard has been exceeded



### *Groundwater quality at MMT*

Groundwater quality is monitored on a quarterly basis at the monitoring points illustrated in Figure 30-1. All the monitoring points are located within the MMT Mining Right area. The groundwater monitoring programme was implemented in 2004. The GHT report (GHT, January 2020) compares the water quality data against the following guidelines and standards:

- Quality of Domestic Water Supplies Volume 1: Assessment Guide, Second Edition, (1998);
- South African Water Quality Guidelines – Volume 1 Domestic Use (1993 and 1996);
- SANS for drinking water (SANS 241:2015); and
- Water Quality Resource Objectives (WQROs) for the D41K Catchment as specified in the MMT IWUL.

The average groundwater quality results for January 2020 have been summarised and are presented in, Table 7-18 and Table 7-19. The results have been classified into classes, ranging from ideal to totally unacceptable, as shown in the notes below the tables. Key conclusions drawn from the MMT water quality data include (GHT, January 2020):

- Water quality at the monitoring points at MMT has elevated concentrations of Electrical Conductivity (EC), Calcium (Ca), Magnesium (Mg), Chloride (Cl), Sulphate (SO<sub>4</sub>) Nitrate (NO<sub>3</sub>-N), Manganese (Mn) and Boron (B). The water is unsuitable for lifetime human consumption in terms of SANS 241:2015;
- The elevated NO<sub>3</sub>-N concentration has been determined to be of a natural origin, and this was confirmed with two background hydrocensus sampling exercises of private properties around the MMT and further afield (GHT, August 2018). This is thought to be the result of rainfall recharge to the Kalahari Formation mobilizing soil nitrates, particularly at sites that have been overgrazed or stripped of vegetation; and
- The water quality results exceed the DWS WRQOs for the following parameters: EC, Na, Ca, Mg, Cl, SO<sub>4</sub>, NO<sub>3</sub>-N, Fluoride (F) and Total Alkalinity (T.Alk).

The results listed above are consistent with the groundwater monitoring data collected since 2004. In addition to the above, as noted in the GHT August 2018 report, bacteriological sampling of the groundwater underlying the sewage plant indicates that bacteriological contaminants (Total Plate Count and Total Coliform Count) from the sewage plant are impacting on the site aquifer currently (GHT, August 2018). This result is not included in the table below but is applicable to monitoring point JB(MMT)23. Hydrocarbon testing found no hydrocarbon contamination to be present in the north and south pit water or at the MMT workshops (GHT, August 2018).

Table 7-18: Groundwater quality at MMT (2020) (SLR, April 2020)

| Sample ID | Site description                     | Date       | Quality | pH   | EC     | TDS  | Na     | Ca     | Mg     | K     | Cl      | SO <sub>4</sub> | SO <sub>4</sub> (Ae) | F    | NO <sub>2</sub> -N | NO <sub>3</sub> -N | NH <sub>3</sub> -N/ NH4-N (Ae) | PO <sub>4</sub> | T,ALK | Fe    | Fe (Ae) | B     | Mn    | Mn (Ae) |       | Ionbal |
|-----------|--------------------------------------|------------|---------|------|--------|------|--------|--------|--------|-------|---------|-----------------|----------------------|------|--------------------|--------------------|--------------------------------|-----------------|-------|-------|---------|-------|-------|---------|-------|--------|
|           |                                      |            | Class   |      |        |      |        |        |        |       |         |                 |                      |      |                    |                    |                                |                 |       |       |         |       |       |         |       |        |
| JB(GLD)05 | North of MMT pit                     | 2020/01/16 | ARS     | 7.08 | 243.00 | 1466 | 55.70  | 230.00 | 121.00 | 5.31  | 470.91  | 31.20           | 31.20                | 0.09 | 0.01               | 95.40              | 0.45                           | 0.09            | 214   | 0.02  | 0.02    | 0.17  | 0.01  | 0.01    | 0.005 | -2.2   |
| JB(MMT)17 | Sinter plant                         | 2020/01/16 | ARS     | 7.29 | 210.00 | 1679 | 94.97  | 220.00 | 133.11 | 10.32 | 60.40   | 828.00          | 828.00               | 0.21 | 0.01               | 32.80              | 0.45                           | 0.05            | 298   | 0.01  | 0.01    | 1.99  | 0.01  | 0.01    | 0.005 | -1.84  |
| JB(MMT)18 | South of MRA                         | 2020/01/16 | ARS     | 7.43 | 62.00  | 368  | 51.80  | 38.50  | 20.20  | 7.79  | 25.39   | 66.47           | 66.47                | 0.18 | 0.12               | 14.59              | 0.47                           | 0.1             | 148   | 0.01  | 0.01    | 0.54  | 1.12  | 1.12    | 0.005 | -0.38  |
| JB(MMT)19 | Near fuel storage facilities         | 2020/01/16 | ARS     | 8.14 | 308.00 | 2048 | 322.00 | 94.89  | 134.74 | 13.60 | 500.44  | 309.56          | 309.56               | 0.09 | 0.33               | 136.00             | 10.60                          | 0.07            | 86    | 0.04  | 0.04    | 0.89  | 0.03  | 0.03    | 0.005 | -1.89  |
| JB(MMT)20 | Near workshops                       | 2020/01/16 | ARS     | 7.33 | 249.00 | 1829 | 103.00 | 253.63 | 117.00 | 9.12  | 319.00  | 197.00          | 197.00               | 0.24 | 0.01               | 164.00             | 0.45                           | 0.04            | 152   | 0.01  | 0.01    | 2.96  | 0.01  | 0.01    | 0.005 | -2.03  |
| JB(MMT)21 | Explosive yard                       | 2020/01/16 | ARS     | 7.23 | 119.00 | 722  | 45.30  | 95.50  | 65.53  | 4.64  | 75.40   | 60.50           | 60.50                | 0.21 | 0.01               | 39.20              | 0.45                           | 0.17            | 331   | 1.52  | 1.52    | 0.19  | 0.01  | 0.01    | 0.005 | -1.87  |
| JB(MMT)22 | Between and South Pit                | 2020/01/16 | ARS     | 7.07 | 336.00 | 2364 | 86.30  | 333.00 | 182.00 | 8.67  | 495.00  | 84.30           | 84.30                | 0.09 | 0.01               | 228.00             | 0.45                           | 0.03            | 273   | 0.02  | 0.02    | 0.21  | 0.01  | 0.01    | 0.005 | -2.56  |
| JB(MMT)23 | Near Sewage farm                     | 2020/01/16 | ARS     | 7.7  | 159.00 | 1009 | 236.00 | 53.78  | 34.35  | 8.04  | 160.00  | 114.00          | 114.00               | 0.71 | 0.01               | 47.40              | 0.45                           | 0.03            | 316   | 0.03  | 0.03    | 0.61  | 0.01  | 0.01    | 0.005 | -2.22  |
| JB(MMT)24 | Near old, rehabilitated tailings dam | 2020/01/16 | ARS     | 6.93 | 459.00 | 3214 | 121.00 | 509.00 | 305.00 | 15.40 | 1034.00 | 903.00          | 903.00               | 0.34 | 0.01               | 7.30               | 0.45                           | 0.13            | 374   | 5.67  | 5.67    | 15.10 | 3.10  | 3.10    | 0.005 | -0.74  |
| JB(RIS)04 | Northwest of MMT pit                 | 2020/01/16 | ARS     | 7.06 | 251.00 | 765  | 41.90  | 105.00 | 70.00  | 4.55  | 86.20   | 36.50           | 36.50                | 0.14 | 0.01               | 47.30              | 0.45                           | 0.06            | 350   | 0.010 | 0.01    | 0.14  | 0.01  | 0.01    | 0.005 | -2.28  |
| O(MMT)01  |                                      | 2020/01/16 | ARS     | 7.63 | 287.00 | 2145 | 106.00 | 227.14 | 187.00 | 6.61  | 354.00  | 280.00          | 280.00               | 0.64 | 2.82               | 197.00             | 4.88                           | 0.03            | 112   | 0.010 | 0.01    | 6.974 | 0.6   | 0.6     | 0.005 | -1.31  |
| O(MMT)02  | South Pit                            | 2020/01/16 | ARS     | 7.61 | 262    | 1881 | 92.80  | 215.70 | 161.59 | 4.06  | 329.00  | 268.38          | 268.38               | 0.65 | 0.02               | 156.00             | 0.45                           | 0.04            | 155   | 0.010 | 0.010   | 6.120 | 0.010 | 0.010   | 0.005 | -2.50  |
| O(MMT)03  | North Pit                            | 2020/01/16 | ARS     | 8.13 | 235    | 2161 | 85.50  | 254.00 | 205.00 | 6.27  | 568.00  | 112.00          | 112.00               | 0.27 | 0.15               | 193                | 0.45                           | 0.05            | 110   | 0.010 | 0.010   | 3.470 | 0.010 | 0.010   | 0.005 | -1.59  |

Quality of Domestic Water Supplies, DWA&F, Second Edition 1998

|         |   |
|---------|---|
| Class 0 | Ideal water quality- Suitable for lifetime use  |
| Class 1 | Good water quality- Suitable for use, rare instances of negative effects                              |
| Class 2 | Marginal water quality- Conditionally acceptable, Negative effects may occur in some sensitive groups |
| Class 3 | Poor water quality- Unsuitable for use without treatment, Chronic effects may occur                   |
| Class 4 | Dangerous water quality- Totally unsuitable for use, Acute effects may occur                          |

SABS South Africa National Standard: Drinking Water, SANS 2411:2015 Edition 2

|         |   |
|---------|---|
| Class 1 | Recommended standard limit- Suitable for lifetime use                       |
| ARS     | Above recommended standard limit- Unsuitable for lifetime human consumption |

SABS South Africa National Standard: Drinking Water, SANS 241:2006 Edition 6.1

|         |  |
|---------|--|
| Class 1 | Recommended operational limit - Suitable for lifetime use        |
| Class 2 | Maximum allowable limit - Suitable for limited duration use only |
| AMA     | Above maximum allowable limit - Unsuitable for human consumption |

\* (Ae) Aesthetic standards,

South Africa Water Quality Guidelines, Volume 1: Domestic Use, DWA&F, First Edition 1993 & Second Edition 1996

|    |   |
|----|---|
| NR | Target water quality- range No risk   |
| IR | Good water quality- Insignificant risk, Suitable for use, rare instances of negative effects    |
| LR | Marginal water quality- Allowable low risk, Negative effects may occur in some sensitive groups |
| HR | Poor water quality- Unsuitable for use without treatment, Chronic effects may occur             |

**Table 7-19: Mine borehole water quality compliance with WRQOS (2020) (SLR, April 2020)**

| Borehole ID | Date      | pH   | EC<br>mS/m | Na<br>mg/L | Ca<br>mg/L | Mg<br>mg/L | Cl<br>mg/L | SO <sub>4</sub><br>mg/L | F<br>mg/L | NO <sub>3</sub> -N<br>mg/L | T.Alk<br>mg/L |
|-------------|-----------|------|------------|------------|------------|------------|------------|-------------------------|-----------|----------------------------|---------------|
| JB(GLD)05   | 1/16/2020 | 7.08 | 243.00     | 55.70      | 230.00     | 121.00     | 470.91     | 31.20                   | 0.09      | 95.40                      | 214.00        |
| JB(MMT)17   | 1/16/2020 | 7.29 | 210.00     | 94.97      | 220.00     | 133.11     | 60.40      | 828.00                  | 0.21      | 32.80                      | 298.00        |
| JB(MMT)18   | 1/16/2020 | 7.43 | 62.00      | 51.80      | 38.50      | 20.20      | 25.39      | 66.47                   | 0.18      | 14.59                      | 148.00        |
| JB(MMT)19   | 1/16/2020 | 8.14 | 308.00     | 322.00     | 94.89      | 134.74     | 500.44     | 309.56                  | 0.09      | 136.00                     | 86.00         |
| JB(MMT)20   | 1/16/2020 | 7.33 | 249.00     | 103.00     | 253.63     | 117.00     | 319.00     | 197.00                  | 0.24      | 164.00                     | 152.00        |
| JB(MMT)21   | 1/16/2020 | 7.23 | 119.00     | 45.30      | 95.50      | 65.53      | 75.40      | 60.50                   | 0.21      | 39.20                      | 331.00        |
| JB(MMT)22   | 1/16/2020 | 7.07 | 336.00     | 86.30      | 333.00     | 182.00     | 495.00     | 84.30                   | 0.09      | 228.00                     | 273.00        |
| JB(MMT)23   | 1/16/2020 | 7.70 | 159.00     | 236.00     | 53.78      | 34.35      | 160.00     | 114.00                  | 0.71      | 47.40                      | 316.00        |
| JB(MMT)24   | 1/16/2020 | 6.93 | 459.00     | 121.00     | 509.00     | 305.00     | 1034.00    | 903.00                  | 0.34      | 7.30                       | 374.00        |
| JB(RIS)04   | 1/16/2020 | 7.06 | 251.00     | 41.90      | 105.00     | 70.00      | 86.20      | 36.50                   | 0.14      | 47.30                      | 350.00        |

**DWS WRWS**

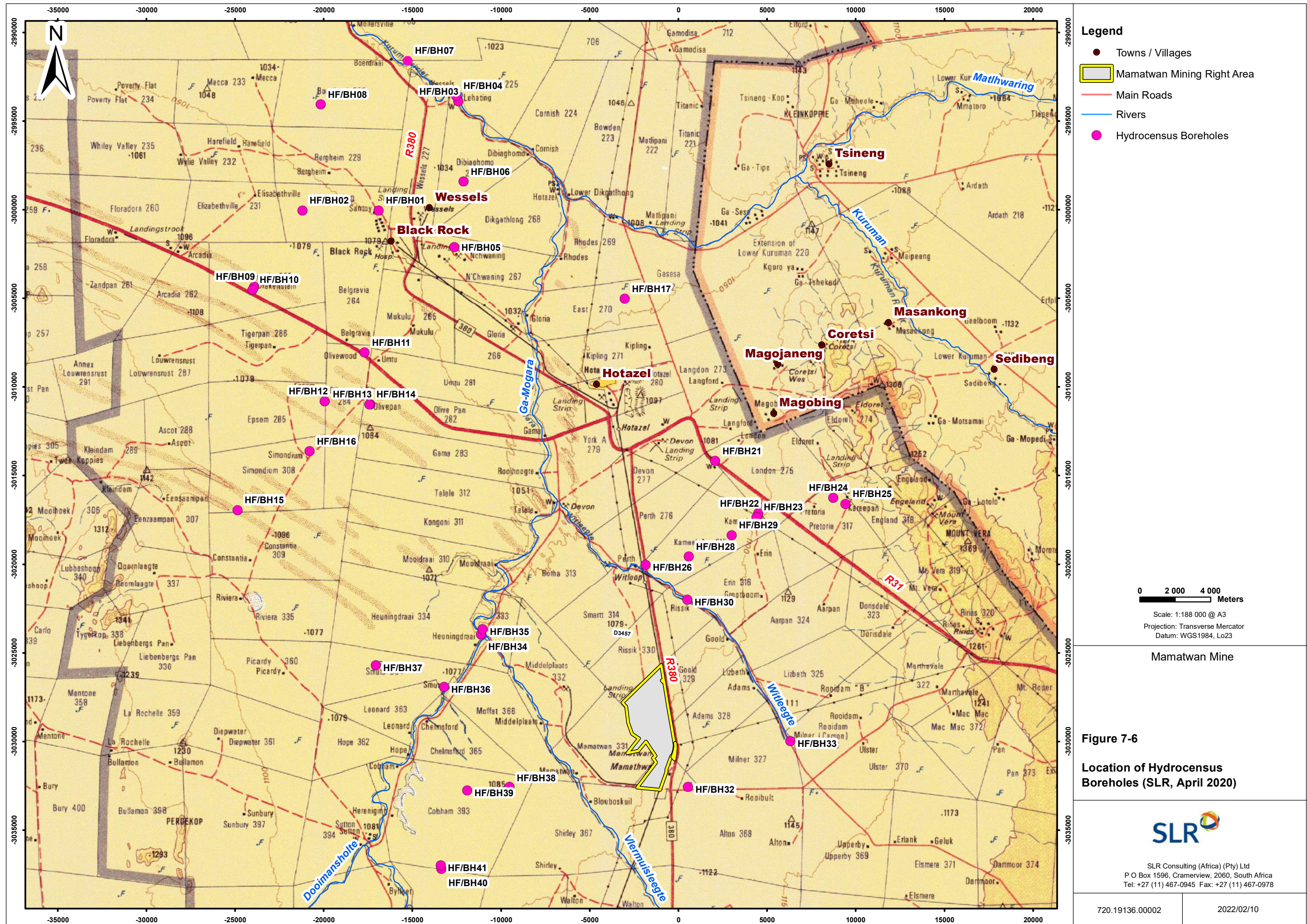
|           |                                  |
|-----------|----------------------------------|
| Below RQO | Below Resource Quality Objective |
| Above RQO | Above Resource Quality Objective |

## Conclusion

Results of the quarterly monitoring undertaken by MMT indicate that water is unsuitable for lifetime human consumption in terms of the SANS 241:2015. Results of the hydrocensus, indicate that more than half of the boreholes sampled are unfit for lifetime human consumption in terms of SANS 241:2015. Several parameters also exceed the DWS WQRO standards. The 2018 hydrocensus also concludes that certain parameters exceed the DWS Livestock Watering Limits. These are however not expected to have significant detrimental effect on livestock depending on the length of exposure and the condition of the livestock.

Monitoring results show that the concentrations of parameters that exceed the SANS 241:2015 and DWS Livestock Watering Limits are higher at the MMT than at third party boreholes. It follows that the MMT and neighbouring mines have potentially influenced the groundwater quality of the area, thereby potentially influencing third parties' access to groundwater for domestic and/or livestock watering purposes. The project alternatives (pipeline and railway line), have no bearing on the geohydrological environment.







### 7.4.1.8 Air Quality

#### Introduction and link to impact

Existing sources of emissions in the region and the characterisation of existing ambient pollution concentrations is fundamental to the assessment of cumulative air impacts. A change in ambient air quality can result in a range of impacts which in turn may cause a disturbance and/or health impacts to nearby receptors. To understand the basis of these potential impacts in the context of the project activities, a baseline situational analysis is described below.

#### Data Sources

Information in this section was sourced from the Air Quality Study compiled for the MMT (Airshed, August 2021) included in Appendix H.

Dust fallout monitoring data was sourced from the 2018 and 2019 annual dust fallout monitoring reports compiled by Skyside. Dispersion modelling data was sourced from the Golder Associates Africa (Pty) Ltd report (Golders, February 2019).

#### Description

##### *Ambient air quality within the region*

The following regional sources of emissions were identified:

- Fugitive dust: Occur as a result of vehicle entrainment of dust from local paved and unpaved roads, wind erosion from open areas and dust generated by agricultural activities. Given that the agriculture in the area is primarily restricted to livestock and game farming, agriculture is not anticipated to contribute significantly to ambient dust rates. Vehicle entrainment from the various unpaved farm and public roads is anticipated to be a significant, but localised source of dust;
- Current mining operations in the area: Particulates represent the main pollutant of concern at mining operations, whether it is underground or opencast. The amount of dust emitted by these activities depends on the physical characteristics of the material, the way in which the material is handled and the weather conditions. Current mining operations in relatively close proximity to the mining area include Kalagadi, Tshipi, Black Rock, Gloria, Wessels, Sebilo, United Manganese of Kalahari (UMK) and Kudumane;
- Biomass burning: Biomass burning emissions such as household fuel burning activities generate carbon monoxide (CO), methane (CH<sub>4</sub>) and nitrogen dioxide (NO<sub>2</sub>) gases;
- Veld burning: Represent significant sources of combustion-related emissions in many areas of the country;
- Rail related emissions: Emissions from diesel generated locomotives include particulates, nitrogen oxides (NO<sub>2</sub>), sulphur dioxide (SO<sub>2</sub>), carbon monoxide (CO) and various volatile organic compounds including polycyclic aromatic hydrocarbons;
- Household fuel combustion: It is likely that households within the district municipality utilise coal or wood for cooking and space heating (during winter) purposes. Emissions from domestic burning include PM<sub>10</sub>, nitrogen dioxide (NO<sub>2</sub>), carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO), polycyclic aromatic hydrocarbons, particulate benzo(a)pyrene and formaldehyde; and
- Vehicle tailpipe emissions: Significant primary pollutants include carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO), hydrocarbons (HCs), sulphur dioxide (SO<sub>2</sub>), oxides of nitrogen (mainly NO<sub>x</sub>), and particulates.

Secondary pollutants include NO<sup>2</sup>, photochemical oxidants (ozone), sulphur acid, sulphates and nitric acid.

#### *Emission sources associated with MMT*

The activities associated with MMT that contribute to ambient air quality are listed in Table 7-20 below. The activities associated with the project that contribute to ambient air quality are listed in Table 7-21 below.

**Table 7-20: Current MMT emission source activities (Airshed, August 2021)**

| Description   | Comments   |
|---|--|
| In-pit operations: drilling and blasting, excavation of ROM ore, top-cut ore, and waste rock, storage of top-cut on in-pit stockpile.   | Mostly PM, gaseous emissions from mining equipment (PM, sulphur dioxide (SO <sub>2</sub> ) oxides of nitrogen (NO <sub>x</sub> ); carbon monoxide (CO); and carbon dioxide (CO <sub>2</sub> )).  |
| In-pit operations: removal and stockpiling of topsoil.  | Mostly PM, gaseous emissions from excavation equipment (PM, SO <sub>2</sub> ; NO <sub>x</sub> ; CO; CO <sub>2</sub> ).   |
| In-pit primary crushing.  | Mostly PM, gaseous emissions from diesel powered machinery (PM, SO <sub>2</sub> ; NO <sub>x</sub> ; CO; CO <sub>2</sub> ).   |
| In-pit operations: haulage of ROM ore, top-cut ore to in-pit crusher, waste rock and topsoil to stockpiles; haulage of discard to discard dump.   | PM from road surfaces, tipping, windblown dust from trucks, windblown dust from conveyors, gaseous emissions from truck exhaust (PM, SO <sub>2</sub> ; NO <sub>x</sub> ; CO; CO <sub>2</sub> ).  |
| ROM feed conveyor (in-pit and surface).   | Mostly PM from tipping and windblown dust, gaseous emissions from machinery (PM, SO <sub>2</sub> ; NO <sub>x</sub> ; CO; CO <sub>2</sub> ).  |
| ROM, discard, waste rock, topsoil, and product stockpiles.  | PM from tipping, windblown dust, gaseous emissions from truck exhaust (PM, SO <sub>2</sub> ; NO <sub>x</sub> ; CO; CO <sub>2</sub> ).  |
| Processing operations: ROM transfer point and reclaim system; primary, secondary and tertiary ROM crushing and screening; stockpiling of lumpy product and fines product and reclaiming to load to trains, stockpiling, and loadout operations, storage of sinter de-dust fines on storage area | Mostly PM, gaseous emissions from diesel powered machinery (PM, SO <sub>2</sub> ; NO <sub>x</sub> ; CO; CO <sub>2</sub> )<br>Current loadout operations include a loading time of 18 hours to load to train, with underutilisation of 260 000 tpa. |
| DMS plant, sinter plant   | PM, SO <sub>2</sub> ; NO <sub>x</sub> ; CO; and CO <sub>2</sub>  |

\* Particulate matter (PM) comprises a mixture of organic and inorganic substances, ranging in size and shape and can be divided into coarse and fine particulate matter. Total Suspended Particulates (TSP) represents the coarse fraction >10 µm, with particulate matter with an aerodynamic diameter of less than 10 µm (PM<sub>10</sub>) and particulate matter with an aerodynamic diameter of less than 2.5 µm (PM<sub>2.5</sub>) falling into the finer inhalable fraction. TSP is associated with dust fallout (nuisance dust) whereas PM<sub>10</sub> and PM<sub>2.5</sub> are considered a health concern.

**Table 7-21: Project emission sources (Airshed, October 2021)**

|                                  | Description  | Sources  | Comments  |
|----------------------------------|--|--|---|
| <b>Proposed Layout Changes</b>   |  |  |   |
| 1                                | Establishment of a top-cut stockpile and associated crushing and screening plant, requiring additional storage space to stockpile top-cut material prior to processing at the sinter plant, and crushing and screening via a mobile crusher prior to being sent to the sinter plant.   | Clearing of indigenous vegetation, crushing and screening, materials handling  | The proposed activities are expected to result in an increase in air quality impacts at sensitive receptors to the east of the MMT mining rights boundary and are assessed in the accompanying AQIA.  |
| 2                                | Changes to waste rock dump height from the approved 2005 EMPR height from 50m to 80m.  | Materials handling, vehicle entrained dust, bulldozing etc.  | Changes in air quality impacts due to the change in waste rock dump height are expected to be minimal, and as such this source was not included in the modelling for the current assessment.  |
| 3                                | Upgrading the railway and railway loadout station. Transnet Freight Rail (TFR) plans to increase the capacity of the Manganese rail line, and in order to meet the TFR expansion requirements the loading rate of trains at MMT needs to be increased. This can be achieved by upgrading the existing loadout station and related railway. | Stacker, reclaimer operations, materials handling including conveyor transfer  | Three proposed options were provided: Option 1: The reduction of the loading time from 18 to 12 hours to load a train with 125 wagons, requiring the reconfiguration of the train station. Option 2: The reduction of the loading time to 8 hours to load a train with 125 wagons, requiring upgrading the existing loadout station and conveyor system. Option 3: The reduction of the loading time to 4 hours to load a train with 125 wagons. This option requires the establishment of a new railway loop, new loadout station, product stockpile areas, stackers and reclaimers. |
| <b>Proposed Activity Changes</b> |  |  |   |
| 1                                | Sale of waste rock as aggregate: MMT is proposing selling some of the waste rock that would have remained on the surface in perpetuity.  | Possible crushing of the waste rock prior to being sold, vehicle entrainment of dust in transporting waste rock to crusher and off-site. | Not enough information was made available as to this activity, and as such the source was not included in the AQIA.   |



|   | Description                                     | Sources  | Comments   |
|---|---|--|--|
| 2 | Re-processing of material located in Adams Pit. | Materials handling at stockpiles, crushing and screening | The re-processing of material located in the Adams Pit was included in the source inventory and impact assessment. |

### Dust fallout

MMT is committed to monitoring dust fallout as per the approved 2005 EMPR. A dust fallout monitoring network is in place at MMT, comprising of eight (8) single dust fallout units (one has been decommissioned) and three (3) directional dust fallout units. Since the NDCRs are based on single dust fallout units following the ASTM D1739 method, the directional units cannot be compared to the NDCR limits. Dust fallout results for the period January 2018 to December 2019 for the single units are provided in Table 7-22 below. Refer to Figure 30-1 for the location of the dust fallout monitoring points.

Dust fallout collected at eight locations in and around MMT during 2018 and 2019 indicate low dust fallout rates, well below the NDCR limit for residential areas (600 mg/m<sup>2</sup>/day) and non-residential areas (1 200 mg/m<sup>2</sup>/day).

**Table 7-22: 2018 dust fallout monitoring results (Airshed, August 2021)**

|       | Jan-18         | Feb-18 | Mar-18 | Apr-18 | May-18 | Jun-18 | Jul-18 <sup>(a)</sup> | Aug-18 | Sep-18 <sup>(a)</sup> | Oct-18 <sup>(b)</sup> | Nov-18 | Dec-18 <sup>(a)</sup> |
|-------|----------------|--------|--------|--------|--------|--------|-----------------------|--------|-----------------------|-----------------------|--------|-----------------------|
| MMT01 | 180            | 150    | 26     | 94     | 111    | 126    | 196                   | ND     | 27                    | 124                   | ND     | 108                   |
| MMT02 | 128            | 127    | 54     | 39     | 44     | 56     | 57                    | ND     | 45                    | 80                    | 80     | 123                   |
| MMT03 | 87             | 74     | 57     | 89     | 60     | 84     | 147                   | ND     | 134                   | 118                   | 67     | 207                   |
| MMT04 | 63             | 52     | 19     | 84     | 119    | 39     | 35                    | ND     | 50                    | 124                   | 33     | 30                    |
| MMT05 | 131            | 38     | 18     | 16     | 33     | 8      | 67                    | ND     | 59                    | 81                    | 45     | 32                    |
| MMT06 | Decommissioned |        |        |        |        |        |                       |        |                       |                       |        |                       |
| MMT07 | 252            | 241    | 109    | 97     | 228    | 147    | 75                    | ND     | 101                   | 201                   | 173    | 38                    |
| MMT08 | 153            | 68     | 47     | 118    | 212    | 90     | 49                    | ND     | 58                    | 62                    | 58     | 57                    |
| MMT09 | 58             | 97     | 41     | 51     | 74     | 24     | 214                   | ND     | 69                    | 136                   | 82     | 175                   |

<sup>(a)</sup> Samples were over exposed (more than the allowable 30(±2) days). <sup>(b)</sup> Samples were under exposed (less than the allowable 30(±2) days). ND – No Data

**Table 7-23: 2019 Dust fallout monitoring results (Airshed, August 2021)**

|       | Jan-19         | Feb-19 | Mar-19 | Apr-19 | May-19 | Jun-19 | Jul-19 | Aug-19 | Sep-19 | Oct-19 | Nov-19 | Dec-19 |
|-------|----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| MMT01 | 98             | 49     | 205    | 89     | 248    | 95     | 271    | 464    | 162    | 196    | 339    | 843    |
| MMT02 | 51             | ND     | 233    | 102    | 126    | 87     | 107    | 223    | 135    | 166    | 188    | 144    |
| MMT03 | 87             | 68     | 124    | 47     | 18     | 39     | 71     | 143    | 76     | ND     | 119    | 98     |
| MMT04 | 40             | 111    | 76     | 20     | 149    | 84     | 98     | 109    | 64     | 21     | 90     | 47     |
| MMT05 | 63             | 137    | 108    | 29     | 169    | 76     | 92     | 164    | 51     | 61     | 170    | 76     |
| MMT06 | Decommissioned |        |        |        |        |        |        |        |        |        |        |        |
| MMT07 | 86             | 85     | 119    | 60     | 119    | 34     | 83     | 220    | 38     | 99     | 122    | 38     |
| MMT08 | 102            | 79     | 89     | 32     | 73     | 16     | 46     | 58     | 56     | 48     | 52     | 66     |
| MMT09 | 94             | 80     | ND     | 87     | 88     | 76     | 117    | 146    | ND     | 65     | 124    | 35     |

#### *Ambient PM monitoring*

MMT does not undertake ambient air quality monitoring of PM<sub>10</sub> concentration levels and therefore the baseline concentration levels are yet to be established for the site. MMT only undertakes dust fallout monitoring which monitors Total Suspended Particulates (TSP) in the form of nuisance dust. In support of a minimum emission standards postponement application for the Sinter plant stack emissions, Golders Associates, undertook dispersion modelling. This modelling indicates that PM concentrations at sensitive receptor locations are likely to be very low and within the NAAQS limit at sensitive receptor locations.

#### *Potential noise sensitive receptors*

The impacts of an intruding industrial air on the environment rarely extends over more than 5 km from the source. The location of the noise sensitive receptors is illustrated in Figure 7-8. These sensitive receptors include a combination of neighbouring industrial sites (Adams solar farm) and isolated farmsteads.

### **Conclusion**

The main pollutant of concern from all the project activities is particulate matter (PM), with PM<sub>10</sub> and PM<sub>2.5</sub> concentrations related to health impacts and dust fallout related to nuisance impacts. The project activities present emission sources that can have a negative impact on ambient air quality and surrounding land uses. This however needs to be considered in the context of emission sources exceeding the NDCR and NAAQS limits near potential air sensitive receptors.

#### **7.4.1.9 Noise**

##### **Introduction and link to impact**

Noise generating activities associated with mining has the potential to increase the ambient noise levels in and around the MMT that may in turn cause a disturbance to nearby sensitive receptors. Land uses surrounding MMT are described in Section 7.4.1.4. To understand the basis of these potential impacts in the context of the project activities, a baseline situational analysis is described below.

## Data source

Information in this section was sourced from the Noise Study Airshed, (September; 2020) compiled for the project (included in Appendix I). The data from a baseline noise survey conducted on 18 July 2019 was studied to determine current noise levels within the area.

## Description

### Background environmental noise

Background environmental noise levels were sampled at three residential sites (Sites 1, 2 and 5) and two industrial sites (Sites 3 and 4). With reference to Table 7-24 the results of the daytime noise sampling are as follows:

- Daytime  $L_{Aeq}$ 's ranged between 32.1 dBA and 62.2 dBA;
- Measured daytime  $L_{Aeq}$ 's at Sites 1, 2 and 5 were typical of the SANS 10103 noise levels for rural areas (SANS day-time limit of 45 dBA), while baseline noise levels at Sites 3 and 4 were within the industrial daytime limits (SANS day-time limit of 70 dBA). The measured daytime  $L_{Aeq}$ 's are significant higher at Site 3 than Site 4. This is to be expected given that Site 3 is located at the entrance of the MMT; and
- Measured daytime  $L_{Aeq}$  at Sites 1, 2, and 5 were below the residential limit (55 dBA IFC limit) and below the guideline for industrial receptors (70 dBA IFC limit) at sites 3 and 4.

With reference to Table 7-24 the results of the night-time noise sampling are as follows:

- Night-time  $L_{Aeq}$ 's ranged between 34.4 dBA and 66.3 dBA;
- Measured night-time  $L_{Aeq}$ 's at Site 1 is typical of night-time noise levels in rural areas (SANS night-time limit of 35dBA), however Sites 2 and 3 exceed the SANS limit for rural night-time noise due to insects and background mining operational noise;
- Measured night-time  $L_{Aeq}$  at Sites 3 and was below what is typical for industrial areas (SANS night-time limit of 60dBA). This limit was however exceeded at Site 4 due to the presence of background mining operations; and
- Measured night-time  $L_{Aeq}$ 's at the Sites 1, 2 and 5 were below the IFC residential guideline limit (45 dBA IFC limit) for night-time noise and were below the industrial limits (70 IFC dBA limit) for industrial noise.

**Table 7-24: Daytime and night-time baseline noise levels (Airshed, September 2020)**

| Site number   | Site description                                  | $L_{Aeq}$ (dBA) | Observations   |
|---|---|-----------------|--|
| <b>Daytime</b>  |   |                 |  |
| <b>IFC Residential Limits – 55 dBA</b>                  |   |                 |  |
| <b>SANS 10103 (2008) Rural District Limits – 45 dBA</b> |   |                 |  |
| Site 1  | Residential (Near Andries van den Berg farmhouse) | 32.1            | Noise background from the Mamatwan and Tshipi mines operations, gusty winds, leaves on shrubs and trees rustling in the wind |
| Site 2  | Residential (Near Nic Fourie farmhouse)           | 37.6            | Gusty winds, leaves on shrubs and trees rustling in the wind   |
| Site 5  | Residential (Near farm workers near               | 44.0            | Cars passing, leaves on shrubs and trees rustling in the wind, gusty winds, birds chirping                                   |

| Site number   | Site description  | L <sub>Aeq</sub> (dBA) | Observations   |
|---|---|------------------------|--|
|   | Decommissioned Middelplaats Mine)                                     |                        |  |
| <b>IFC Industrial Limits – 70 dBA</b><br><b>SANS 10103 (2008) Industrial District Limits – 70 dBA</b> |   |                        |  |
| Site 3  | Industrial (Entrance to MMT)  | 62.2                   | Train hooting & passing, birds chirping, shrubs and trees rustling in the wind, mining operations                        |
| Site 4  | Industrial (Adams Solar farm)   | 40.8                   | Leaves on shrubs and trees rustling in the wind, traffic from the road, community activities                             |
| <b>Night-time</b>   |   |                        |  |
| <b>IFC Residential Limits – 45 dBA</b><br><b>SANS 10103 (2008) Rural District Limits – 35 dBA</b>     |   |                        |  |
| Site 1  | Residential (Near Andres van den Berg farmhouse)                      | 34.4                   | Sound of insects, noise background from the mining operations (hooter from the mines)                                    |
| Site 2  | Residential (Near Nic Fourie farmhouse)                               | 36.3                   | Sound of insects and noise background from the mining operations   |
| Site 5  | Residential (Near farm workers near Decommissioned Middelplaats Mine) | 38.3                   | Dogs barking, noise background from the mining operations, sound of insects  |
| <b>IFC Industrial Limits – 70 dBA</b><br><b>SANS 10103 (2008) Industrial District Limits – 60 dBA</b> |   |                        |  |
| Site 3  | Industrial (Entrance to MMT)  | 50.5                   | Sounds of generator (mechanical noise), mining operations, insects, sound of insects, trucks & cars passing and hooting. |
| Site 4  | Industrial (Adams Solar farm)   | 66.3                   | Road traffic (trucks hooting and passing), noise background from the mine operations (mechanical noise or generator)     |

### Potential noise sensitive receptors

Disturbing industrial noise levels on the receiving environment rarely extends more than 5 km from the source. The location of the noise sensitive receptors is illustrated in Figure 7-7. These noise sensitive receptors include a combination of neighbouring industrial sites (Adams Solar Farm and the Eskom substation) and residential sites (isolated farm homesteads). The closest noise sensitive receptors to the project activities include the Adams Solar farm, the Eskom substation and the isolated farm homestead, located to the east of MMT (all MMT related infrastructure) and the west of the mine (this is applicable to farmsteads close to the preferred dewatering pipeline 1).

The remaining noise sensitive receptors are likely to be influenced by the neighbouring Tshipi Borwa Mine given the proximity to the mine. Based on the prevailing wind field (Section 7.4.1.3), disturbing noise levels are



expected to be more notable to the east and south of the MMT during the day and to the north and north-northwest of the MMT during the night.

## Conclusion

The noise sampling results undertaken both near the MMT and near sensitive noise receptors indicate that SANS 10103 (2008) residential and industrial night-time noise levels were exceeded. The proposed project has the potential to contribute to ambient noise levels, as part of land clearing activities. The disposal of general waste (including rubble and used conveyor belts) and the storage of sinter de-dust into Adams Pit presents a source that currently contributes to the existing ambient noise levels. These contributions however need to be considered within the context of the existing MMT mine and neighbouring mines (Tshipi Borwa Mine), that have influenced the natural ambient noise environment.

#### 7.4.1.10 Visual

##### Introduction

The visual character of an area is determined by considering landscape character, scenic quality, sensitivity of the visual resource, sense of place and visual receptors. Mining related infrastructure and activities has the potential to alter the visual aspects in a project area and surrounding area.

##### Data sources

Information in this section was sourced from aerial imagery and site visits undertaken by the specialist team. The specialist visual report was compiled by Scientific Services in November 2019.

##### Description

###### *Landscape character*

The landscape character to the immediate east and south of the current MMT and west of the decommissioned Middelplaats Mine can be described as relatively flat terrain with the bushveld vegetation composition being homogenous with the surrounding area. The landscape character associated with the undisturbed proposed project areas (proposed top-cut stockpile, and Middelplaats water pipeline routes 2 and 3), resemble characteristics similar to that of undisturbed areas to the east of the MMT and the west of the decommissioned Middelplaats Mine.

Areas to north and west of the MMT and north-east and south-east of the decommissioned Middelplaats mine are characterised by mining activities. The UMK borders the northern boundary of the MMT, while the Tshipi Borwa Mine is located along the western boundary of the MMT. WRDs form the backdrop to these areas from many viewpoints. The landscape character associated with the remaining project components is fundamentally altered due to mining characteristics.

###### *Scenic quality*

The scenic quality is linked to the type of landscapes that occurs within an area. In this regard, scenic quality can range from high to low as follows:

- High – these include the natural features such as mountains and koppies and drainage systems;
- Moderate – these include agricultural activities, smallholdings, and recreational areas; and
- Low – these include towns, communities, roads, railway line, industries and existing mines.

The landscape to the immediate east and south of MMT and west of the decommissioned Middelplaats Mine which has not been disturbed by existing and surrounding mining activities provides limited topographical variety since the terrain is relatively flat with limited distinguishing topographical features and is not considered scarce as it is representative of the greater landscape and common in the area. This scenic quality also applies to the undisturbed proposed project areas (proposed top-cut stockpile, and Middelplaats water pipeline routes 2 and 3).

The scenic quality to the west and north of the MMT, north-east and southeast of the decommissioned Middelplaats mine, including the remaining project components is fundamentally changed by mining operations. It follows that the overall scenic quality is low.

#### *Sense of place*

The sense of place results from the combined influence of landscape diversity and distinctive features. The primary informant of these qualities is the spatial form and character of the natural landscape taken together with the cultural transformations and traditions associated with the historic use and habitation of the area. The project areas are located within a “mining belt”. Surrounding existing mining operations and the infrastructure that supports these mines dominates the area to the west and north of the MMT and north-east and southeast of the decommissioned Middelplaats mine. It follows that the immediate area within and surrounding the project areas has a relatively weak sense of place (when the viewer is within the mining belt). However, seen in context with the site surrounded by large open spaces of arid vegetation, the harsh nature of the mining activities is “softened”. When the viewer views the area from outside the “mining belt”, the larger area has a stronger sense of place.

#### **Conclusion**

When viewed from the perspective of tourists and residents of the area, mining operations could be associated with a sense of dissatisfaction. However, the project areas are situated in a remote area where a very limited number of sensitive receptors (isolated farmsteads) are present. The great majority of traffic on the adjacent road is linked with services to the mines. Much of the project infrastructure (including alternatives) would merge with the existing facilities and is not expected to stand out. Since the visual intrusion is already present in the area, most receptors to the east have grown accustomed to the features.

#### **7.4.1.11 Traffic**

Due to the fact that all of the proposed activities will be carried out within the Mamatwan Mining Right Area, there is an insignificant risk of impacts on traffic during the construction phase. During the operational phase, there is a slight positive impact to local traffic as the mine will be equipped to optimise the transport of materials via rail, which will avoid any additional road traffic that may be required for trucking of materials.

#### **7.4.1.12 Heritage/cultural and palaeontological resources**

A specialist study was carried out by PGS Heritage in February 2020 and was updated in October 2021.

#### **Introduction and link to project**

Most archaeological material in the Northern Cape is found near water sources due to the extreme water constraints within this Province. Sites usually comprise of open sites where the majority of evidence of human occupation is scatters of stone tools.

#### **Source Data**

A literature review and sensitivity analysis were carried out to understand the background to the project and the receiving environment. A physical survey was conducted by vehicle through the proposed project area by a qualified heritage specialist. The survey was conducted in July and October of 2019. The site assessment aimed at locating and documenting any relevant cultural heritage or archaeological artefacts or sites that are located within or adjacent to the proposed development footprint.

## Description

### *Stone Age*

An important archaeological site in the region is the Wonderwerk Cave which is located about 100km from MMT. The Early Stone Age (ESA) levels at the Wonderwerk Cave date to about 780 000 years old. The site is characterised by Acheulean stone tools such as prepared cores, bifacial cleavers and refined and axes. A few [pieces of haematite were also found in the upper most Middle Stone Age (MSA) layers. Bedding material recovered indicates that the site was used as a home base by the end of the ESA.

MSA artefacts belonging to the Fauresmith industry are also found in the region. The Fauresmith is characterised by prepared cores, long, narrow flake blades, convergent points and small, broad hand axes. Layers with Fauresmith tools were dated to 276 000 – 510 000 Before Present (BP). Associated with the MSA materials were several incised stone slabs, most with curved parallel lines. Between 70 000 and 12 500 BP the site was abandoned due to significantly drier conditions, and during this time much of the region was abandoned and settlements limited to a few permanent water sources.

The earlier Later Stone Age (LSA) industry of the region forms part of the Oakhurst industry characterised by rare, retouched artefacts, mostly large oblong scrapers. The predominant raw materials are banded ironstone and dolomite. Very few adzes and blades are found, while backed artefacts and bone tools are absent. Pottery makes an appearance and there are two discrete stone tool industries associated with pottery in the Northern Cape. Prehistoric specularite mines were excavated near Postmasburg-Doornfontein area and at Blinkklipkop. These sites show that mining started before 1 200 BP.

Rock engravings are plentiful in the Northern Cape. Most engravings were made by the San and are associated with their religious beliefs and rituals. As the wider landscape became increasingly inhabited, the San were forced to move further west and northwest, following availability of wild game.

### *Iron Age*

The Tlharo is documented to be the first Tswana group to enter the Kuruman area. They originated to the north-east, and after splitting with the larger group, moved in a southern direction along the Molopo River. The early settlements included Khuis, Madibeng, Huiningvlei, Langeberg and Tsineng. The town of Tsineng is in the general vicinity of the MMT study area.

## Conclusion

Based on the background research and desktop assessment of the previous studies undertaken for this site, only archaeological finds were considered to have a possibility of occurring in the largely disturbed study area. These archaeological finds would be protected through section 35 of the National Heritage Resources Act (NHRA). The fieldwork has however confirmed that no heritage resources as considered under Section 3 of the NHRA were found (this includes alternative project sites). A “chance find procedure” should be compiled and implemented during construction should any artefact be uncovered.



### 7.4.1.13 Socio-economic Baseline Socio-Economic Environment Affected by the Project

#### Introduction and Link to Impact

Typically mining projects have the potential to result in both positive and negative socio-economic impacts. The positive impacts are usually economic in nature with projects contributing directly towards employment, procurement, skills development and taxes on a local, regional and national scale. In addition, projects indirectly contribute to economic growth in the national, local and regional economies. The negative impacts can be both social and economic in nature and related to the influx of people seeking job opportunities (with related social ills and pressures on existing services) and a change to existing land uses (with related changes to social structures and way of life).

#### Data sources

Information in this section was sourced from the John Taolo Gaetsewe District Municipality Draft IDP 2021/22, the Joe Morolong Local Municipality Draft IDP 2020/21 as well as Statistics SA 2016.

#### Description

The MMT is located in the John Taolo Gaetsewe District Municipality and Joe Morolong Local Municipality of the Northern Cape Province. The nearest community to the mine is the town Hotazel, located approximately 25km north of the MMT. No informal or rural type settlements occur within the surrounding areas.

#### Population

The Hotazel community has a very low population of 1 755 people when compared to the local municipality population of 89 377, the district municipality population of 242 264 and the Northern Cape Province population of 1 145 861. This provides an indication of the remoteness of the project area.

#### Education

In general, statistics throughout the identified regions indicate poor educational profiles. Significant numbers of the population within the municipalities and province have received no schooling or only limited primary education. In figures, 18 569 people have no schooling in the JMLM, while 42 628 and 175 584 people have no schooling in the JTGD and the Northern Cape province, respectively. The average number across the regions profiled of people completing high school education were relatively consistent; however, there is greater disparity when considering Grade 12 education, further education and training and tertiary education.

#### Employment

The majority of the population within the Northern Cape, John Taolo Gaetsewe District Municipality and Joe Morolong Local Municipality are not economically active. In 2011, the district had an unemployment rate of 30%. The Joe Morolong Municipality has the highest unemployment rate in the district at 40%, while 48% of the Hotazel population is employed.

#### Dwellings

The most dominant type of dwelling utilized within the Northern Cape Province, the John Taolo Gaetsewe District Municipality, the Joe Morolong Local Municipality and Hotazel is a formally constructed house or brick structure. Traditional dwellings (e.g. huts/ structures made of traditional material) are the second highest used dwelling type in the district and local municipalities with informal dwellings (e.g. shacks) being the second

highest dwelling type within the Northern Cape Province. No traditional dwellings are located within the town of Hotazel; rather the second highest used dwelling type is flats.

#### *Basic Services*

Despite the relatively formalized housing infrastructure, basic services infrastructure appears to be far less formalized when considering the province and municipalities as a whole. In general, Hotazel is well formalised in terms of basic services. This may be attributed to the Hotazel area being more urbanized having been developed and supported by surrounding mines in recent years.

#### **Conclusion**

In general mining related projects have the potential to influence socio-economic conditions both positively and negatively to which the approved mine already contributes. The project activities form part of existing approved operations and as such are unlikely to influence the existing socio-economic conditions of the area.

### **7.4.2 Description of current Land Uses**

#### **Introduction and link to impact**

Mining related activities have the potential to affect land uses both within the mine area and in the surrounding areas. This can be caused by physical land transformation and through direct or secondary impacts. The key related potential environmental impacts are loss of soil, loss of biodiversity, air pollution, noise pollution and visual impacts. To understand the basis of these potential impacts in the context of the project activities, a baseline situational analysis is described below.

#### **Data source**

Mining Right and land ownership details were sourced from MMT and a deed search undertaken by SLR. On-site and surrounding land use data was sourced from site observations and through the review of topographical maps and satellite imagery.

#### **Description – MMT mining right**

MMT through the legal entity Hotazel Manganese Mines (Pty) Ltd, holds a mining right (NC 256 MR) to mine manganese ore over portion 1, and portion 2 of the farm Mamatwan 331, the farm Sinterfontein 748, portion 3 of the farm Moab 700, portion 4 of the farm Adams 328 and portion 5 and 9 of the farm Goold 329. The mining rights boundary is illustrated in Figure 1-1.

#### **Description – surrounding mining right and environmental authorisation holders**

The following applies to properties directly adjacent to the MMT (refer to Figure 7-8):

- Tshipi holds a Mining Right over on a portion of portion 1 (Currently portion 16) and a portion of portion 2 (Currently portion 17) of the farm Mamatwan 331;
- UMK holds the Mining Right over the farm Botha 313, the remaining extent of the farm Smartt 314, and portions 1 and 3 (a portion of RE) of the farm Rissik 330;
- Enel Green Power (Pty) Ltd holds an environmental authorisation over the remaining extent of the farm Adams 328; and

- Danax Energy (Pty) Ltd holds an environmental authorisation for the establishment of a new solar farm on portion 1 of the farm Shirely 367.

### Description – landowners within and surrounding the MMT Mine

The surface right owners and corresponding title deeds numbers of the land in and adjacent to the MMT Mining Right area is listed in Table 7-25 and Table 7-27 respectively. The surface rights to all the properties within the MMT Mining Right area are held by HMM. In terms of the project areas, the NE topsoil stockpile is located on portion 9 of the farm Goold 329. Adams's pit and associated disposal of general waste (including rubble and used conveyor belts) and storage of sinter de-dust takes place on portion 4 of the farm Adams 328, portion 5 of the farm Goold 329 the farm Sinterfontein 748. The project areas are all located within the MMT Mining Right area.

**Table 7-25: Land ownership within the MMT mining right area**

| Portion                  | Landowner                         | Title deed number |
|--------------------------|-----------------------------------|-------------------|
| <b>Mamatwan 331</b>      |                                   |                   |
| Portion 1                | Hotazel Manganese Mines (Pty) Ltd | T2426/2010        |
| Portion 2                | Hotazel Manganese Mines (Pty) Ltd | T2426/2010        |
| <b>Sinterfontein 748</b> |                                   |                   |
| Portion 0                | Hotazel Manganese Mines (Pty) Ltd | T2426/2010        |
| <b>Moab 700</b>          |                                   |                   |
| Portion 3                | Hotazel Manganese Mines (Pty) Ltd | T953/2009         |
| <b>Adams 328</b>         |                                   |                   |
| Portion 4                | Hotazel Manganese Mines (Pty) Ltd | T338/2009         |
| <b>Goold 329</b>         |                                   |                   |
| Portion 5                | Hotazel Manganese Mines (Pty) Ltd | T2426/2010        |
| Portion 9                | Hotazel Manganese Mines (Pty) Ltd | T3211/2015        |

**Table 7-26: Landowners adjacent to the MMT mining right area**

| Portion                           | Landowner                                | Title deed number |
|-----------------------------------|--|-------------------|
| <b>Mamatwan 331</b>               |  |                   |
| Remaining extent                  | Andries Mathys Van Den Berg              | T594/ 1987        |
| Portions 1 and 2                  | Hotazel Manganese Mines (Pty) Ltd        | T2426/2010        |
| Remaining extent of portion 3     |  | T953/2009         |
| Portion 7                         | Transnet                                 | T666/1965         |
| Portion 8                         | Tshipi é Ntle Manganese Mining (Pty) Ltd | T515/1992         |
| Portion 18 (Portion of Portion 3) | Tshipi é Ntle Manganese Mining (Pty) Ltd | T416/2014         |
| Portion 16 (Portion of Portion 1) | Tshipi é Ntle Manganese Mining (Pty) Ltd | T416/2014         |
| Portion 17 (Portion of Portion 2) | Tshipi é Ntle Manganese Mining (Pty) Ltd | T416/2014         |
| <b>Moab 700</b>                   |  |                   |
| Portion 1                         | Transnet                                 | T250/1983         |
| Remaining extent                  | Machiël Andries Kruger                   | T594/1987         |
| <b>Middelplaats 332</b>           |  |                   |
| Remaining Extent                  | Saltrim Ranches (Pty) Ltd                | T2297/2006        |

| Portion                 | Landowner                              | Title deed number |
|-------------------------|--|-------------------|
| Portion 1               | Terra Nominees (Samancor Manganese)    | T2397/1996        |
| Portion 4               | Hotazel Manganese Mines (Pty) Ltd      | T2426/2010        |
| <b>Middelplaats 184</b> |  |                   |
| Whole farm              | Abraham Johannes De Klerk              | T1135/1965        |
| <b>Adams 328</b>        |  |                   |
| Remaining Extent        | Saltrim Ranches (Pty) Ltd              | T2297/2006        |
| Portion 1               | Eskom Holdings                         | T347/1971         |
| Portion 2               |  | T1162/1982        |
| Portion 3               | Transnet                               | T1107/1992        |
| <b>Rissik 330</b>       |  |                   |
| Portion 0               | Gideon Poolman Familie Trust           | T3211/2015        |
| Portion 1               | Terra Nominees (Samancor Manganese)    | T2395/1996        |
| Portion 2               | Transnet                               | T515/1992         |
| Portion 3               | United Manganese of Kalahari Pty Ltd   | T2092/2009        |
| <b>Goold 329</b>        |  |                   |
| Portion 1               | Kruger Machiel Andries                 | T399/1977         |
| Portion 2               | Kruger Nicolaas Philippus Fourie       | T455/2010         |
| Portion 8               | Transnet                               | T515/1992         |
| Portion 9               | Hotazel Manganese Mines (Pty) Ltd      | T2821/2011        |
| <b>Shirley 367</b>      |  |                   |
| Portion 0               | Leatitia Penny Trust                   | T3464/1997        |
| Portion 1               | Annalien Elizabeth Fourie              | T730/1984         |
| Portion 2               | Pretorius Hester Johannes              | T718/1979         |
| Portion 3               | Transnet                               | T43/1993          |
| <b>Smartt 314</b>       |  |                   |
| Portion 0               | Terra Nominees (Samancor Manganese)    | T2396/1996        |
| Portion 1               | Transnet                               | T221/1966         |
| <b>Alton 368</b>        |  |                   |
| Portion 0               | Booyesen Jacomina Maria                | T285/1979         |
| Portion 1               | Andries Matthys Duvenhage Testamentere | T905/2009         |
| <b>Milner 327</b>       |  |                   |
| Whole Farm              | Kruger Machiel Andries                 | T26/1931          |

### Description – land claims

The DRDLR: Land Claims Commissioner was contacted on 13 November 2019 to confirm if any land claims have been lodged on the farms on which the project activities are located. The Land Claims Commissioner has confirmed that no land claims have been lodged on the farms on which the project activities/infrastructure are located. Proof of correspondence is included in Appendix C1.



### Description – land use within the project area

Land use at the project sites includes existing mining activities and infrastructure associated with MMT mining right area.

### Description – land use surrounding the project areas (further afield)

Land uses further afield from the project areas include a mixture of agriculture, isolated residence/ residential areas, infrastructure/servitudes, mining and solar activities. More detail is provided below.

#### *Agriculture*

Agricultural activities currently undertaken in the areas surrounding the MMT include game farming and ad-hoc livestock grazing.

#### *Isolated residence/ residential area*

With reference to Figure 7-8, the nearest towns / residential areas to the MMT include:

- The Black Rock mining community located approximately 30 km north-west of the MMT;
- Hotazel situated approximately 20 km north of the MMT;
- Kuruman located approximately 45 km south-east of the MMT; and
- Kathu located approximately 40 km to the south of the MMT.

Due to the lack of available surface water resources in the area, no informal settlements are located in immediate proximity to the MMT. There are sparsely situated residences and farmhouses on the surrounding farms within an approximate radius of 5 km of the MMT. These are owned and/or occupied by farmers and farm workers and include:

- Farm workers residence located on the Farm Middelplaats 332 located approximately 5.5 km north-west from the area respectively (see Figure 7-8);
- A permanent farm homestead (A. Pyper) located on the Farm Middelplaats 332 approximately 6.3 km north-west from the project area (see Figure 7-8);
- A permanent farm homestead (Andries van den Berg) located on the Farm Mamatwan 331 approximately 4.8 km south-west from the project area (see Figure 7-8);
- Permanent farm homesteads (Nic Fourie) located on the Farm Shirley 367 approximately 5 km south from the project area (see Figure 7-8)
- A permanent farm homestead (Michael Kruger) located on the remaining extent of the farm Moab 700 approximately 2.8 km south-east from the project area (see Figure 7-8).

#### *Infrastructure and servitudes*

The Sedibeng Vaal-Gamagara water supply pipeline supplies the MMT with process and potable water. A pipeline connection to the Sedibeng Vaal-Gamagara reservoir is located approximately 2.5 km south from the project area (see Figure 7-8).

#### *Surrounding mines*

Mining operations located within a 7km radius of the MMT include the (Figure 7-8):

- The Tshipi Borwa Mine (Tshipi é Ntle Manganese Mining (Pty) Ltd is located directly west of the MMT Mining Right boundary and approximately 1.5 km west of the project areas.

- The Sebilo Mine (Sebilo Resources (Pty) Ltd) – Located approximately 7 km north from the nearest section of the MMT; and
- The dormant / temporarily closed Middelpaats Mine – Located approximately 4 km north-west from the nearest section of the MMT.

Mining operations located further afield from the project areas include the (see Figure 7-7):

- The Wessels Mine (South32) – Located approximately 28 km north from the nearest section of the MMT;
- The Nchwaning/Black Rock Mine (Assmang (Pty) Ltd) – Located approximately 26 km north from the nearest section of the MMT;
- The Gloria Mine (Assmang (Pty) Ltd) – Located approximately 21 km north from the nearest section of the MMT;
- The Kalagadi Mine (Kalagadi Manganese (Pty) Ltd) – Located approximately 17 km northwest from the nearest section of the MMT;
- The Kudumane Mine (Kudumane Manganese Resources (Pty) Ltd) – Located approximately 13 km north from the nearest section of the MMT;
- The old Hotazel Mine (dormant/closed) – Located approximately 15 km northeast from the nearest section of the MMT;
- The old Devon mine (dormant/closed) – Located approximately 14.7 km northeast from the nearest section of the MMT; and
- The old York Mine (dormant/closed) – Located approximately 12.8 km north from the nearest section of the MMT.

#### *Solar plant*

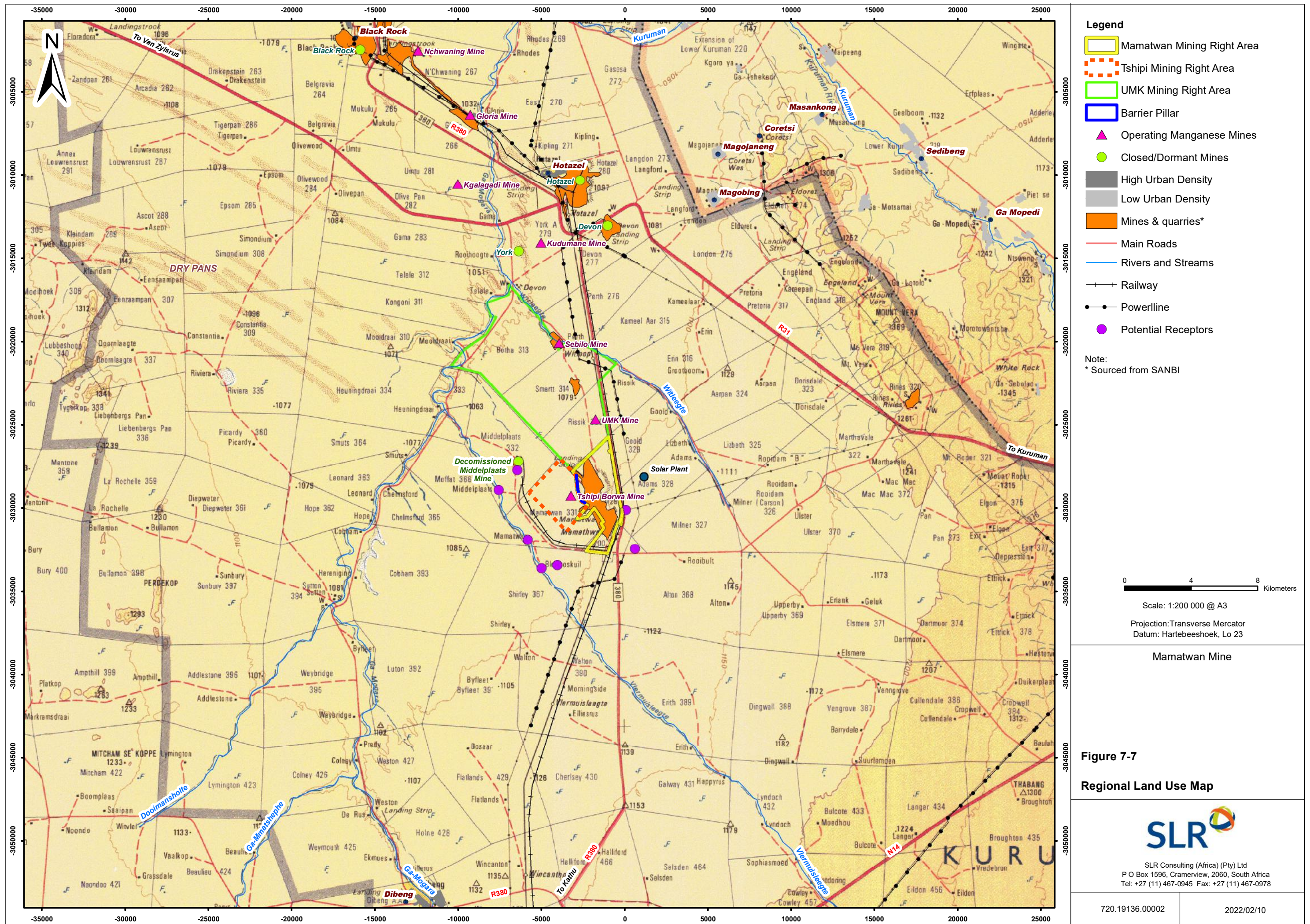
The Adams Solar Plant (Adams Solar PV Project Two (Pty) Ltd), owned by Enel Green Power (Pty) Ltd, is situated approximately 2 km southeast from the project area and is located on the Farm Adams 328. The Adams Solar Plant will aid the new renewable generation capacity of the national grid and contribute to the 42% share targeted by the Department of Energy for renewable energy (Integrated Resource Plan, 2010-2030). According to the strategy, 8.4 GW of new generation capacity in South Africa will be obtained from the Adams Solar Plant over the next twenty years.

Danax Energy (Pty) Ltd holds an environmental authorisation for the establishment of a new solar farm on portion 1 of the farm Shirely 367. This solar farm has not been established. It is anticipated that the new solar farm will generate a capacity 75 MW and will be connected to the Eskom grid. The NE topsoil stockpile and are located approximately 4 km and 2 km, respectively, north of the new solar farm to be established on the farm Shirley 367.

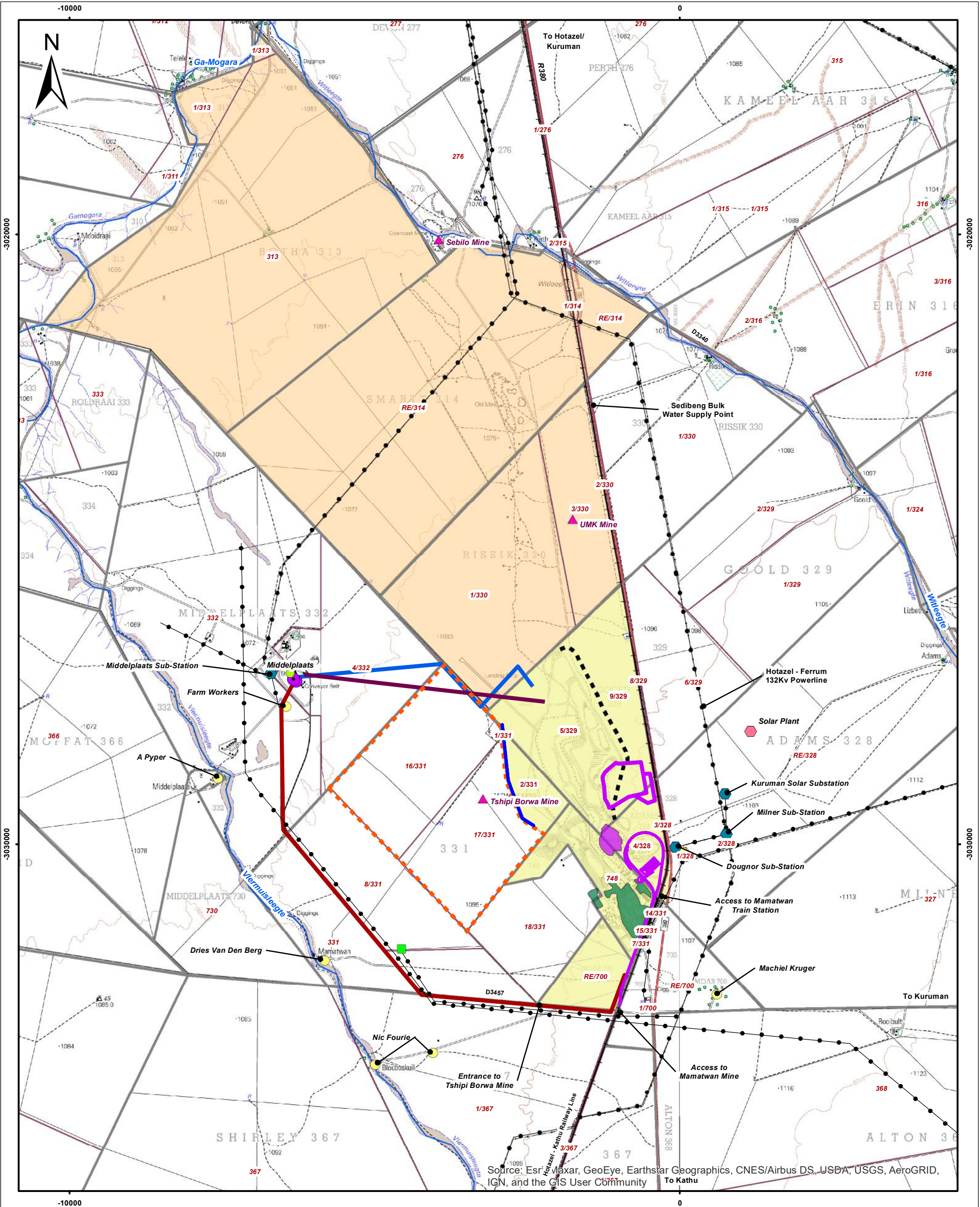
#### **Conclusion**

There are a number of land uses within and surrounding the project areas which may be influenced by the project activities. It should, however, be noted that land has already been significantly influenced through mining and agricultural activities and associated infrastructure and servitudes.









Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

**Legend**

Mamatwan Mining Right Area

Layout Changes Already Taken Place

Proposed Layout Changes

UMK Mining Right Area

Tshipi Mining Right Area

Barrier Pillar

Operating Manganese Mines

Closed/Dormant Mines

Potential Receptors

Main Roads

Secondary Roads

Power Line

Rivers and Streams

Railway

Farm Boundaries

Farm Portions

Approved Eskom 33/11/kV 10mVA Substation

**Alternative Pipeline Routes**

Alternative Pipeline Route 1 - Preferred Route


Alternative Pipeline Route 2

Alternative Pipeline Route 3

**Mamatwan Mine**

**Figure 7-8**

**Local Land Use**



SLR Consulting (Africa) (Pty) Ltd  
P O Box 1596, Cramerville, 2060, South Africa  
Tel: +27 (11) 467-0945 Fax: +27 (11) 467-0978

720.19136.00002

2022/02/10

010002000Meters

Scale: 1:60 000 @ A3  
Projection: Transverse Mercator  
Datum: WGS1984, Lo23



### 7.4.3 Description of specific environmental features and infrastructure on the site

The environmental features and infrastructure at the MMT is described in Section 7.4.1. In summary:

- Soils at the MMT are well-drained sandy soil, which allows for high infiltration rates and low organic content and is highly erodible. The soil fertility is low due to a deficiency in key nutrients, such as phosphorus.
- The proposed WRD extension footprint lies within the Kathu Thornveld habitat. The MMT is not located in a threatened ecosystem, CBAs, ESA, or IBAs, or an area earmarked as part of the NPAES, or an area ranked as a priority area by the Mining and Biodiversity Guideline (2012).
- No watercourses or wetlands are located at the MMT.
- Groundwater quality had been influenced by anthropogenic pollution from farming and surrounding mining activities.
- Air quality, noise and aesthetics within and surrounding the MMT has already been influenced through the presence of mining activities and associated infrastructure.
- There is a low possibility of palaeontological resources occurring in the project area. No heritage/cultural resources are located at the MMT.
- The notable infrastructure surrounding the surface use area includes roads (R380), a railway line, powerline and a water pipeline (Vaal Gamagara). The existing road network provides a fair level of service.
- The area surrounding the MMT is sparsely populated and is characterised by isolated farmsteads located within a 5 km radius of the MMT, with the closest town (Hotazel) located approximately 20 km from the MMT. The areas surrounding the MMT have also been influenced by surrounding dormant and active mines within a 7 km radius. This includes mines such as the Sebilu Mine, the dormant Middelpaats Mine, the UMK mine and the adjacent Tshipi Borwa Mine.

### 7.4.4 Environmental and current land use maps

A conceptual map showing topographical information as well as land uses on and immediately surrounding the MMT is provided in Figure 7-7 and Figure 7-8.

## 7.5 ENVIRONMENTAL IMPACTS AND RISKS OF THE ALTERNATIVES

In terms of this section, a list of potential impacts on the biophysical and socio-economic environment should be provided. It must be noted, however, that the alignment alternatives for the pipeline and the railway loop are insignificant. While the pipeline preferred route is along an existing road servitude, the other two alternative alignments would not have generated any significant impacts. Similarly for the railway loop, the preferred alternative is an optimisation of the second alternative, thereby requiring a smaller footprint for clearing. Neither railway loop alternative would have a significant impact on the receiving environment.

## 7.6 METHODOLOGY USED IN DETERMINING THE SIGNIFICANCE OF ENVIRONMENTAL IMPACTS

The method used for the assessment of environmental issues is set out in Table 7-27. This assessment methodology enables the assessment of environmental issues including cumulative impacts, the severity of impacts (including the nature of impacts and the degree to which impacts may cause irreplaceable loss of

resources), the extent of the impacts, the duration and reversibility of impacts, the probability of the impact occurring, and the degree to which the impacts can be mitigated.

**Table 7-27: Impact assessment methodology**

*Note: Part A provides the definition for determining impact consequence (combining intensity, spatial scale and duration) and impact significance (the overall rating of the impact). Impact consequence and significance are determined from Part B and C. The interpretation of the impact significance is given in Part D.*

| <b>PART A: DEFINITIONS AND CRITERIA*</b>                              |            |  |
|---|------------|--|
| <b>Definition of SIGNIFICANCE</b>                                     |            | <b>Significance = consequence x probability</b>  |
| <b>Definition of CONSEQUENCE</b>                                      |            | <b>Consequence is a function of intensity, spatial extent and duration</b>   |
| <b>Criteria for ranking of the INTENSITY of environmental impacts</b> | <b>VH</b>  | Severe change, disturbance or degradation. Associated with severe consequences. May result in severe illness, injury or death. Targets, limits and thresholds of concern continually exceeded. Substantial intervention will be required. Vigorous/widespread community mobilization against project can be expected. May result in legal action if impact occurs. |
|   | <b>H</b>   | Prominent change, disturbance or degradation. Associated with real and substantial consequences. May result in illness or injury. Targets, limits and thresholds of concern regularly exceeded. Will definitely require intervention. Threats of community action. Regular complaints can be expected when the impact takes place.                                 |
|   | <b>M</b>   | Moderate change, disturbance or discomfort. Associated with real but not substantial consequences. Targets, limits and thresholds of concern may occasionally be exceeded. Likely to require some intervention. Occasional complaints can be expected.   |
|   | <b>L</b>   | Minor (Slight) change, disturbance or nuisance. Associated with minor consequences or deterioration. Targets, limits and thresholds of concern rarely exceeded. Require only minor interventions or clean-up actions. Sporadic complaints could be expected.   |
|   | <b>VL</b>  | Negligible change, disturbance or nuisance. Associated with very minor consequences or deterioration. Targets, limits and thresholds of concern never exceeded. No interventions or clean-up actions required. No complaints anticipated.  |
|   | <b>VL+</b> | Negligible change or improvement. Almost no benefits. Change not measurable/will remain in the current range.  |
|   | <b>L+</b>  | Minor change or improvement. Minor benefits. Change not measurable/will remain in the current range. Few people will experience benefits.  |
|   | <b>M+</b>  | Moderate change or improvement. Real but not substantial benefits. Will be within or marginally better than the current conditions. Small number of people will experience benefits.   |
|   | <b>H+</b>  | Prominent change or improvement. Real and substantial benefits. Will be better than current conditions. Many people will experience benefits. General community support.   |
|   | <b>VH+</b> | Substantial, large-scale change or improvement. Considerable and widespread benefit. Will be much better than the current conditions. Favourable publicity and/or widespread support expected.   |
|   | <b>VL</b>  | Very short, always less than a year. Quickly reversible  |

|   |           |  |
|---|-----------|--|
| <b>Criteria for ranking the DURATION of impacts</b> | <b>L</b>  | Short-term, occurs for more than 1 but less than 5 years. Reversible over time.                          |
|   | <b>M</b>  | Medium-term, 5 to 10 years.  |
|   | <b>H</b>  | Long term, between 10 and 20 years. (Likely to cease at the end of the operational life of the activity) |
|   | <b>VH</b> | Very long, permanent, +20 years (Irreversible. Beyond closure)   |
| <b>Criteria for ranking the EXTENT of impacts</b>   | <b>VL</b> | A part of the site/property.   |
|   | <b>L</b>  | Whole site.  |
|   | <b>M</b>  | Beyond the site boundary, affecting immediate neighbours   |
|   | <b>H</b>  | Local area, extending far beyond site boundary.  |
|   | <b>VH</b> | Regional/National  |

| PART B: DETERMINING CONSEQUENCE |             |           |                             |            |                                       |  |                   |
|---------------------------------|-------------|-----------|-----------------------------|------------|---------------------------------------|--|-------------------|
|                                 |             |           | EXTENT                      |            |                                       |  |                   |
|                                 |             |           | A part of the site/property | Whole site | Beyond the site, affecting neighbours | Local area, extending far beyond site. | Regional/National |
|                                 |             |           | VL                          | L          | M                                     | H                                      | VH                |
| INTENSITY = VL                  |             |           |                             |            |                                       |  |                   |
| <b>DURATION</b>                 | Very long   | <b>VH</b> | Low                         | Low        | Medium                                | Medium                                 | High              |
|                                 | Long term   | <b>H</b>  | Low                         | Low        | Low                                   | Medium                                 | Medium            |
|                                 | Medium term | <b>M</b>  | Very Low                    | Low        | Low                                   | Low                                    | Medium            |
|                                 | Short term  | <b>L</b>  | Very low                    | Very Low   | Low                                   | Low                                    | Low               |
|                                 | Very short  | <b>VL</b> | Very low                    | Very Low   | Very Low                              | Low                                    | Low               |
| INTENSITY = L                   |             |           |                             |            |                                       |  |                   |
| <b>DURATION</b>                 | Very long   | <b>VH</b> | Medium                      | Medium     | Medium                                | High                                   | High              |
|                                 | Long term   | <b>H</b>  | Low                         | Medium     | Medium                                | Medium                                 | High              |
|                                 | Medium term | <b>M</b>  | Low                         | Low        | Medium                                | Medium                                 | Medium            |
|                                 | Short term  | <b>L</b>  | Low                         | Low        | Low                                   | Medium                                 | Medium            |
|                                 | Very short  | <b>VL</b> | Very low                    | Low        | Low                                   | Low                                    | Medium            |
| INTENSITY = M                   |             |           |                             |            |                                       |  |                   |
| <b>DURATION</b>                 | Very long   | <b>VH</b> | Medium                      | High       | High                                  | High                                   | Very High         |
|                                 | Long term   | <b>H</b>  | Medium                      | Medium     | Medium                                | High                                   | High              |
|                                 | Medium term | <b>M</b>  | Medium                      | Medium     | Medium                                | High                                   | High              |
|                                 | Short term  | <b>L</b>  | Low                         | Medium     | Medium                                | Medium                                 | High              |
|                                 | Very short  | <b>VL</b> | Low                         | Low        | Low                                   | Medium                                 | Medium            |

| INTENSITY = H  |             |    |        |        |           |           |           |
|----------------|-------------|----|--------|--------|-----------|-----------|-----------|
| DURATION       | Very long   | VH | High   | High   | High      | Very High | Very High |
|                | Long term   | H  | Medium | High   | High      | High      | Very High |
|                | Medium term | M  | Medium | Medium | High      | High      | High      |
|                | Short term  | L  | Medium | Medium | Medium    | High      | High      |
|                | Very short  | VL | Low    | Medium | Medium    | Medium    | High      |
| INTENSITY = VH |             |    |        |        |           |           |           |
| DURATION       | Very long   | VH | High   | High   | Very High | Very High | Very High |
|                | Long term   | H  | High   | High   | High      | Very High | Very High |
|                | Medium term | M  | Medium | High   | High      | High      | Very High |
|                | Short term  | L  | Medium | Medium | High      | High      | High      |
|                | Very short  | VL | Low    | Medium | Medium    | High      | High      |

| PART C: DETERMINING SIGNIFICANCE           |                         |    |               |               |          |        |           |
|--|-------------------------|----|---------------|---------------|----------|--------|-----------|
| PROBABILITY<br>(of exposure<br>to impacts) | Definite/<br>Continuous | VH | Very Low      | Low           | Medium   | High   | Very High |
|  | Probable                | H  | Very Low      | Low           | Medium   | High   | Very High |
|  | Possible/<br>frequent   | M  | Very Low      | Very Low      | Low      | Medium | High      |
|  | Conceivable             | L  | Insignificant | Very Low      | Low      | Medium | High      |
|  | Unlikely/<br>improbable | VL | Insignificant | Insignificant | Very Low | Low    | Medium    |
|  |                         |    | VL            | L             | M        | H      | VH        |
| CONSEQUENCE                                |                         |    |               |               |          |        |           |

| PART D: INTERPRETATION OF SIGNIFICANCE |   |
|--|---|
| Significance                           | Decision guideline  |
| Very High                              | Potential fatal flaw unless mitigated to lower significance.  |
| High                                   | It must have an influence on the decision. Substantial mitigation will be required.                       |
| Medium                                 | It should have an influence on the decision. Mitigation will be required.                                 |
| Low                                    | Unlikely that it will have a real influence on the decision. Limited mitigation is likely to be required. |
| Very Low                               | It will not have an influence on the decision. Does not require any mitigation                            |
| Insignificant                          | Inconsequential, not requiring any consideration.   |



## 7.7 POSITIVE AND NEGATIVE IMPACTS OF THE ACTIVITY AND ALTERNATIVES

As discussed earlier in the document, there are no expected significant impacts related to the alternatives for the pipeline and the railway loop. The preferred alternatives will be assessed in Section 9 of this report. The majority of the identified impacts are focused on elements of this application that do not have alternatives because they must support existing mining infrastructure and activities and therefore need to be within a specific location and provide a specific output to the existing process.

## 7.8 POSSIBLE MANAGEMENT ACTIONS THAT COULD BE APPLIED AND THE LEVEL OF RISK

This section requires that a list of issues raised by I&APs is provided together with the impacts associated with the issues and the mitigation actions identified to address these issues. A full summary of issues and concerns raised by I&APs during the EIA process is provided in Section 7.3. The section below only focusses on issues that require management actions to address I&APs concerns.

**Table 7-28: Possible management actions and impacts**

| Issues and concerns raised  | Possible management action to address issue                          | Impact significance of the possible management action before and after mitigation |           |
|---|--|---|-----------|
|   |  | Unmitigated   | Mitigated |
| <p>Hotazel Manganese Mines (Pty) Ltd (HMM), a subsidiary of South32, is the holder of a Mining Right (MR) (Ref No.: NC 256 MR) for the Mamatwan Mine (MMT). The MMT is bordered to the West by the Tshipi Borwa Mine, and to the North by the United Manganese of Kalahari (UMK) Mine. The mine is operated by South32 and is located 25 km to the south of the town Hotazel, in the John Taolo Gaetsewe District Municipality and Joe Morolong Local Municipality in the Northern Cape Province. SLR Consulting has been appointed by Hotazel Manganese Mines (Pty) Ltd to conduct an Environmental Authorisation (EA) Amendment Application for proposed changes to the infrastructure layout and activities at the Mamatwan Mine, near Hotazel, Northern Cape Province (NC-00198-MR/102).</p> <p>A draft Scoping Report (DSR) has been submitted in terms of the National Environmental Management Act, 1998 (NEMA) and the 2017 EIA Regulations for activities that trigger the Mineral and Petroleum Resources Development Act, 2002 (MPRDA)(As amended). The proposed change in layout and activities includes the following: establishment of top-cut stockpile and associated mobile crushing and screening plant, establishment of stormwater management infrastructure, establishment of pipelines, and upgrading the railway and railway loadout station. The DSR notes that a Heritage and Palaeontological Study will be compiled for the project as part of the EIA phase.</p> <p>In an Interim Comment issued on the 23/04/2021 (<a href="https://sahris.sahra.org.za/node/570238">https://sahris.sahra.org.za/node/570238</a>), SAHRA noted the pending Heritage Impact Assessment and Palaeontological Impact Assessment. Since the issuing of the Interim Comment, the HIA and PIA have been submitted to the case along with the Final EIA (09/12/2021).</p> | Implementation of a chance find procedure as outlined in Section 28. | Not applicable as no resources were identified on site.                           |           |

| Issues and concerns raised  | Possible management action to address issue | Impact significance of the possible management action before and after mitigation |           |
|---|---|---|-----------|
|   |   | Unmitigated   | Mitigated |
| <p>Butler, E. 2020. Palaeontological Exemption Report of the Mamatwan Mine – Changes to Infrastructure Layout and Activities, near Hotazel, Northern Cape Province.</p> <p>The proposed development is underlain at depth by the Griqualand West Basin Rocks which are overlain by the Cenozoic Kalahari Group. Stromatolites may be present in the Griqualand West Basin Rocks, while poorly preserved fossils may be present in the Kalahari Group sands. No recommendations were provided. Fourie, W. 2021. Heritage Impact Assessment: Mamatwan Mine – Changes to Infrastructure Layout and Activities, near Hotazel, Northern Cape Province. No heritage resources were identified within the proposed development footprint area. A Chance Finds Procedure is recommended to be implemented.</p> <p>The following comments are made as a requirement in terms of section 3(4) of the NEMA Regulations and section 38(8) of the NHRA in the format provided in section 38(4) of the NHRA and must be included in the Final EMPr:</p> <p>38(4)a – The SAHRA Archaeology, Palaeontology and Meteorites (APM) Unit has no objections to the proposed development;</p> <p>38(4)b – The recommendations of the specialists are supported and must be adhered to. No further additional specific conditions are provided for the development;</p> <p>38(4)c(i) – If any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils or other categories of heritage resources are found during the proposed development, SAHRA APM Unit (Natasha Higgitt/Phillip Hine 021 462 5402) must be alerted as per section 35(3) of the NHRA. Non-compliance with section of the NHRA is an offense in terms of section 51(1)e of the NHRA and item 5 of the Schedule;</p> |   |   |           |

| Issues and concerns raised  | Possible management action to address issue | Impact significance of the possible management action before and after mitigation |           |
|---|---|---|-----------|
|   |   | Unmitigated   | Mitigated |
| <p>38(4)c(ii) – If unmarked human burials are uncovered, the SAHRA Burial Grounds and Graves (BGG) Unit (Thingahangwi Tshivhase/Ngqalabutho Madida 012 320 8490), must be alerted immediately as per section 36(6) of the NHRA. Non-compliance with section of the NHRA is an offence in terms of section 51(1)e of the NHRA and item 5 of the Schedule;</p> <p>38(4)d – See section 51(1) of the NHRA regarding offences;</p> <p>38(4)e – The following conditions apply with regards to the appointment of specialists:</p> <p>i) If heritage resources are uncovered during the course of the development, a professional archaeologist or palaeontologist, depending on the nature of the finds, must be contracted as soon as possible to inspect the heritage resource. If the newly discovered heritage resources prove to be of archaeological or palaeontological significance, a Phase 2 rescue operation may be required subject to permits issued by SAHRA.</p> <p>As the Final EIA has been finalised without including SAHRA comments, this comment must be forwarded directly to the competent authority for their consideration during the decision-making process. Proof of delivery and receipt thereof must be provided.</p> <p>The Final EMP must be submitted to SAHRA for record purposes. The decision regarding the EA Application must be communicated to SAHRA and uploaded to the SAHRIS Case application.</p> |   |   |           |



## 7.9 MOTIVATION WHERE NO ALTERNATIVE SITES WERE CONSIDERED

This application includes the following activities, where some activities had feasible alternatives for consideration.

### 7.9.1 The establishment of a top-cut stockpile and associated crushing and screening plant

The top-cut stockpile location was identified to be within the Mine Surface working area and to be accessed by existing roads. There is no alternative location for this stockpile and the stockpile location was informed by available space within the current footprint. The top-cut stockpile is located to the east of the Southeast Waste Rock Dump and north of Adams Pit in order to limit the required transport of material and to all of for the top-cut material to be accessible to the road network and to the new rail loop.

### 7.9.2 Establishment of stormwater management infrastructure

The stormwater infrastructure has been designed to cater to the stormwater expected for the site. The infrastructure needs to link into and optimise the existing stormwater infrastructure. The locations and designs of new infrastructure is limited by the existing infrastructure and the expected stormwater flow direction and volumes.

### 7.9.3 Changes to waste rock dump height

The increase in the waste rock dump height is restricted to the existing waste rock dump footprint. The value of the increase is determined by the required additional capacity. Therefore, no alternatives were assessed with this.

### 7.9.4 Establishment of a pipeline to transport abstracted water from the decommissioned Middelplaats Mine to Mamatwan Mine

The pipeline for the transport of water from Middelplaats Mine was assessed using three alignment options. The preferred option runs within an existing road servitude and therefore has the least potential impacts to the receiving environment. It is also technically the best route for engineering of the pipeline.

### 7.9.5 Upgrading the railway and railway loadout station

The railway loop alignment presented two options, the first was extended past both stockpiles to the east of Adams Pit. This option was optimised and the loop is now more conservative and runs between the two stockpiles with the future product stockpile stackers and reclaimers within the loop, in close proximity to the product stockpile.

### 7.9.6 Sale of waste rock as aggregate

There are no alternatives to the process of waste rock sales as aggregate. However, this process reduces the volumes of waste rock requiring long term disposal.

### 7.9.7 Re-processing of material located in Adams Pit.

There are no alternatives that have been identified for the reprocessing of the material at Adams Pit. The location for reprocessing is restricted to the location of the Pit and the location of the processing plant.

## 7.10 STATEMENT MOTIVATING THE PREFERRED ALTERNATIVE

### 7.10.1 Pipeline Route

The potable water pipeline route was selected from three alternatives. The preferred alternative is within an existing access road servitude and therefor limits the introduction of potential impacts to a greenfields environment. The maintenance and monitoring of the pipeline will be more easily implemented along the access road, precluding the necessity to send vehicles and equipment into undisturbed areas of the project area.

### 7.10.2 Railway Loop

The initial railway loop design was optimised to reduce the offprint of the railway track and maintain the loop within the Mamatwan Mining Right Area and within the disturbed footprint. The smaller loop makes the unloading of rail cars more efficient, allowing for an optimal operation.

## 8. FULL DESCRIPTION OF THE PROCESS UNDERTAKEN TO IDENTIFY, ASSESS AND RANK THE IMPACTS AND RISKS THE ACTIVITY WILL IMPOSE ON THE PREFERRED SITE THROUGH THE LIFE OF THE ACTIVITY

### 8.1 DESCRIPTION OF THE PROCESS UNDERTAKEN TO IDENTIFY IMPACTS

#### 8.1.1 Desktop Assessments

The Scoping Phase of the process included the review of available reports and information of the study area. This included the following:

- Previous environmental and specialist reports for the Mamatwan Mine;
- Previous environmental and specialist reports for Tshipi Mine;
- Description of the proposed activities;
- Site layout maps of the mine and existing infrastructure; and
- Google Earth imagery of the Mining Rights area and adjacent land.

#### 8.1.2 Engagement with Local Knowledge

Discussions with the Mine management and onsite staff provided a good understanding of the existing process and how the proposed activities and infrastructure would support and link into the existing mining facilities. Engagement with key stakeholders such as representatives of adjacent mines and landowners provided further understanding of the potential impact of the proposed activities to the region.

#### 8.1.3 Site investigations

Site investigations were carried out by the environmental and social project team as well as by the specialist team to confirm the desktop findings. Samples were taken of the receiving environmental aspects of concern and sensitive receptors were identified and mapped. Sensitive habitats, communities and water bodies were identified and delineated.

#### 8.1.4 Impact Assessment

An impact assessment methodology was provided for use by the entire SLR project team in order to ensure that rankings would be comparable and would be reported on in a similar manner. Workshops were held with the specialist team in order to discuss and adjust impact ratings where appropriate or to obtain clarity on the ratings in the context of the project.

#### 8.2 DESCRIPTION OF THE PROCESS UNDERTAKEN TO ASSESS AND RANK THE IMPACTS AND RISKS

The method used for the assessment of environmental issues is set out in Table 7-27. Part A provides the definition for determining impact consequence (combining intensity, spatial scale and duration) and impact significance (the overall rating of the impact). Impact consequence and significance are determined from Part B and C. The interpretation of the impact significance is given in Part D.

The assessment methodology enables the assessment of environmental issues including cumulative impacts, the severity of impacts (including the nature of impacts and the degree to which impacts may cause irreplaceable loss of resources), the extent of the impacts, the duration and reversibility of impacts, the probability of the impact occurring, and the degree to which the impacts can be mitigated.

#### 8.3 POSITIVE AND NEGATIVE IMPACTS OF THE PROPOSED ACTIVITY AND ALTERNATIVES

The proposed activity was assessed to potentially generate the impacts as summarised in Section 9.

#### 8.4 POSSIBLE MANAGEMENT ACTIONS THAT COULD BE APPLIED AND THE LEVEL OF RISK

The proposed management actions that could be applied and the level or residual risk per potential impact is provided in Section 28.

#### 8.5 DESCRIPTION OF THE IMPACTS AND RISKS IDENTIFIED DURING THE ENVIRONMENTAL ASSESSMENT PROCESS

Descriptions of the biophysical, cultural heritage and socio-economic impacts in respect of each of the main project activities and phases are provided in Table 8-1 below.

**Table 8-1: List of Potential Impacts in respect in each of Activity and Phase**

| Potential Impact  | Activity   | Phase  |
|---|--|--|
| Loss and sterilisation of mineral resources   | N/A  | N/A  |
| Altering topography   | <ul style="list-style-type: none"> <li>• Site preparation</li> <li>• Civil works</li> <li>• Earthworks</li> <li>• Rehabilitation</li> <li>• Maintenance and aftercare</li> </ul> | <ul style="list-style-type: none"> <li>• Construction</li> <li>• Decommissioning</li> <li>• Closure</li> </ul> |
| Hazardous excavations and infrastructure resulting in safety risks to third parties and animals | <ul style="list-style-type: none"> <li>• Site preparation</li> <li>• Civil works</li> <li>• Earthworks</li> </ul>  | <ul style="list-style-type: none"> <li>• Construction</li> </ul>   |

| Potential Impact                                       | Activity  | Phase   |
|--|---|---|
| Soil erosion   | <ul style="list-style-type: none"> <li>• Site preparation</li> <li>• Civil works</li> <li>• Earthworks</li> <li>• Transport systems</li> <li>• General site management</li> <li>• Demolition</li> <li>• Rehabilitation</li> <li>• Maintenance and aftercare</li> </ul>  | <ul style="list-style-type: none"> <li>• Construction</li> <li>• Operation</li> <li>• Decommissioning</li> <li>• Closure</li> </ul> |
| Disturbance of original soil profiles                  | <ul style="list-style-type: none"> <li>• Site preparation</li> <li>• Civil works</li> <li>• Earthworks</li> <li>• Transport systems</li> <li>• General site management</li> <li>• Demolition</li> <li>• Rehabilitation</li> <li>• Maintenance and aftercare</li> </ul>  | <ul style="list-style-type: none"> <li>• Construction</li> <li>• Operation</li> <li>• Decommissioning</li> <li>• Closure</li> </ul> |
| Chemical pollution of soil                             | <ul style="list-style-type: none"> <li>• Site preparation</li> <li>• Civil works</li> <li>• Earthworks</li> <li>• Transport systems</li> <li>• General site management</li> <li>• Demolition</li> <li>• Rehabilitation</li> <li>• Maintenance and aftercare</li> </ul>  | <ul style="list-style-type: none"> <li>• Construction</li> <li>• Operation</li> <li>• Decommissioning</li> <li>• Closure</li> </ul> |
| Physical destruction and disturbance of floral species | <ul style="list-style-type: none"> <li>• Site preparation</li> <li>• Civil works</li> <li>• Earthworks</li> <li>• Transport systems</li> <li>• General site maintenance</li> <li>• Demolition</li> <li>• Rehabilitation</li> <li>• Maintenance and aftercare</li> </ul> | <ul style="list-style-type: none"> <li>• Construction</li> <li>• Decommissioning</li> <li>• Closure</li> </ul>                      |
| Physical destruction and disturbance of faunal species | <ul style="list-style-type: none"> <li>• Site preparation</li> <li>• Civil works</li> <li>• Earthworks</li> <li>• Transport systems</li> <li>• General site maintenance</li> <li>• Demolition</li> <li>• Rehabilitation</li> <li>• Maintenance and aftercare</li> </ul> | <ul style="list-style-type: none"> <li>• Construction</li> <li>• Decommissioning</li> <li>• Closure</li> </ul>                      |
| Alteration of natural drainage patterns                | <ul style="list-style-type: none"> <li>• Site preparation</li> <li>• Civil works</li> <li>• Earthworks</li> <li>• Transport system</li> <li>• Site maintenance</li> <li>• Stormwater diversion and management</li> <li>• Rehabilitation</li> </ul>                      | <ul style="list-style-type: none"> <li>• Construction</li> <li>• Operation</li> <li>• Decommissioning</li> <li>• Closure</li> </ul> |
| Contamination of surface water resources               | <ul style="list-style-type: none"> <li>• Site preparation</li> <li>• Civil works</li> </ul>   | <ul style="list-style-type: none"> <li>• Construction</li> <li>• Operation</li> </ul>   |



| Potential Impact   | Activity  | Phase   |
|--|---|---|
|  | <ul style="list-style-type: none"> <li>Earthworks</li> <li>Transport systems</li> <li>General site maintenance</li> <li>Demolition</li> <li>Rehabilitation</li> </ul> Maintenance and aftercare   | <ul style="list-style-type: none"> <li>Decommissioning</li> <li>Closure</li> </ul>  |
| Contamination of groundwater resources                   | <ul style="list-style-type: none"> <li>Site preparation</li> <li>Civil works</li> <li>Earthworks</li> <li>Transport systems</li> <li>General site maintenance</li> <li>Demolition</li> <li>Rehabilitation</li> <li>Maintenance and aftercare</li> </ul> | <ul style="list-style-type: none"> <li>Construction</li> <li>Operation</li> <li>Decommissioning</li> <li>Closure</li> </ul> |
| Air pollution  | <ul style="list-style-type: none"> <li>Site preparation</li> <li>Civil works</li> <li>Earthworks</li> <li>Transport systems</li> <li>General site maintenance</li> <li>Demolition</li> <li>Rehabilitation</li> </ul>                                    | <ul style="list-style-type: none"> <li>Construction</li> <li>Operation</li> <li>Decommissioning</li> <li>Closure</li> </ul> |
| Increase in disturbing noise levels                      | <ul style="list-style-type: none"> <li>Site preparation</li> <li>Civil works</li> <li>Earthworks</li> </ul>   | <ul style="list-style-type: none"> <li>Construction</li> <li>Decommissioning</li> </ul>                                     |
| Negative visual views                                    | <ul style="list-style-type: none"> <li>N/A</li> </ul>   | <ul style="list-style-type: none"> <li>N/A</li> </ul>   |
| Road disturbance and traffic safety                      | <ul style="list-style-type: none"> <li>N/A</li> </ul>   | <ul style="list-style-type: none"> <li>N/A</li> </ul>   |
| Loss of cultural/heritage and palaeontological resources | <ul style="list-style-type: none"> <li>Site preparation</li> <li>Civil works</li> <li>Earthworks</li> </ul>   | <ul style="list-style-type: none"> <li>Construction</li> <li>Decommissioning</li> </ul>                                     |
| Inward migration and economic impact                     | <ul style="list-style-type: none"> <li>Site Preparation</li> <li>Civil works</li> <li>Earth works</li> </ul>  | <ul style="list-style-type: none"> <li>Construction</li> </ul>  |
| Change in land use                                       | <ul style="list-style-type: none"> <li>N/A</li> </ul>   | <ul style="list-style-type: none"> <li>N/A</li> </ul>   |

## 8.6 ASSESSMENT OF THE SIGNIFICANCE OF EACH IMPACT AND RISK AND AN INDICATION OF THE EXTENT OF TO WHICH THE ISSUE AND RISK CAN BE AVOIDED OR ADDRESSED BY THE ADOPTION OF MANAGEMENT ACTIONS

The assessment of the significance of potential biophysical, cultural/heritage and socio-economic impacts, including the extent to which impacts can be avoided or mitigated, is included in Chapter 9 and Appendix R.

## 9. ASSESSMENT OF EACH IDENTIFIED POTENTIALLY SIGNIFICANT IMPACT AND RISK

A summary of the assessment of the identified potentially significant biophysical, cultural heritage and socio-economic impacts associated with the proposed project is provided in the table below. A full description of the assessment is included in Appendix C.

**Table 9-1: Assessment of significant impacts and risks**

| Activity   | Potential impact  | Aspects affected         | Phase   | Significance (Unmitigated) | Management actions type   | Significance (Mitigated) | Extent to which the impact can be reversed, avoided or cause irreplaceable loss and the degree to which the impact and risk can be mitigated   |
|--|---|--------------------------|---|----------------------------|---|--------------------------|--|
| <ul style="list-style-type: none"> <li>Site preparation</li> <li>Civil works</li> <li>Earthworks</li> <li>Rehabilitation</li> <li>Maintenance and aftercare</li> </ul>   | Altering topography   | Topography               | <ul style="list-style-type: none"> <li>Construction</li> <li>Decommissioning</li> <li>Closure</li> </ul>                    | <b>Insignificant</b>       | <ul style="list-style-type: none"> <li>Minimise the area of disturbance by designing and constructing the most compact infrastructure practically possible; and</li> <li>Rehabilitate in accordance with the approved mine closure plan that ensure a suitable post-closure land use is achieved.</li> </ul>  | <b>INSIGNIFICANT</b>     |  |
| <ul style="list-style-type: none"> <li>Site preparation</li> <li>Civil works</li> <li>Earthworks</li> </ul>  | Hazardous excavations and infrastructure resulting in safety risks to third parties and animals |                          | <ul style="list-style-type: none"> <li>Construction</li> </ul>  | <b>Medium</b>              | <ul style="list-style-type: none"> <li>The project area will be fenced off to prevent inadvertent access by third parties and animals;</li> <li>Access control will be implemented to ensure access is only granted to those who have authorisation;</li> <li>Barriers will be erected around all hazardous excavations;</li> <li>Warning signage will be erected at all hazardous excavations; and</li> <li>Where the proposed project has caused injury to third parties or animals, appropriate compensation will be provided;</li> <li>Care must be taken to ensure that third-party infrastructure, such as telephone lines, etc. are not damaged during the construction phase.</li> </ul>  | <b>Low</b>               | <ul style="list-style-type: none"> <li>Highly likely to be mitigated.</li> <li>Highly unlikely to be reversed in the case of injury or death.</li> <li>Highly likely to be avoided with mitigation.</li> <li>Highly likely to cause irreplaceable loss in the case of injury or death.</li> </ul>  |
| <ul style="list-style-type: none"> <li>Site preparation</li> <li>Civil works</li> <li>Earthworks</li> <li>Transport systems</li> <li>General site management</li> <li>Demolition</li> <li>Rehabilitation</li> <li>Maintenance and aftercare</li> </ul> | Soil erosion  | Soil and Land Capability | <ul style="list-style-type: none"> <li>Construction</li> <li>Operation</li> <li>Decommissioning</li> <li>Closure</li> </ul> | <b>Medium</b>              | <ul style="list-style-type: none"> <li>Implement the soil conservation procedure as per the EMPR.</li> <li>Establish short term perennial vegetation that will stabilise the site but allow the indigenous vegetation to establish over the site;</li> <li>Use existing established roads;</li> <li>Ensure vegetation clearing is undertaken in phases;</li> <li>Limit vegetation clearance to only the areas where the infrastructure will be constructed;</li> <li>Avoid parking of vehicles and equipment outside of designated parking areas;</li> <li>Plan vegetation clearance for dry seasons (late autumn, winter and early spring); and</li> <li>Re-establish vegetation along the railway infrastructure to reduce the impact of run-off from the compacted surface of the railway area.</li> </ul> | <b>Low</b>               | <ul style="list-style-type: none"> <li>Highly likely to be mitigated.</li> <li>Unlikely to be reversed where vegetation has been removed, highly likely to be reversed beyond the project footprint.</li> <li>Unlikely to be avoided where vegetation has been removed, highly likely to be avoided beyond the project footprint.</li> <li>Highly unlikely to result in irreplaceable loss.</li> </ul> |
| <ul style="list-style-type: none"> <li>Site preparation</li> <li>Civil works</li> <li>Earthworks</li> <li>Transport systems</li> <li>General site management</li> <li>Demolition</li> <li>Rehabilitation</li> <li>Maintenance and aftercare</li> </ul> | Disturbance of original soil profiles   |                          | <ul style="list-style-type: none"> <li>Construction</li> <li>Operation</li> <li>Decommissioning</li> <li>Closure</li> </ul> | <b>Medium</b>              | <ul style="list-style-type: none"> <li>Land clearance must only be undertaken immediately prior to construction activities within the development footprint; and</li> <li>Level any remaining topsoil that was removed from the railway area and that remained on the surface instead of allowing small stockpiled of soil to remain on the surface.</li> </ul>   | <b>Low</b>               | <ul style="list-style-type: none"> <li>Highly likely to be mitigated.</li> <li>Unlikely to be reversed where vegetation has been removed, highly likely to be reversed beyond the project footprint.</li> <li>Unlikely to be avoided where vegetation has been removed, highly likely to be avoided beyond the project footprint.</li> <li>Highly unlikely to result in irreplaceable loss.</li> </ul> |
| <ul style="list-style-type: none"> <li>Site preparation</li> <li>Civil works</li> <li>Earthworks</li> <li>Transport systems</li> </ul>   | Chemical pollution of soil  |                          | <ul style="list-style-type: none"> <li>Construction</li> <li>Operation</li> <li>Decommissioning</li> <li>Closure</li> </ul> | <b>Medium</b>              | <ul style="list-style-type: none"> <li>Conduct potentially polluting activities (i.e., loading, hauling, tipping, transportation, handling and storage) in a manner that pollutants are contained at source and do not pollute soils. In this regard:</li> <li>Service all vehicles and mobile equipment regularly in workshops, service bays and wash bays with contained impermeable, floors, dirty water collection facilities and oil traps;</li> <li>Design and operate all new and used chemical, fuel and oil storage and handling facilities in a manner that all spillages are contained in impermeable areas and cannot be released into the environment;</li> </ul>  | <b>Low</b>               | <ul style="list-style-type: none"> <li>Highly likely to be mitigated.</li> <li>Highly likely to be reversed with remediation.</li> <li>Highly likely to be avoided with mitigation.</li> <li>Highly unlikely to cause irreplaceable loss.</li> </ul>   |

| Activity   | Potential impact                                       | Aspects affected | Phase   | Significance (Unmitigated) | Management actions type   | Significance (Mitigated) | Extent to which the impact can be reversed, avoided or cause irreplaceable loss and the degree to which the impact and risk can be mitigated  |
|--|--|------------------|---|----------------------------|---|--------------------------|---|
| <ul style="list-style-type: none"> <li>General site management</li> <li>Demolition</li> <li>Rehabilitation</li> <li>Maintenance and aftercare</li> </ul>   |  |                  |   |                            | <ul style="list-style-type: none"> <li>Report ad hoc spills of potentially polluting substances (whether in dirty areas or in the environment) to the environmental manager immediately and clean up and/or remediate immediately;</li> <li>Implement and maintain a dirty water management system;</li> <li>Implement the waste management practices, as per the IWWMP and EMPR.</li> <li>Educate and train all employees (temporary and permanent) and contractors in pollution prevention; and</li> <li>Implement formalised action plans to enable fast and efficient reaction to contain and remediate pollution incidents.</li> <li>Take into account the requirements for long term soil pollution prevention, land function and confirmatory monitoring in the design of any permanent and potentially polluting structures; and</li> <li>Implement the emergency response procedure in the event any major spillage incident.</li> </ul>   |                          |   |
| <ul style="list-style-type: none"> <li>Site preparation</li> <li>Civil works</li> <li>Earthworks</li> <li>Transport systems</li> <li>General site management</li> <li>Demolition</li> <li>Rehabilitation</li> <li>Maintenance and aftercare</li> </ul> | Physical destruction and disturbance of floral species | Biodiversity     | <ul style="list-style-type: none"> <li>Construction</li> <li>Operation</li> <li>Decommissioning</li> <li>Closure</li> </ul> | Medium                     | <ul style="list-style-type: none"> <li>A biodiversity specialist shall do a walkdown of the project footprint prior to land clearing activities to identify protected floral species and floral SCC that may have been lying dormant during initial field observations; <ul style="list-style-type: none"> <li>Should any protected floral species and floral SCC be located on site, the necessary permits need to be obtained from DENC and/or DFFE prior to removal. They are to be relocated and the relocation success of such species should be monitored for three years post-construction. Immediate actions are to be taken if it becomes evident that relocation is not successful;</li> <li>Ensure the removal of indigenous vegetation is restricted to what is absolutely necessary;</li> <li>No collection of floral species and floral SCC is allowed;</li> </ul> </li> <li>Limit edge effects to the surrounding environment by: <ul style="list-style-type: none"> <li>Demarcating all footprint areas during construction;</li> <li>Preventing construction rubble or cleared alien vegetation and invasive species to be disposed outside of demarcated areas;</li> <li>Ensuring that construction rubble and cleared alien and invasive species are taken to a registered waste disposal facility; and</li> <li>Managing the spread of alien and invasive species.</li> </ul> </li> <li>Provide appropriate sanitary facilities and ensure the disposal thereof at a registered licenced facility;</li> <li>Ensure no temporary dump sites are created on site;</li> <li>No fires are allowed on site;</li> <li>Compile an alien invasive species management or control plan for implementation with the following recommendations: <ul style="list-style-type: none"> <li>A buffer area of 30 m surrounding the railway balloon should be regularly checked for alien invasive species;</li> <li>Remove alien invasive species throughout the construction, operation and maintenance phases;</li> <li>Ensure alien vegetation is removed prior to the removal of indigenous vegetation;</li> <li>Ensure only trained personnel are involved in the chemical control of alien invasive species;</li> <li>Edge effects arising from the proposed project which may affect adjacent areas must be strictly managed;</li> <li>Ongoing alien invasive species monitoring must be undertaken throughout all phases; and</li> <li>Removed alien invasive species must not be placed on unprotected ground as seeds may disperse upon it. All cleared alien invasive species must be disposed of at a licenced waste facility.</li> </ul> </li> </ul> | LOW                      | <ul style="list-style-type: none"> <li>Very highly likely to be mitigated.</li> <li>Medium likelihood to be reversed.</li> <li>Medium likelihood to be avoided with mitigation.</li> <li>Unlikely to cause irreplaceable loss.</li> </ul> |
| <ul style="list-style-type: none"> <li>Site preparation</li> <li>Civil works</li> <li>Earthworks</li> <li>Transport systems</li> <li>General site management</li> <li>Demolition</li> <li>Rehabilitation</li> <li>Maintenance and aftercare</li> </ul> | Physical destruction and disturbance of faunal species | Biodiversity     | <ul style="list-style-type: none"> <li>Construction</li> <li>Operation</li> <li>Decommissioning</li> <li>Closure</li> </ul> | High                       | <ul style="list-style-type: none"> <li>A biodiversity specialist shall do a walkdown of the project footprint prior to land clearing activities to identify faunal species on site and to assist with the relocation thereof;</li> <li>It is recommended that culverts of sufficient size be placed beneath the railway line so as to allow for the movement of small faunal species between the remaining habitat inside the railway loop and that of the larger habitat outside. Culverts must be regularly inspected for infilling and blockages, ensuring they are kept clear of debris;</li> <li>No collection, trapping and harming of faunal species and faunal SCC is allowed;</li> <li>Construction personnel are to undergo environmental awareness training pertaining to the potential faunal species located on site;</li> <li>While no protected faunal species were identified on site, if any species are encountered on site, the necessary permits need to be obtained from DENC and/or DFFE prior to removal/relocation;</li> <li>Perimeter fencing installed as part of the proposed project must allow for the movement of small animals (e.g., palisade fencing or cattle fencing). Should impermeable fencing be installed, small openings must be created to allow for the continuous movement of small animals. Such openings must be continuously monitored and cleared of debris; and</li> <li>Smaller species that are not readily able to move out of an area ahead of vegetation and ground clearing activities (such as scorpions and reptiles), will be less mobile during rainfall events and cold days. As such, care must be taken to look for these species prior to these activities and should these species be encountered, they are to be carefully</li> </ul>  | Medium                   | <ul style="list-style-type: none"> <li>Very highly likely to be mitigated.</li> <li>Medium likelihood to be reversed.</li> <li>Medium likelihood to be avoided with mitigation.</li> <li>Unlikely to cause irreplaceable loss.</li> </ul> |

| Activity   | Potential impact  | Aspects affected                                | Phase   | Significance (Unmitigated) | Management actions type  | Significance (Mitigated) | Extent to which the impact can be reversed, avoided or cause irreplaceable loss and the degree to which the impact and risk can be mitigated  |
|--|---|---|---|----------------------------|--|--------------------------|---|
|  |   |   |   |                            | and safely moved to an area of similar habitat outside of the project footprint. A suitably trained specialist shall be instructed to carry out the removal of venomous snake species.   |                          |   |
| <ul style="list-style-type: none"> <li>Site preparation</li> <li>Civil works</li> <li>Earthworks</li> <li>General site management</li> <li>Rehabilitation</li> </ul>   | Alteration of natural drainage patterns                 | Surface water resources                         | <ul style="list-style-type: none"> <li>Construction</li> <li>Operation</li> <li>Decommissioning</li> <li>Closure</li> </ul> | Medium                     | <ul style="list-style-type: none"> <li>Stormwater management plan has been designed to channel runoff and separate dirty water from clean water, aligning with the GN704.</li> </ul>   | Low                      | <ul style="list-style-type: none"> <li>Very highly likely to be mitigated.</li> <li>Medium likelihood to be reversed.</li> <li>Medium likelihood to be avoided with mitigation.</li> <li>Unlikely to cause irreplaceable loss.</li> </ul> |
| <ul style="list-style-type: none"> <li>Site preparation</li> <li>Civil works</li> <li>Earthworks</li> <li>General site management</li> <li>Rehabilitation</li> </ul>   | Contamination of surface water resources                |   |   | Medium                     | <ul style="list-style-type: none"> <li>Drip trays to be placed under all standing machinery and equipment.</li> <li>Water quality monitoring plan and implementation.</li> <li>Stormwater management plan to minimise the potential to contaminate surface water and separates dirty and clean water.</li> <li>Optimise the reuse of mine water to minimise disposal / treatment / storage of dirty water.</li> </ul>  | Low                      | <ul style="list-style-type: none"> <li>Very highly likely to be mitigated.</li> <li>Medium likelihood to be reversed.</li> <li>Medium likelihood to be avoided with mitigation.</li> <li>Unlikely to cause irreplaceable loss.</li> </ul> |
| <ul style="list-style-type: none"> <li>Site preparation</li> <li>Civil works</li> <li>Earthworks</li> <li>Transport systems</li> <li>General site management</li> <li>Demolition</li> <li>Rehabilitation</li> <li>Maintenance and aftercare</li> </ul> | Contamination of groundwater resources                  | Groundwater resources                           | <ul style="list-style-type: none"> <li>Construction</li> <li>Operation</li> <li>Decommissioning</li> <li>Closure</li> </ul> | Medium                     | <ul style="list-style-type: none"> <li>Implement approved management actions pertaining to the containment of dirty water in accordance with Regulation 704 (June 1999);</li> <li>Any sheet runoff from compacted areas must be slowed down by the strategic placement of berms; and</li> <li>Control stormwater through the implementation of HMM's existing Stormwater Management Plan.</li> </ul>   | Low                      |   |
| <ul style="list-style-type: none"> <li>Site preparation</li> <li>Civil works</li> <li>Earthworks</li> <li>Demolition</li> </ul>  | Air pollution   | Air Quality                                     | <ul style="list-style-type: none"> <li>Construction</li> <li>Decommissioning</li> </ul>                                     | Low                        | <ul style="list-style-type: none"> <li>Continue the implementation of HMM's dust fallout monitoring programme;</li> <li>Reduce vehicle exhaust emissions through the use of better-quality diesel;</li> <li>Implement inspection and maintenance programmes;</li> <li>Implement dust suppression measures (wet and dry) to limit dust impacts.</li> </ul>  | Very Low                 | <ul style="list-style-type: none"> <li>Very highly likely to be mitigated.</li> <li>Low likelihood to be reversed.</li> <li>High likelihood to be avoided with mitigation.</li> <li>Very unlikely to cause irreplaceable loss.</li> </ul> |
| <ul style="list-style-type: none"> <li>Site preparation</li> <li>Civil works</li> <li>Earthworks</li> </ul>  | Increase in disturbing noise levels                     | Noise   | <ul style="list-style-type: none"> <li>Construction</li> </ul>  | Low                        | <ul style="list-style-type: none"> <li>Use noise barriers and low noise equipment and vehicles.</li> <li>Investigate use of alternatives to audible reversing alarms and maximise forward movements of mobile plant and vehicles.</li> <li>Staff training and awareness of noise control plan.</li> <li>Avoid clustering of mobile equipment near receptors.</li> <li>Noise generating activities to be limited to daytime hours.</li> <li>Maintenance of vehicles and equipment.</li> </ul> | Very Low                 | <ul style="list-style-type: none"> <li>Very highly likely to be mitigated.</li> <li>Low likelihood to be reversed.</li> <li>High likelihood to be avoided with mitigation.</li> <li>Very unlikely to cause irreplaceable loss.</li> </ul> |
| <ul style="list-style-type: none"> <li>Site preparation</li> <li>Civil works</li> <li>Earthworks</li> </ul>  | Loss of cultural/heritage and paleontological resources | Cultural/heritage and paleontological resources | <ul style="list-style-type: none"> <li>Construction</li> </ul>  | Insignificant              | <ul style="list-style-type: none"> <li>Implement the chance find procedure in the event of the discovery of cultural/heritage and/or palaeontological resources on site.</li> </ul>  | INSIGNIFICANT            |   |
| <ul style="list-style-type: none"> <li>Site preparation</li> <li>Civil works</li> <li>Earthworks</li> </ul>  | Inward migration and economic impact                    | Socio-economic                                  | <ul style="list-style-type: none"> <li></li> </ul>  | Medium                     | <ul style="list-style-type: none"> <li>Communication with local communities to identify and manage inward migration.</li> <li>Indicate the extent to which additional employment may be available for the construction phase.</li> </ul>   | Low                      | <ul style="list-style-type: none"> <li>Moderately likely to be mitigated.</li> <li>Moderate likelihood to be reversed.</li> </ul>   |



| Activity | Potential impact | Aspects affected | Phase | Significance (Unmitigated) | Management actions type | Significance (Mitigated) | Extent to which the impact can be reversed, avoided or cause irreplaceable loss and the degree to which the impact and risk can be mitigated          |
|----------|------------------|------------------|-------|----------------------------|-------------------------|--------------------------|---|
|          |                  |                  |       |                            |                         |                          | <ul style="list-style-type: none"><li>Moderate likelihood to be avoided with mitigation.</li><li>Very unlikely to cause irreplaceable loss.</li></ul> |

## 10. SUMMARY OF SPECIALIST REPORT FINDINGS

The relevant specialist studies that were undertaken as part of the proposed project including the recommendations made by the specialists are provided in the table below. All relevant specialist reports have been attached as appendices to this report.

**Table 10-1: Summary of specialist recommendations**

| Specialist Study   | Recommendation of Specialist   | Specialist Recommendations that have been included in this EIAR (Mark with X) | Reference to Applicable Section in this Report |
|--------------------|--|---|--|
| Biodiversity Study | <ul style="list-style-type: none"> <li>Minimise loss of indigenous vegetation where possible through effective planning and limiting the development footprint to what is essential. The designs must further adhere to all legislation and all possible precautions taken to prevent potential spills and /or leaks.</li> <li>It is recommended that prior to the commencement of construction activities the entire construction servitude be fenced off, and clearly demarcated to limit footprint creep and edge effects. This will be carried out where feasible and where the fencing will not obstruct other activities.</li> <li>It is recommended that prior to any construction/ earth moving activities are to take place, a detailed walkdown of all-natural areas falling within the final expansion footprint area be undertaken and all protected floral species be marked.</li> <li>It is recommended that prior to the commencement of construction activities the entire proposed top cut be fenced off and clearly demarcated, any burrows should be monitored after fencing has been established to ensure no SCC are utilizing the area. If SCC are noted permits for their removal are necessary.</li> <li>Development should consider sensitive habitats for fauna within the study area.</li> <li>No hunting, trapping or collecting of faunal species is allowed.</li> <li>No collection/ trapping or hunting of faunal SCCs may be allowed by any construction personnel.</li> <li>The walkdown should be undertaken during the summer season when most herbaceous floral species will be in flower, and accurate identification will be easier.</li> <li>Once all floral SCC and NCNCA protected floral species within the development footprint has been identified, a rescue and relocation plan should be designed specifically to each species. Rescue and relocation activities need to take place prior to commencement of any expansion activities. Rescue and relocation need to be overseen by a suitably qualified contractor/ mine employee. The success of relocation actions needs to be monitored quarterly for a minimum period of three years post-relocation.</li> <li>The necessary permits need to be obtained from DOFF and NCDENC prior to the implementation of rescue and relocation activities.</li> <li>During the surveying and site-pegging phases, all faunal SCC that will be affected by surface infrastructure must be marked and, where possible, relocated to suitable habitat surrounding the disturbance footprint. The relevant permits must be applied for from the Northern Cape Department of Environment and Nature Conservation (NCDENC) prior to the commencement of the construction phase.</li> <li>Should any other faunal species protected under National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) or the Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) (NCNCA) be encountered within the study area authorisation to relocate such species must be obtained from the NCDENC or the Department of Environmental Affairs (DEA).</li> <li>Edge effect control needs to be implemented to ensure no further degradation and potential loss of faunal SCC outside of the proposed project footprint area.</li> <li>Should any SCC be observed on the site a biodiversity specialist should be contacted in order to map the best way forward.</li> <li>Prior to vegetation clearing activities in the Kathu Bushveld habitat, the site should be inspected for the presence of burrowing scorpion burrows, pythons and Aardvark. If located, these species should be carefully excavated ensuring no harm to fauna and relocated to similar surrounding habitat outside of the footprint area.</li> <li>An AIP Management/Control Plan should be compiled for implementation: <ul style="list-style-type: none"> <li>Removal of alien invasive species should preferably commence during the pre-construction phase and continue throughout the construction, operational, decommissioning and post-closure phases. AIPs should be cleared within areas where they have become proliferate within the existing mining and infrastructure areas (Degraded Bushveld and Transformed Habitat) as well as where new infrastructure is planned before any construction activities commence, thereby ensuring that no AIP propagules are spread, or soils contaminated with AIP seeds, during construction phases;</li> <li>An AIP Management/Control Plan should be implemented by a qualified professional. No chemical control of AIPs to occur without a certified professional;</li> <li>Of particular importance is the control of <i>Prosopis glandules</i>, which comprise of a deep-rooted taproot as well as an extensive lateral root system. This species subsequently not only compete with the indigenous <i>V. erioloba</i> for deep groundwater but also take-up sparse precipitation within the soil profile. This species also has a high transpiration rate, which further result in a rapid decline of the water table (Schattschneider and February 2013). The proliferation of these species have the potential to result in significant long-term negative impacts on the surrounding landscape, particularly the NFA protected species <i>V. erioloba</i> and <i>V. haematoxylon</i>, which play a vital role in the ecosystem by providing habitat for a number of floral and faunal species (Seymour &amp; Milton, 2003); and - Prior to the commencement of construction activities on site, a rehabilitation plan should be developed for implementation throughout the development phases.</li> </ul> </li> <li>The footprint areas of all surface infrastructure must be minimised to what is absolutely essential and within the designated and approved boundary.</li> <li>No additional habitat is to be disturbed during the operational phase of the development. All material placed on the top-cut stockpile should be restricted to the footprint area that is authorised. Weekly monitoring and recording of the footprint area must be done.</li> </ul> | X   | Appendix G                                     |

| Specialist Study | Recommendation of Specialist   | Specialist Recommendations that have been included in this EIAR (Mark with X) | Reference to Applicable Section in this Report |
|------------------|--|---|--|
|                  | <ul style="list-style-type: none"> <li>Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the construction activities. Additional road construction should be limited to what is absolutely necessary, and the footprint thereof kept to a minimum. Any temporary roads should be rehabilitated as soon as they are no longer in use to prevent effects of habitat fragmentation; STS 190041: Section B: Floral Assessment May 2020 30.</li> <li>No dumping of waste on site should take place. As such it is advised that waste disposal containers and bins be provided during the construction phase for all construction rubble and general waste.</li> <li>Cut vegetation from site clearing to be removed immediately and not allowed to accumulate within surrounding natural habitat.</li> <li>If any spills occur, they should be immediately cleaned up to avoid soil contamination that can hinder floral rehabilitation later down the line. Spill kits should be kept on site within workshops. In the event of a breakdown, maintenance of vehicles must take place with care, and the recollection of spillage should be practised preventing the ingress of hydrocarbons into the topsoil.</li> <li>Natural habitat outside of the direct mining footprint areas must be avoided, and no construction vehicles, personnel, or any other construction-related activities are to encroach upon these areas.</li> <li>The footprint of daily operational activities must be strictly monitored to ensure that edge effects from the operational facilities do not affect the surrounding floral habitat outside of the Mining Right Area.</li> <li>Alien vegetation that is removed must not be allowed to lay on unprotected ground as seeds might disperse upon it. All cleared plant material to be disposed of at a licensed waste facility which complies with legal standards.</li> <li>No collection of floral SCC or medicinal floral species within the site boundary must be allowed by construction personnel.</li> <li>Edge effect control needs to be implemented to prevent further degradation and potential loss of floral SCC and protected floral species outside of the proposed expansion footprint area.</li> <li>An effective dust management plan must be designed and implemented in order to mitigate the impact of dust on flora through the construction and operation phase.</li> <li>No illicit fires must be allowed during the construction and operational phases of the proposed expansion activities.</li> <li>Fire breaks should be maintained during the operational phase.</li> <li>Adequate stormwater management must be incorporated into the design of the proposed development in order to prevent erosion of topsoil and the loss of floral habitat through the discharge of dirty water into the receiving environment. In this regard, special mention is made of: <ul style="list-style-type: none"> <li>Sheet runoff from cleared areas, paved surfaces and access roads needs to be curtailed; and</li> <li>Runoff from paved surfaces should be slowed down by the strategic placement of bioswales.</li> </ul> </li> <li>Rehabilitation of natural vegetation should proceed in accordance with a rehabilitation plan compiled by a suitable specialist. This rehabilitation plan should consider all development phases of the project indicating rehabilitation actions to be undertaken during and once construction has been completed, ongoing rehabilitation during the operational phase of the project as well as rehabilitation actions to be undertaken during decommissioning and closure.</li> <li>The construction process should be phased where possible to limit the extent of exposed areas at any one time and ensure that the time between initial disturbance and completion of construction is as short as possible with rehabilitation occurring concurrently where feasible.</li> <li>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 construction site during clearing and construction activities, they are to be carefully and safely moved to an area of similar habitat outside of the disturbance footprint.</li> <li>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 should be contacted to affect the relocation of the species, should it not move off on its own.</li> <li>Should any snakes be encountered, either a suitably trained staff member or expert should be contacted to capture and relocate the specimen. No harm should be done to any snakes located within the study area.</li> <li>Any natural areas beyond the expansion footprint, that have been affected by the construction and operational activities, must be rehabilitated using indigenous species.</li> <li>As part of a Biodiversity Action Plan (BAP), floral monitoring should be done every two to three years during operational activity. Please also refer to the monitoring guidelines below.</li> <li>No hunting/trapping or collecting of faunal species is allowed</li> <li>As part of a Biodiversity Action Plan (BAP), faunal monitoring should be done annually.</li> <li>Rehabilitation must be implemented concurrently, and disturbed areas must be rehabilitated as soon as such areas become available. This will not only reduce the total disturbance footprint but will also reduce the overall rehabilitation effort and cost.</li> <li>All soils compacted as a result of construction activities falling outside of the project area should be ripped and profiled. Special attention should be paid to alien and invasive control within these areas.</li> <li>All infrastructure and mining operation footprints should be rehabilitated in accordance with a rehabilitation plan compiled by a suitable specialist.</li> <li>All rehabilitated areas should be rehabilitated to a point where natural processes will allow the ecological functioning and biodiversity of the area to be re-instated as per the post-closure objective.</li> <li>Rehabilitation efforts must be implemented for a period of at least five years after decommissioning and closure.</li> </ul> |   |  |

| Specialist Study   | Recommendation of Specialist  | Specialist Recommendations that have been included in this EIAR (Mark with X) | Reference to Applicable Section in this Report |
|--|---|---|--|
|  | <ul style="list-style-type: none"> <li>Edge effects of decommissioning and closure activities, such as erosion and alien plant species proliferation, which may affect adjacent sensitive habitat, need to be strictly managed adjacent to the expansion footprint.</li> <li>Ongoing alien and invasive vegetation monitoring and eradication should take place throughout the closure/ decommissioning phase of the development, and the Mamatwan Operations and immediate surrounding area should be regularly checked during the decommissioning phase for alien vegetation proliferation to prevent spread into surrounding natural area.</li> <li>An Alien and Invasive Plant Management and Control Plan must be designed and implemented in order to monitor and control alien floral recruitment in disturbed areas. The alien floral control plan must be implemented for a period of at least 5 years after decommissioning and closure.</li> </ul>   |   |  |
| HIA and PIA  | <ul style="list-style-type: none"> <li>Implement chance find procedures in case where possible heritage or palaeontological finds are made.</li> </ul>  | X   | Chapter 7.4.1.12 and Appendix O and Appendix P |
| Soils, Land Capability and Agricultural Compliance Statement | <ul style="list-style-type: none"> <li>Temporary erosion control measures may be used to protect the disturbed soils until adequate vegetation has established.</li> <li>All disturbed areas can be re-vegetated with an appropriate indigenous veld reclamation mix, if necessary, to re-establish a protective cover, to minimise soil erosion.</li> <li>Avoid vehicular movement on arable soils as far as practically possible.</li> <li>Compacted soils adjacent to disturbed areas should be ripped at 25cm as soon as possible to alleviate compaction and potential crusting.</li> <li>Contractors and mining crew conducting the works on site should be informed about approved waste disposal facilities.</li> <li>Stockpiles should be revegetated to establish a vegetation cover as an erosion control measure. These stockpiles should also be kept alien vegetation free at all times to prevent loss of soil quality; SAS 219162 December 2019 27.</li> <li>Temporary berms can be constructed, around stockpile areas whilst vegetation cover has not established to avoid soil loss through erosion.</li> <li>The stockpiled soil should only be used for intended purpose of rehabilitation at closure of mine operation. Soil stockpiles should be clearly demarcated with No Go areas and monitored regularly.</li> <li>Dumping of waste material next to or on the stockpiles must be prohibited at all times. Integrated soil stockpile management plans and monitoring programmes as well as an employee awareness programme must be put in place to significantly reduce the risk of soil stockpile robbery and/or contamination.</li> <li>The recovered soils should be re-used to rehabilitate the development footprint following mine closure.</li> <li>Loss of Land Capability and Agricultural Potential Management compilation and implementation during operation and decommissioning phases.</li> <li>During the decommissioning phase the footprint should be thoroughly cleaned, and all waste material should be removed to a suitable disposal facility.</li> <li>The footprint should be ripped to alleviate compaction where necessary.</li> <li>Stored topsoil should be replaced (if any) and the footprint graded to a smooth surface.</li> <li>The landscape should be backfilled and reprofiled to mimic the natural topography for potential agricultural activities and grazing opportunities post mining. If possible, ensure a continuation of the pre mining surface drainage pattern.</li> <li>Slopes of the backfilled surface should change gradually since abrupt changes in slope gradient increase the susceptibility for erosion initiation.</li> <li>The topsoil should be ameliorated according to soil chemical analysis taken on the undisturbed areas.</li> <li>The soil fertility status should be determined by soil chemical analysis after levelling (before seeding/re-vegetation). Soil amelioration should be done according to the soil analyses as recommended by a soil specialist, to correct the pH and nutrition status before revegetation.</li> <li>The footprint should be re-vegetated with a grass seed mixture as soon as possible, preferably in spring and early summer to stabilise the soil and prevent soil loss during the rainy season.</li> </ul> | X   | Chapter 7.4.1.4 and Appendix F                 |
| Air Quality  | <ul style="list-style-type: none"> <li>Construction and closure phases: <ul style="list-style-type: none"> <li>Air quality impacts during construction would be reduced through basic control measures such as limiting the speed of haul trucks and to apply water sprays on regularly travelled unpaved road sections.</li> <li>When haul trucks need to use public roads, the vehicles need to be cleaned of all mud and the material transported must be covered to minimise windblown dust.</li> </ul> </li> <li>Operational phases: <ul style="list-style-type: none"> <li>For the control of vehicle entrained dust it is recommended that water (at an application rate &gt;2 litre/m<sup>2</sup>/hour), be applied. Literature reports an emissions reduction efficiency of 75%.</li> <li>In controlling dust from mobile crushing operations, it is recommended that water sprays be applied to keep the ore wet, to achieve a control efficiency of up to 50%.</li> <li>Mitigation of materials transfer points should be done using water sprays at the tip points. This should result in a 50% control efficiency. Regular clean-up at loading points is recommended.</li> <li>In minimizing windblown dust from stockpile areas, water sprays should be used to keep surface material moist. A mitigation efficiency of 50 % is anticipated.</li> </ul> </li> </ul>   | X   | Chapter 9 and Appendix L                       |



| Specialist Study | Recommendation of Specialist  | Specialist Recommendations that have been included in this EIAR (Mark with X) | Reference to Applicable Section in this Report |
|------------------|---|---|--|
|                  | <ul style="list-style-type: none"> <li>○ In minimizing windblown dust from the conveyors, roofing and covering of one side of the conveyor should be installed to achieve a mitigation efficiency of 50 %.</li> <li>○ To ensure that mitigation is effective, it is recommended that the dustfall monitoring network at the mine be expanded to include single dust buckets at AQSR 4 and AQSR 5 and also that PM<sub>10</sub> sampling be conducted at AQSR 5 (or AQSR 6 if it is more secure). This can be done as an annual campaign before the project commences (as part of the baseline) and again once mitigated project operations are in place.</li> <li>• Greenhouse Gas Emissions: <ul style="list-style-type: none"> <li>○ The fuel usage and electricity usage by the mine needs to be supplied in order to complete the GHG quantification for the project.</li> </ul> </li> </ul>  |   |  |
| Noise            | <ul style="list-style-type: none"> <li>• Train staff on noise control plan during health and safety briefings.</li> <li>• Avoid clustering of equipment near receptors.</li> <li>• Ensure periods of respite are provided in case of unavoidable maximum noise level events.</li> <li>• Ensure high level of maintenance on all equipment. Any change in the noise emission characteristics of equipment should serve as trigger for withdrawing it for maintenance.</li> <li>• Other non-routine noisy activities such as construction, decommissioning, start-up and maintenance, should be limited to day-time hours.</li> <li>• Machines should intermittently be shut down between work periods and not left running unnecessarily.</li> <li>• Equipment generating noise directionally should be orientated so the noise is directed away from the sensitive receptors.</li> <li>• Regular and effective maintenance of equipment and plants must be carried out.</li> </ul>  | X   | Chapter 9 and Appendix M                       |
| Surface Water    | <ul style="list-style-type: none"> <li>• Drip trays should be placed under all standing machinery.</li> <li>• Oil recovered from any vehicle or machinery on-site should be collected, stored and disposed of by accredited vendors for recycling.</li> <li>• Traffic and movement over stabilised areas should be controlled (minimised and kept to specific paths), and damage to stabilised areas should be repaired timeously.</li> <li>• A water quality monitoring plan must be formulated before construction.</li> <li>• Construction must be undertaken during the dry season as far as possible This will significantly reduce the potential for sedimentation through erosion due to construction activities.</li> <li>• Concurrent rehabilitation of disturbed land and revegetation should be carried out to minimise the amount of time that bare soils are exposed to the erosive effects of rain and subsequent runoff.</li> <li>• The development of a stormwater infrastructure will result in positive impacts such as pollution control however clean water must be released into the environment to minimize alteration of natural drainage flow.</li> </ul> | X   | Chapter 9 and Appendix H                       |
| Groundwater      | <ul style="list-style-type: none"> <li>• Replacement boreholes as well as cone of drawdown and contaminant plume monitoring boreholes are drilled and added to the monitoring network.</li> <li>• Much of the current mitigation and management measures that are in place at the mine will reduce the significance of potential impacts.</li> </ul>  | X   | Chapter 9 an Appendix K                        |

## 11. ENVIRONMENTAL IMPACT STATEMENT

### 11.1 SUMMARY OF KEY FINDINGS

This section provides a summary of the findings as part of the proposed project and assessed potential impacts on the receiving environment in both the unmitigated and mitigated scenarios, including cumulative impacts. A summary of the potential impacts associated with the preferred alternative in the unmitigated and mitigated scenarios for all project phases is included in Table 11-1.

The assessment of the proposed project presents the potential for negative impacts to occur (in an unmitigated scenario) on the biophysical environments both on the project footprint and in the surrounding area. With the implementation of management actions, these potential impacts can be prevented or reduced to acceptable levels.

It follows that provided the EMPR is effectively implemented, there is no biophysical, cultural heritage or socio-economic reason why the proposed project should not proceed.

**Table 11-1: Summary of Potential Impacts**

| Aspect                              | Potential impact  | Cumulative impact significance of the impact (the ratings are negative unless otherwise specified) |                      |
|-------------------------------------|---|--|----------------------|
|                                     |   | Unmitigated  | Mitigated            |
| Geology                             | Loss and sterilisation of mineral resources   | <b>INSIGNIFICANT</b>   |                      |
| Topography                          | Altering topography   | <b>INSIGNIFICANT</b>   |                      |
|                                     | Hazardous excavations and infrastructure resulting in safety risks to third parties and animals | <b>Low</b>   | <b>INSIGNIFICANT</b> |
| Soil and land capability            | Soil erosion  | <b>Medium</b>  | <b>LOW</b>           |
|                                     | Disturbance of original soil profiles   | <b>Medium-Low</b>  | <b>VERY LOW</b>      |
|                                     | Chemical pollution of soils   | <b>Medium</b>  | <b>LOW</b>           |
| Biodiversity                        | Floral Habitat and Biodiversity   | <b>High</b>  | <b>MEDIUM</b>        |
|                                     | Floral Species of Conservation Concern  | <b>High</b>  | <b>MEDIUM</b>        |
|                                     | Loss of Faunal Habitat and Biodiversity   | <b>Medium</b>  | <b>LOW</b>           |
|                                     | Faunal Species of Conservation Concern  | <b>Medium</b>  | <b>VERY LOW</b>      |
| Surface water resources             | Soil erosion and Sedimentation  | <b>Medium</b>  | <b>LOW</b>           |
|                                     | Alteration of natural drainage patterns   | <b>Medium</b>  | <b>LOW</b>           |
|                                     | Contamination of surface water resources  | <b>High</b>  | <b>MEDIUM</b>        |
| Groundwater                         | Contamination of groundwater resources  | <b>Medium</b>  | <b>LOW</b>           |
|                                     | Drawdown  | <b>Medium</b>  | <b>LOW</b>           |
| Air quality                         | Air pollution   | <b>Medium</b>  | <b>LOW</b>           |
| Noise                               | Increase in disturbing noise levels   | <b>Medium</b>  | <b>LOW</b>           |
| Visual                              | Negative visual views   | <b>INSIGNIFICANT</b>   |                      |
| Traffic                             | Road disturbance and traffic safety   | <b>INSIGNIFICANT</b>   |                      |
| Cultural heritage and palaeontology | Loss of cultural/heritage and palaeontological resources  | <b>INSIGNIFICANT</b>   |                      |
| Socio-economic                      | Inward migration  | <b>Medium</b>  | <b>LOW</b>           |
|                                     | Job creation  | <b>Very Low</b>  | <b>LOW</b>           |

## 11.2 FINAL SITE MAP

Please see Figure 4-1.

## 11.3 SUMMARY OF POSITIVE AND NEGATIVE IMPACTS AND RISKS OF THE ACTIVITY AND IDENTIFIED ALTERNATIVES

The positive and negative impacts and risks of the proposed activity and preferred alternatives are summarised above in Section 11.1.

## 12. IMPACT MANAGEMENT OBJECTIVES AND OUTCOMES

Based on the outcome of the impact assessment, and where applicable from the specialist reports, the proposed management objectives and outcomes are provided within this chapter.

### 12.1 PROPOSED MANAGEMENT OBJECTIVES AND OUTCOMES FOR ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACTS

Specific environmental objectives and outcomes to control, remedy or prevent potential impacts from the proposed project are provided in the table below.

**Table 12-1: Environmental Objectives and Outcomes**

| Aspect                           | Environmental Objective  | Environmental Outcome  |
|----------------------------------|--|--|
| <b>Topography</b>                | The objective is to minimise changes to natural topography.  | The outcome is to limit the alteration of topography during the proposed project and through rehabilitation.   |
|                                  | The objective is to prevent physical harm to third parties and animals resulting from potentially hazardous excavations and infrastructure.  | The outcome is to ensure no third parties or animals are harmed during the proposed project.   |
| <b>Soils and Land Capability</b> | The objective is to minimise the loss of soil resources and related land capability from erosion.  | The outcome is to handle, manage and conserve soil resources to be used as part of rehabilitation and re-establishment of the pre-mining land capability.  |
|                                  | The objective is to minimise the loss of soil resources and related land capability from physical disturbance and compaction and soil pollution.   |  |
|                                  | The objective is to minimise the loss of soil resources and related land capability from soil pollution.   |  |
| <b>Biodiversity</b>              | The objective is to prevent the unacceptable loss and disturbance to floral species, and to prevent the proliferation of alien invasive species within and surrounding the project area. | The outcome is to prevent the spread of alien species in the project area, as well to limit disturbance as far as practically possible to existing faunal and floral habitats and species of conservation concern. |
|                                  | The objective is to prevent the unacceptable destruction and disturbance to faunal species.  | The outcome is to ensure that no faunal species are harmed or disturbed in the project area.   |
| <b>Groundwater Resources</b>     | The objective is to prevent pollution of groundwater resources.  | The outcome is to ensure that groundwater quality remains within acceptable limits for both domestic and agricultural purposes.  |
| <b>Air Quality</b>               | The objective is to prevent air pollution health impacts.  | The outcome is to ensure that any pollutants emitted as a result of the proposed project   |



| Aspect                                     | Environmental Objective  | Environmental Outcome  |
|--|--|--|
|  |  | remains within acceptable limits so as to prevent health related impacts.  |
| <b>Cultural/Heritage and Palaeontology</b> | The objective is to minimise the disturbance of cultural/heritage and paleontological resources. | The outcome is to protect heritage resources where possible. If disturbance is unavoidable, then mitigate impact in consultation with a specialist and the SAHRA and in line with regulatory requirements. |

### 12.1.1 Impacts that require monitoring programmes

The following impacts will require extensive monitoring programmes during the construction, operation and decommissioning phases of the project.

- Hydrocarbon and dangerous goods handling, storage and disposal to avoid spills that may impact on soil or water quality;
- Erosion of soils on disturbed areas;
- Fencing of working areas;
- Stormwater management and the separation of clean and dirty water;
- Surface water quality and volumes within local surface water resources;
- Groundwater quality at specified monitoring points;
- Air quality PM<sub>10</sub> and dust fallout;
- Noise monitoring at sensitive receptors, if applicable;
- Rehabilitation Management Plan.

### 12.1.2 Activities and infrastructure

The source activities of potential impacts which require management include:

- Site preparation;
- Earthworks;
- Civil works;
- Transport systems;
- General site management;
- Demolition;
- Rehabilitation; and
- Maintenance and aftercare.

The phases of development associated with the above-mentioned source activities are provided in Table 4-1.

### 12.1.3 Management actions

Management actions which will be implemented to control the proposed project activities or processes which have the potential to pollute or result in environmental degradation are provided in chapter 12 and Table 12-1.

### 12.1.4 Roles and responsibilities

The key personnel to ensure compliance with this EIAR and EMPR are the operations executive and the Environmental Department Manager and officers. As a minimum, their roles as they relate to the implementation of monitoring programmes and management activities, include:

- Ensuring that monitoring programmes and audits are scoped to be fit for purpose and included in the annual mine budget;
- Identifying and appointing appropriately qualified specialists/engineers to undertake the monitoring programmes;
- Appointing specialists in a timeous manner to ensure work can be carried out to acceptable standards;
- Liaising with the relevant company, municipal and community structures in terms of the commitments in the Social and Labour Plan (SLP);
- Ensuring that commitments in the SLP are developed and implemented timeously;
- Establishing and maintaining good working relations with surrounding communities and landowners; and
- Facilitating stakeholder communication, information sharing and a grievance mechanism.

Further defined roles and responsibilities will be discussed within the EIAR.

## 13. FINAL ALTERNATIVES

The alternatives that have been assessed for this EIAR are discussed in Section 7.1.

## 14. ASPECTS FOR INCLUSION AS CONDITIONS OF THE AUTHORISATION

Management actions (refer to 28) including monitoring requirements should form part of the conditions of the EA. With reference to Regulation 26 of Government Notice Regulation (GNR) 982 of NEMA, additional conditions that should form part of the EA that are not specifically included in the EMPR report, include compliance with all applicable environmental legislation, whether specifically mentioned in this document or not, and which may be amended from time to time.

## 15. ASSUMPTIONS, UNCERTAINTIES, LIMITATIONS AND GAPS IN KNOWLEDGE

### 15.1 ENVIRONMENTAL ASSESSMENT LIMIT

The EIA process focussed on third parties only and did not assess health and safety impacts on the South32 employees and contractors. It is assumed that this would be regulated separately by the Health and Safety Legislation, policies and standards and that South32 will adhere to these.

The Impact Assessment is based on the expertise and recommendation of the specialist team. However, where there needs to be an adjustment of ratings to a particular specialist ranking, this is done in order to ensure that all ratings across the environmental aspects are consistent. Where any ratings have been adjusted by the EAP, there is a comment indicating this and providing reasons therefore.

### 15.2 AIR QUALITY ASSESSMENT

The main assumptions, exclusions and limitations are summarized below:

- Meteorological data: no onsite meteorological data was available. Data from the South African Weather Services (SAWS) Kuruman Weather Station (located approximately 43 km to the southeast of the mine) was obtained for the period January 2016 – December 2018.
- Operational hours for the processing plant were provided as 7920 hours per year. Operational hours for mining activities were calculated from provided annual and hourly throughputs as 12 hours per day, 7 days a week. It was assumed that this information is correct.
- Emissions:
  - The quantification of sources of emission was for project activities only. Background sources were not included.
  - Information required for the calculation of emissions from fugitive dust sources for the facility's operations were provided in the form of run-of-mine (ROM), top-cut, overburden and product tonnages.
  - Throughputs were provided for current activities only. Since no other information was available, it was assumed that project operations will have the same throughput as baseline operations.
  - Only routine emissions were estimated and modelled. This was done for the provided operational hours.
  - Gaseous emissions from vehicle exhaust and other auxiliary equipment were not quantified as the impacts from these sources are usually localized and unlikely to exceed health screening

limits outside the project area. The main pollutant of concern from the operations at the study site is particulate matter and hence formed the focus of the study.

- Particle size distribution for ROM, overburden, topsoil, discard and product material was based on information from similar mining processes.
- Greenhouse gas emissions could not be calculated, since no information was made available at the time of writing the report.
- Impact assessment:
  - Impacts due to two operational phases (baseline and project) were assessed quantitatively, whilst the construction, closure and decommissioning phases were assessed qualitatively due to the limited information available.
  - The impact assessment was limited to airborne particulate (including TSP and PM<sub>10</sub>).
  - There will always be some degree of uncertainty in any geophysical model, but it is desirable to structure the model in such a way to minimize the total error. A model represents the most likely outcome of an ensemble of experimental results. The total uncertainty can be thought of as the sum of three components: the uncertainty due to errors in the model physics; the uncertainty due to data errors; and the uncertainty due to stochastic processes (turbulence) in the atmosphere. Nevertheless, dispersion modelling is generally accepted as a necessary and valuable tool in air quality management and typically provides a conservative prediction of emission concentrations.

### 15.3 BIODIVERSITY

- The biodiversity desktop assessment is confined to the study area and does not include detailed results for the neighbouring and adjacent properties, although the sensitivity of surrounding areas is included on the respective maps; and
- It is important to note that although all data sources used provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the actual site characteristics within the study area at the scale required to inform the EIA process. However, this information is considered useful as background information to the study, and based on the desktop results, sufficient decision making can take place with regards to the development activities.
- The floral assessment is confined to the study area and does not include the neighbouring and adjacent properties or the entire MMT.
- With ecology being dynamic and complex, certain aspects (some of which may be important) may have been overlooked. The most limiting condition was the extreme drought still experienced at the time of the assessment, with the majority of forbs reduced to underground plant parts or died back to unidentifiable parts. On-site data were augmented with historic studies undertaken for the Mamatwan Mine (NSS, 2018). On this basis, the floral ecology associated with the study area is considered to be adequately assessed and considered, and the information provided is sufficient to allow for informed decision making and to facilitate integrated environmental management.
- Sampling by its nature means that not all individuals are assessed and identified. Some species and taxa within the study area may, therefore, have been missed during the assessment.
- A field assessment was undertaken from the 5th to the 7th of November 2019 (spring season), to determine the floral ecological status of the study area, and to “groundtruth” the results of the desktop assessment (presented in Part A). A more accurate assessment would require that assessments take place in all seasons of the year, especially within the flowering season of most floral species. On-site data was significantly augmented with all available desktop data and previous studies undertaken for the



Mamatwan Mine (NSS, 2018), and together with project experience in the area, the findings of this assessment are considered to be an accurate reflection of the ecological characteristics of the study area.

- Herbaceous floral SCC during the site assessment were reduced to underground parts, with a few remnant leaves/ seeds identified. The abundance of herbaceous SCC is therefore anticipated to be higher than what was observed during the field assessment. It is recommended that a summer walkdown (January to February) be undertaken and all herbaceous SCC marked, in order to accurately determine the number of individuals that need to be rescued and relocated during the proposed mining development, as part of the requirements for the permit application.
- The faunal assessment is confined to the study area and does not include the neighbouring and adjacent properties nor the MRA (Mining Right Area).
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most faunal communities have been accurately assessed and considered and the information provided is considered sufficient to allow informed decision making to take place and facilitate integrated environmental management.
- Due to the nature and habits of most faunal taxa, the high level of surrounding anthropogenic activities, it is unlikely that all species would have been observed during a field assessment of limited duration. Therefore, site observations were compared with literature studies where necessary.
- Sampling by its nature, means that not all individuals are assessed and identified. Some species and taxa within the footprint area may therefore have been missed during the assessment.
- A field assessment was undertaken from t<sup>he</sup> 5th to t<sup>he</sup> 7th of November 2019 (spring season), to determine the faunal ecological status of the study area, and to “groundtruth” the results of the desktop assessment (presented in Section A). A more accurate assessment would require that assessments take place in all seasons of the year. However, on-site data was significantly augmented with all available desktop data and specialist experience in the area, and the findings of this assessment are considered to be an accurate reflection of the ecological characteristics of the study area.

## 15.4 CULTURAL HERITAGE

Not detracting in any way from the comprehensiveness of the fieldwork undertaken, it is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the area. Various factors account for this, including the subterranean nature of some archaeological sites. As such, should any heritage features and/or objects not included in the present inventory be located or observed, a heritage specialist must immediately be contacted.

Such observed or located heritage features and/or objects may not be disturbed or removed in any way until such time that the heritage specialist has been able to make an assessment as to the significance of the site (or material) in question. This applies to graves and cemeteries as well. In the event that any graves or burial places are located during the development, the procedures and requirements pertaining to graves and burials will apply as set out below.

## 15.5 NOISE ASSUMPTIONS

- Meteorological data: As no onsite meteorological data was available, use was made of measured meteorological data from the closest SAWS monitoring station located at Kuruman approximately 43 km east of the project site. Data for the period 2015 to 2018 was considered for this assessment.

- The quantification of sources of noise was limited to the operational phase of the project. Construction and closure phase activities are expected to be similar or less significant and its impacts only assessed qualitatively. Noise impacts will cease post-closure.
- The assessment is based on the list of noise sources provided by SLR Consulting (South Africa) (Pty) Ltd. The list was found to be appropriate. The assumption is that this information is correct and reflects the routine operational phase of the project.
- Process activities such as the crushing and screening plants and the stacker reclaimer for railway loadout station Option 3, were assumed to be 24 hours per day.
- The loadout station Option 3 was assumed to receive one train per day during day-time hours.
- Location of the crushing and screening plant for the waste material was assumed to be below the western waste rock dumps.
- The change in noise due to the increase in dump height was tested and shown to have minimal change in noise impacts. This source was therefore not modelled for the current assessment as the list of equipment operating on the waste rock dumps was not available.
- Although other existing sources of noise within the area were identified during the survey, such sources were not quantified but were considered during the baseline sampling.

## 15.6 SOIL AND LAND CAPABILITY

- Sampling by definition means that not all areas are assessed, and therefore some aspects of soil and land capability may have been overlooked in this assessment. However, it is the opinion of the specialist that this assessment was carried out with sufficient sampling and in sufficient detail to enable the proponent, the Environmental Assessment Practitioner (EAP) and the regulating authorities to make an informed decision regarding the proposed mining related activities.
- Land Potential was classified according to current soil restrictions, with respect to prevailing climatic conditions on site; however, it is virtually impossible to achieve 100% purity in soil mapping, the delineated soil map units could include other soil type(s) as the boundaries between the mapped soils are not absolute but rather form a continuum and gradually change from one type to another. Soil mapping and the findings of this assessment were therefore inferred from extrapolations from individual observation points.
- Since soils occur in a continuum with infinite variances, it is often problematic to classify any given soils as one form, or another. For this reason, the classifications presented in this report are based on the "best fit" to the soil classification system of South Africa.
- Soil fertility status was not considered a limitation, seeing as inherent nutrient deficiencies and/or toxicities would be rectified by appropriate liming and/or fertilization prior to cultivation. It should be noted that soil fertility is more of a land suitability importance than agricultural potential. Therefore, for this study it was not considered a limitation as soil fertility status can be corrected to suit acceptable ranges for plant uptake for that particular plant/s to be cultivated.

## 15.7 VISUAL ASSUMPTIONS

- No specific national legal requirements for VIAs currently exist in South Africa. However, the assessment of visual impacts is required by implication when the provisions of relevant acts governing environmental management are considered and when certain characteristics of either the receiving environment or the proposed project indicate that visibility and aesthetics are likely to be significant issues and that visual input is required (Oberholzer, 2005).

- No viewshed analysis was undertaken, as the topography of the area surrounding and within the MMT is relatively flat. Within this context, minor topographical features, SAS 219163 – Mamatwan Mine VIA November 2019 6 vegetative screening and anthropogenic structures would be important factors influencing the degree of visibility and visual intrusion, which is not considered during the viewshed analysis.
- Distance and terrain play a critical role when assessing visual impacts of an area. Due to the relatively flat terrain of the MMT area and height of the proposed structures, it was deemed necessary to identify all potential sensitive receptors within a 10km radius, on a desktop-level, which would then be verified during the field assessment. The 10km radius can be considered the visual assessment zone. It should be noted that the visibility of an object decreases exponentially the further away the observer is from the source of impact. During the field assessment it was established that the bushveld vegetation limits the view of the observer to the immediate surroundings, not allowing one to see across the vistas. Consequently, it was deemed unnecessary to visit all potentially sensitive receptors within the visual assessment zone, thus focus was placed on visiting sensitive receptors within a 2 km radius. Several sensitive receptors situated further than 3 km were however visited to confirm that both the MMT and proposed expansion activities are not visible from these locations.
- Due to a lack of visual specialist guidelines within the Northern Cape Province, the “Guidelines for Involving Visual and Aesthetic Specialists in the EIA Process” (Oberholzer, 2005), prepared for the Western Cape Department of Environmental Affairs & Development Planning, was used.
- All information relating to the proposed project as referred to in this report is assumed to be the latest available information. Additionally, best practice guidelines were taken into consideration and utilising the maximum expected heights of the infrastructure and the placement thereof in viewshed calculations as a precautionary approach.
- Abstract or qualitative aspects of the environment and the intangible value of elements of visual and aesthetic significance are difficult to measure or quantify and as such depend to some degree on subjective judgments. It therefore is necessary to differentiate between aspects that involve a degree of subjective opinion and those that are more objective and quantifiable.

## 15.8 WASTE CLASSIFICATION

- Models are only as accurate as the input data provided.
- Samples from the historical tailing’s dams were not collected as these facilities have been rehabilitated.
- Multiple stockpiles are stored in the stockyard. As part of this project each individual stockpile was not sampled, rather the four samples of product that were collected (top cut, high grade, low grade and standard sinter product) provide an understanding of the various grades. The leachate results are considered to be representative of product stockpiles not sampled, as the only difference is the size of the particles and as such the constituents of concern are not anticipated to differ significantly.
- Plant spillages constitutes 1% of the overall Adam’s pit stockpile and is a mixture of Sinter de-dust and product. As part of the project, it was not possible to collect a sample of the plant spillages given that this material was not easily distinguishable. Given that plant spillages constitute 1% it is unlikely that the exclusion of this proportion from the source term model for the Adam’s stockpile would significantly change the results.

## 15.9 GROUNDWATER

The following assumptions were made in terms of Middelplaats:

- The following assumptions have been made for the underground mine:
- The total volume of water stored in the underground voids = 1,400,000 m<sup>3</sup>

- Two production boreholes will pump from the underground storage a total of 1,500 m<sup>3</sup>/day; this volume will be depleted in approximately 3 years;
- The groundwater available in the underground mine after the production pumping consists in passive groundwater flow (seepage) into the underground voids.

It is important to note that as part of the IWULA process for the mine, the groundwater model will be updated to include pump test data. This will be undertaken in order to verify the cone of draw done from Middelplaats once a sustainable abstraction yield has been confirmed following the pump tests.

## 15.10 WATER BALANCE

A detailed water balance will be established for the mine as part of the IWULA process.

## 15.11 STORMWATER MANAGEMENT

A daily time step rainfall-runoff model for the dirty stormwater catchments was coupled with a daily time step water balance model for the PCD. The rainfall-runoff model is based on the Soil Conservation Service (SCS) method and is used to estimate the portion of the rainfall which infiltrates or runs off from each catchment, for each day of the simulation. The water balance model considers stormwater inflows, the direct rainfall reaching the dam, the evaporation losses and the return water pumping policy and calculates the volume of water in the PCD for each day of the simulation.

The key variables and assumptions used in the modelling are as follows:

- The model is run on a daily time step using the almost 88 years of daily rainfall data.
- Fixed monthly evaporation values;
- Stormwater runoff from two catchment types were considered:
  - Impermeable surfaces; and
  - Permeable (soil) surfaces
- The return water pumping system will be set up to pump water out of the PCD whenever water is available. The mine currently prioritises using clean water in the Plant, except for in the DMS Plant where it is mostly a closed loop cycle. Dirty water that is pumped from the North and South Pit can be potentially used at the Primary Crusher and in the Plant, but this is not the situation currently being adopted. The only current water use for dirty water around the mine is for dust suppression. There are many opportunities available for use of dirty water around the mine, such as:
  - Dust suppression;
  - Use within the Plant (the Plant currently only uses potable water from the Vaal-Gamagara Pipeline (VGP), which is managed by the Sedibeng Water. This would be beneficial as the cost of potable water is increasing and the MMT would not be completely reliant on Sedibeng Water;
  - Another option that could be explored is the selling of this dirty water to neighbouring mines in the water scarce Northern Cape Province;
  - Dirty water treatment and reuse.
- The PCD have been modelled assuming vertical sides for simplicity;
- The runoff from the infrastructure related areas was calculated using the SCS stormflow equation (Schulze et al., 1992) using a curve number (CN) of 84 for the plant areas (area weighted). The CN describes the runoff factor for sub-catchments. The simulated runoff was then entered into the daily time step water balance model to calculate the size of the PCD and the associated spillage frequency;



- The volume of water in the dams, the evaporation, and the amount abstracted through pumping and the spill volumes were calculated for each day over the full simulation record available. The simulation calculates the required capacity of the dams and the number of spills during the ~88-year simulation period which is directly related to the abstraction rate.

## **16. REASONED OPINION AS TO WHETHER THE ACTIVITY SHOULD OR SHOULD NOT BE AUTHORISED**

### **16.1 REASONS WHY THE ACTIVITY SHOULD BE AUTHORIZED OR NOT**

The proposed activities and infrastructure will optimise the current mining operation. The activities and infrastructure will remain within the current Mining Rights area and disturbed footprint. The proposed activities will optimise current activities, such as the transport of material by rail, thereby negating the potential for additional impact to roads and road users generated where trucking of materials is carried out. Similarly, the use of piped water from the Middelpplaats shaft reduces the amount of clean water required for the MMT operation and promotes recycling of the Middelpplaats water within the mine process. The increase in the WRD height means that no new location and footprint will be required for the disposal of waste rock, but that the use of the existing footprint can be enhanced.

The reprocessing of materials within Adams Pit is also a reuse of disposed waste, thereby aligning with the waste hierarchy in the handling of waste, remediating the Adams Pit from much of the disposed material, and promoting sale of aggregate to local SMMEs. This strongly aligns with many principals of responsible environmental management and waste management.

### **16.2 CONDITIONS THAT MUST BE INCLUDED IN THE AUTHORISATION**

#### **16.2.1 Specific conditions for inclusion in the EMPR**

See chapter 14 as well as chapter 10.

#### **16.2.2 Rehabilitation requirements**

Rehabilitation requirements are included within the discussion in chapter 12.

## **17. PERIOD FOR WHICH AUTHORISATION IS REQUIRED**

With specific reference to Table 4-1, the identified activities relate to all phases of the mining operation. Given that the proposed project will supplement mining operations at MMT, it follows that the authorisation is required for the remaining life of mine, until 2037.

The section below provides an indication of the environmental authorisation period relevant to each listed activity.

**Table 17-1: Environmental authorisation period associated with each listed activity**

| Listed activity number, applicable listing notice and activity description   | Period of authorisation   |
|--|---|
| <b>NEMA (GNR 984 of 2014) as amended by GNR.325 of 2017 (G.G. 40772 of 07/04/2017: Listing Notice 2, Activity 15:</b> The clearance of an area of 20 ha or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for:(i) The undertaking of a linear activity; or<br>(ii) Maintenance purposes undertaken in accordance with a maintenance management plan.   | The clearance of indigenous vegetation would have required environmental authorisation for a period of one to two years during site preparation for the rail loop and associated infrastructure, and top-cut stockpile. The clearance of indigenous vegetation is however unlikely to be required for the remaining life of mine.   |
| <b>NEMA (GNR 983 of 2014) as amended by GNR.327 of 2017 (G.G. 40772 of 07/04/2017) and GNR.706 of 2018 (G.G. 41766 of 13/07/2018): Listing Notice 1, Activity 13:</b> The development of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50 000 m <sup>3</sup> or more, unless such storage falls within the ambit of activity 16 in Listing Notice 2 of 2014.  | The construction of the PCD with a depth of 5m including supporting infrastructure such as the stormwater channels and diversion berms will need to be authorised for the entire life of mine.<br><br>The clearance of indigenous vegetation would have required environmental authorisation for a period of one to two years during site preparation for the proposed project including the PCD and the clearance of 5.6 ha of land for the establishment of the future stockpile area and contractors' areas. The clearance of indigenous vegetation is however unlikely to be required for the remaining life of mine. |
| <b>NEMA (GNR 983 of 2014) as amended by GNR.327 of 2017 (G.G. 40772 of 07/04/2017) and GNR.706 of 2018 (G.G. 41766 of 13/07/2018): Listing Notice 1, Activity 27:</b> The clearance of an area of 1 ha or more, but less than 20 ha of indigenous vegetation, except where such clearance of indigenous vegetation is required for:<br>(i) The undertaking of a linear activity; or<br>(ii) Maintenance purposes undertaken in accordance with a maintenance management plan.  |   |
| <b>NEMA (GNR 984 of 2014) as amended by GNR.325 of 2017 (G.G. 40772 of 07/04/2017: Listing Notice 2, Activity 16:</b> The development of a dam where the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, is 5 m or higher or where the highwater mark of the dam covers an area of 10 ha or more.  |   |
| <b>NEMA (GNR 983 of 2014) as amended by GNR.327 of 2017 (G.G. 40772 of 07/04/2017) and GNR.706 of 2018 (G.G. 41766 of 13/07/2018: Listing Notice 1, Activity 34:</b> The expansion of existing facilities or infrastructure for any process or activity where such expansion will result in the need for a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the release of emissions, effluent or pollution, excluding -<br>(i) where the facility, infrastructure, process or activity is included in the list of waste management activities | The change in the height of the WRDs from 50m to 80m will permanently increase the volume of the existing dumps and will need to be authorised for the entire life of mine.   |

| Listed activity number, applicable listing notice and activity description  | Period of authorisation  |
|---|--|
| published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies;<br>(ii) the expansion of existing facilities or infrastructure for the treatment of effluent, wastewater, polluted water or sewage where the capacity will be increased by less than 15 000 cubic metres per day; or<br>(iii) the expansion is directly related to aquaculture facilities or infrastructure where the wastewater discharge capacity will be increased by 50 cubic meters or less per day.   |  |
| <b>NEMA (GNR 983 of 2014) as amended by GNR.327 of 2017 (G.G. 40772 of 07/04/2017) and GNR.706 of 2018 (G.G. 41766 of 13/07/2018): Listing Notice 1, Activity 9:</b><br>The development of infrastructure exceeding 1 000 m in length for the bulk transportation of water or stormwater:<br>(i) With an internal diameter of 0,36 m or more; or<br>(ii) With a peak throughput of 120 l/s or more.<br>excluding where:<br>(a) Such infrastructure is for bulk transportation of water or stormwater or stormwater drainage inside a road reserve or railway line reserve; or<br>(b) Where such development will occur within an urban area.  | A new pipeline of 10 inches (0.26 m) in diameter, with a maximum pumping capacity in excess of 120 l/s exceeding 1 000 m in length will be required to transport water from the Middelplaats mine workings to MMT. The pipeline will need to be authorised for the entire life of mine.  |
| <b>NEMA (GNR 984 of 2014) as amended by GNR.325 of 2017 (G.G. 40772 of 07/04/2017): Listing Notice 2, Activity 17:</b> Any activity including the operation of that activity which requires a mining right as contemplated in section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including -<br>(a) associated infrastructure, structures and earthworks, directly related to the extraction of a mineral resource; or<br>(b) the primary processing of a mineral resource including winning, extraction, classifying, concentrating, crushing, screening or washing; but excluding the secondary processing of a mineral resource, including the smelting, beneficiation, reduction, refining, calcining or gasification of the mineral resource in which case activity 6 in this Notice applies. | The sale of waste rock as aggregate may require crushing and screening prior to sale to third parties. The re-processing of material in Adams Pit requires the use of screening materials for various processing, handling and disposal. These activities will require approval for the LoM.<br><br>The reprocessing of material currently stored / disposed of at Adams Pit will allow for optimisation of the material and will allow for the rehabilitation of the Pit. |

## 18. UNDERTAKING

I, Sharon Meyer, the EAP responsible for compiling this EIA, undertake that:

- The information provided herein is correct;
- Comments and inputs from I&APs and commenting authorities have been included and correctly recorded in this EIAR;
- Inputs and recommendations from the specialist reports have been included where relevant; and
- Any information provided to I&APs and any responses to comments or inputs made is correct or was correct at that time



Signature of EAP

10 / 02 / 2022  
Date



Signature of Commissioner of oath

10 Feb 2022  
Date

**OREN JAN VAN VREDE**  
**COMMISSIONER OF OATHS**  
**EX OFFICIO**  
**PROFESSIONAL**  
**ACCOUNTANT (S.A.)**  
  
**FOURWAYS MANOR OFFICE PARK**  
**UNIT 7, FOURWAYS**  
**☎ (011) 467 - 0945**



## 19. FINANCIAL PROVISION

### 19.1 METHOD TO DERIVE THE FINANCIAL PROVISION

The proposed layout/activity changes at MMT that have been costed as part of the financial provision include: the top-cut stockpile area, the mobile crushing and screening plant, and the new pipeline from Middelplaats Mine to MMT and will be incorporated into the overall MMT mine-closure plan and the annual financial provision updates. In this regard, the financial provision is calculated as per the methodology of the DMR guideline document of January 2005 and inflated by the Consumer Price Index to account for escalation since January 2005. As per the DMR guideline, MMT is classified as a Class C (low risk) mine, with a medium environmental sensitivity based on the pre-mining environment of the mining area, the proximity of the mine to local communities and the surrounding area's existing economic activity.

The amount determined for financial provision for the MMT is provided in Section 29.

### 19.2 CONFIRM THAT THE AMOUNT CAN BE PROVIDED FOR FROM OPERATING EXPENDITURE

The amount required in order to manage and rehabilitate the environmental disturbance (as a result of MMT's activities) is provided for in the operating costs.

## 20. DEVIATION FROM THE APPROVED SCOPING REPORT AND PLAN OF STUDY

### 20.1 DEVIATIONS FROM THE METHODOLOGY USED IN DETERMINING THE SIGNIFICANCE POTENTIAL ENVIRONMENTAL IMPACTS AND RISKS

There has been no deviation in the methodology as presented within the Scoping Report and Plan of Study for EIA.

### 20.2 MOTIVATION FOR DEVIATION

Not applicable.

## 21. OTHER INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

### 21.1 IMPACT ON THE SOCIO-ECONOMIC CONDITIONS OF ANY DIRECTLY AFFECTED PERSON

The impacts associated with socio-economic conditions are discussed in chapter 8. Management and management actions identified to address any socio-economic impacts are included in chapter 10.

No person will be directly affected by the project given that no I&APs currently reside within the MMT Mining Right area. However, other direct impacts include:

- Road and traffic safety (**expected to be negligible**);
- Influx of job seekers to an area which in turn increases pressure on existing communities, housing, basic service delivery and raises concerns around safety and security (**expected to be low**); and
- Employment and procurement of goods and services (**expected to be low positive**).

Indirect socio-economic impacts include:

- Alteration of drainage patterns by reducing the volume of runoff into the downstream catchments (**Low**);
- Contamination of groundwater through long term seepage and/or runoff (**Low**);
- Contamination of surface water resources through long term seepage and/or runoff (**Low**);
- Air pollution sources that can have a negative impact on ambient air quality (**Low**);
- Increase in disturbing noise levels (**Low**); and
- Visual impacts on this receiving environment may be caused by activities and infrastructure (**INSIGNIFICANT**).

### 21.2 IMPACT ON ANY NATIONAL ESTATE REFERRED TO IN SECTION 3(2) OF THE NATIONAL HERITAGE RESOURCES ACT

Not applicable. No national estate will be affected as part of the project.

### 21.3 DEPARTMENT OF ENVIRONMENTAL AFFAIRS SCREENING TOOL

The Department of Environmental Affairs (DEA) has developed an online screening tool, which is compulsory to use as of 04 October 2019. The report generated by the DEA screening tool was attached to the NEMA application for the project as included in Appendix B. The screening tool report outlines specialist studies that need to be considered as part of the project. In this regard, the table below outlines the specialist studies proposed in the screening tool report along with an explanation pertaining to the applicability of these proposed specialist studies in relation to the project.

**Table 21-1: Findings of the DEA screening tool**

| Theme            | Sensitivity | Requirements   |
|------------------|-------------|--|
| Agriculture      | Medium      | The agricultural screening tool protocol specifies that an Agricultural Compliance Statement for a low agricultural sensitivity is required. In this regard, the required compliance statement is incorporated into the soils and land capability report included in Appendix F. |
| Landscape/visual |             | A Visual study was undertaken for the project and is included in Appendix N. This study was informed by site work.   |

| Theme  | Sensitivity                            | Requirements   |
|--|--|--|
| Archaeological and Cultural Heritage Impact Assessment | Not specified in screening tool report | A Heritage/cultural study was undertaken for the project and is included in Appendix O and Appendix P respectively. This study was informed by site work.  |
| Animal Species Assessment                              |  | A terrestrial biodiversity study has been undertaken for the project and is included in Appendix G. There is no specific protocol for this theme. The Terrestrial Biodiversity study complies with NEMA Appendix 6 requirements for specialist reports.          |
| Hydrology Assessment                                   |  | Not applicable to the MMT. The mine is not located near watercourses. However, a stormwater management plan has been provided to identify necessary infrastructure for management of clean and dirty water on site.  |
| Geotechnical assessment.                               |  | A geotechnical investigation was undertaken for the rail loop and is included in Appendix Q. This study was informed by site work.   |
| Radioactivity  |  | Not applicable to the MMT. The mine does not produce nor handle radioactive materials.   |
| Seismicity   |  | Not applicable to the MMT. The mine is not located in a highly active fault zone (Esterhuyse et al. 2014).   |
| Noise Impact Assessment                                |  | A Noise study was undertaken for the project and included in Appendix M. This study will be informed by site work.   |
| Traffic Assessment                                     |  | The proposed activities are not associated with an increase in traffic volumes and as such a Traffic study is not applicable to this project.  |
| Socio-economic Assessment                              |  | The proposed activities are not anticipated to influence current socio-economic conditions at the mine and as such a Socio-economic study is not applicable to this project.   |
| Air Quality Assessment                                 |  | An Air Quality study was undertaken for the project and is included in Appendix L. This study will be informed by site work.   |
| Ambient Air Quality Assessment                         |  |  |
| Health Impact Assessment                               |  | The need for a health assessment associated with the proposed activities is not deemed necessary based on the findings of the Air Quality study.   |
| Aquatic Biodiversity                                   | Low                                    | An Aquatic assessment indicated that no aquatic habitats are present on or near the site.  |
| Civil Aviation   | Low                                    | Not applicable as the project will not present any tall structures that could influence flight paths.  |
| Palaeontology  | Medium                                 | A Palaeontological study was undertaken for the project and is included in Appendix P.   |
| Plant Species Assessment                               | Low                                    | A terrestrial biodiversity study was undertaken for the project and is included in Appendix G. There is no specific protocol for this theme. The terrestrial biodiversity study complies with NEMA Appendix 6 requirements for specialist reports.               |
| Terrestrial Biodiversity                               | Low                                    | The terrestrial screening tool protocol specifies that a Terrestrial Biodiversity Compliance Statement for low terrestrial biodiversity is required. In this regard, the required compliance statement was incorporated into the Terrestrial Biodiversity study. |
| Defence  | Low                                    | Not applicable to the MMT. The mine is not located near any areas of defence.  |

## **22. OTHER MATTERS REQUIRED IN TERMS OF SECTION 24(4)(A) AND (B) OF THE ACT**

No additional matters are required in terms of Section 24(4)(A) and (B) of the Act.

## PART– B - ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

The following section has been completed in accordance with the reporting requirements as set out in the DMRE EIA and EMPr template format (refer to Section 1.6). It is however important to note, that for ease of implementation, a stand-alone EMPr has been developed for the mine. This stand-alone EMPr is attached in Appendix S. Information in the attached stand-alone EMPr does not differ from that provided in Part B of this report.



## **23. DETAILS OF THE EAP**

The details of the EAPs who undertook the EIA process and prepared this EIR are provided in Part A, Section 2.

## **24. DESCRIPTION OF THE ASPECTS OF THE ACTIVITY**

The activities that are covered in the EMPr are included in Part A, Section 8.

## **25. COMPOSITE MAP**

A composite map superimposed on the environmentally sensitive areas of the preferred site is included in Appendix T.

## 26. DESCRIPTION OF IMPACT MANAGEMENT OBJECTIVES INCLUDING MANAGEMENT STATEMENTS

### 26.1 DETERMINATION OF CLOSURE OBJECTIVES

The closure objectives for the MMT were determined taking into account the existing type of environment as described in Section 7.4.1, in order to ensure that the closure objectives strive to achieve a condition approximating its natural state as far as possible. Further information pertaining to the closure objectives identified for the project is provided in Section 29.1.1.

### 26.2 THE PROCESS FOR MANAGING ANY ENVIRONMENTAL DAMAGE, POLLUTION, PUMPING AND TREATMENT OF EXTRANEEOUS WATER OR ECOLOGICAL DEGRADATION AS A RESULT OF UNDERTAKING A LISTED ACTIVITY

The management actions outlined in Section 28 have been identified to manage and reduce impacts associated with the project in order to prevent unnecessary damage to the environment as a result of the project activities. If incidents occur that may result in environmental damages the emergency response procedure as outlined in Section 31.2.2 will be implemented to avoid pollution or degradation.

### 26.3 POTENTIAL RISK OF ACID MINE DRAINAGE

With reference to Section 7.4.1.1 there is a low risk of acid mine drainage associated with the MMT.

### 26.4 STEPS TAKEN TO INVESTIGATE, ASSESS AND EVALUATE THE IMPACT OF ACID MINE DRAINAGE

With reference to Section 7.4.1.1 there is a low risk of acid mine drainage associated with the MMT. It follows that the completion of this section is not required.

### 26.5 ENGINEERING OR MINE DESIGN SOLUTIONS TO BE IMPLEMENTED TO AVOID OR REMEDY ACID MINE DRAINAGE

With reference to Section 7.4.1.1 there is a low risk of acid mine drainage associated with the MMT. It follows that the completion of this section is not required.

### 26.6 MEASURES THAT WILL BE PUT IN PLACE TO REMEDY ANY RESIDUE OR CUMULATIVE IMPACT THAT MAY RESULT FROM ACID MINE DRAINAGE

With reference to Section 7.4.1.1 there is a low risk of acid mine drainage associated with the MMT. It follows that the completion of this section is not required.

## 26.7 VOLUMES AND RATE OF WATER USE REQUIRED FOR THE MINING, TRENCHING OR BULK SAMPLING OPERATION

The detailed water balance for the mine is included in Section 4.2.1.8. The water balance outlines the water requirements for MMT.

## 26.8 HAS A WATER USE LICENCE BEEN APPLIED FOR?

HMM holds an amended IWUL (License number: 10/D41K/KAGJ/1537) issued by the DWS (currently the DWS) in 2017 and amended in 2020. An amendment to the existing IWUL is required for the project. This will be managed as part of a separate process with the DWS.

## 26.9 IMPACTS TO BE MITIGATED IN THEIR RESPECTIVE PHASES

The assessment of impacts is summarised in Section 9 and detailed in Appendix D. Management actions which will be implemented to avoid and minimise potential impacts are detailed in Section 28. The section below focuses on mitigation measures that are specific to **listed activities** based on the actions outlined in Section 28.

**Table 26-1: Measures to rehabilitate the environment affected by the undertaking of any listed activity**

| Activity (Listed: NEMA and NEM:WA)   | Phase        | Size and scale of disturbance  | Mitigation measures  | Compliance with standards | Time period for implementation |
|--|--------------|--|--|---------------------------|--------------------------------|
| <b>NEMA (GNR 984 of 2014) as amended by GNR.325 of 2017 (G.G. 40772 of 07/04/2017: Listing Notice 2, Activity 15:</b> The clearance of an area of 20 ha or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for:<br>(i) The undertaking of a linear activity; or<br>(ii) Maintenance purposes undertaken in accordance with a maintenance management plan. | Construction | <ul style="list-style-type: none"> <li>Establishment of a top-cut stockpile and associated mobile crushing and screening plant – 34 ha</li> </ul>  | <p>Refer to Section 28 for mitigation measures associated with:</p> <ul style="list-style-type: none"> <li>Topography</li> <li>Water management</li> <li>Land use management</li> <li>Soil loss and stockpile management</li> <li>Loss of land capability and agricultural potential</li> <li>Flora and fauna</li> <li>Heritage and palaeontological</li> <li>Closure</li> <li>Visual</li> <li>Noise</li> <li>Air quality</li> </ul> | Refer to Section 28       | Refer to Section 28            |
| <b>NEMA (GNR 984 of 2014) as amended by GNR.325 of 2017 (G.G. 40772 of 07/04/2017: Listing Notice 2, Activity 6:</b> The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent.                  | Construction | <ul style="list-style-type: none"> <li>Establishment of a top-cut stockpile and associated mobile crushing and screening plant – 34 ha</li> <li>Establishment of stormwater management infrastructure – PCD and evaporation channels – 1 ha</li> </ul> |  | Refer to Section 28       | Refer to Section 28            |
| <b>NEMA (GNR 983 of 2014) as amended by GNR.327 of 2017 (G.G. 40772 of 07/04/2017) and GNR.706 of 2018 (G.G. 41766 of 13/07/2018): Listing Notice 1,</b>   | Construction | <ul style="list-style-type: none"> <li>Establishment of stormwater management infrastructure – PCD and evaporation channels – 1 ha</li> </ul>  |  | Refer to Section 28       | Refer to Section 28            |



| Activity (Listed: NEMA and NEM:WA)  | Phase        | Size and scale of disturbance   | Mitigation measures   | Compliance with standards | Time period for implementation |
|---|--------------|---|---|---------------------------|--------------------------------|
| <b>Activity 13:</b> The development of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50 000 m3 or more, unless such storage falls within the ambit of activity 16 in Listing Notice 2 of 2014.   |              |   |   |                           |                                |
| <b>NEMA (GNR 983 of 2014) as amended by GNR.327 of 2017 (G.G. 40772 of 07/04/2017) and GNR.706 of 2018 (G.G. 41766 of 13/07/2018): Listing Notice 1, Activity 27:</b> The clearance of an area of 1 ha or more, but less than 20 ha of indigenous vegetation, except where such clearance of indigenous vegetation is required for:<br>(i) The undertaking of a linear activity; or<br>(ii) Maintenance purposes undertaken in accordance with a maintenance management plan. | Construction | <ul style="list-style-type: none"> <li>Establishment of stormwater management infrastructure – PCD and evaporation channels – 1 ha</li> <li>Upgrading the railway loadout station – 5.6 ha</li> </ul> | Refer to Section 28 for mitigation measures associated with: <ul style="list-style-type: none"> <li>Topography</li> <li>Water management</li> <li>Land use management</li> <li>Soil loss and stockpile management</li> <li>Loss of land capability and agricultural potential</li> <li>Flora and fauna</li> <li>Heritage and palaeontological</li> <li>Closure</li> <li>Visual</li> <li>Noise</li> <li>Air quality</li> </ul> | Refer to Section 28       | Refer to Section 28            |
| <b>NEMA (GNR 984 of 2014) as amended by GNR.325 of 2017 (G.G. 40772 of 07/04/2017): Listing Notice 2, Activity 16:</b> The development of a dam where the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, is 5 m or higher or   | Construction | <ul style="list-style-type: none"> <li>Establishment of stormwater management infrastructure – PCD and evaporation channels – 1 ha</li> </ul>   |   | Refer to Section 28       | Refer to Section 28            |

| Activity (Listed: NEMA and NEM:WA)   | Phase        | Size and scale of disturbance   | Mitigation measures   | Compliance with standards | Time period for implementation |
|--|--------------|---|---|---------------------------|--------------------------------|
| where the highwater mark of the dam covers an area of 10 ha or more.   |              |   |   |                           |                                |
| <b>NEMA (GNR 983 of 2014) as amended by GNR.327 of 2017 (G.G. 40772 of 07/04/2017) and GNR.706 of 2018 (G.G. 41766 of 13/07/2018): Listing Notice 1, Activity 10:</b> The development and related operation of infrastructure exceeding 1 000 m in length for the bulk transportation of sewage, effluent, process water, wastewater, return water, industrial discharge or slimes:(i) With an internal diameter of 0,36 m or more; or<br>(ii) With a peak throughput of 120 l/s or more; excluding where:<br>(a) Such infrastructure is for the bulk transportation of sewage, effluent, process water, wastewater, return water, industrial discharge or slimes inside a road reserve or railway line reserve; or<br>(b) Where such development will occur within an urban area. | Construction | <ul style="list-style-type: none"> <li>Establishment of stormwater management infrastructure – Proposed pumping system to transfer process water from the PCD to the plant for re-use.</li> </ul> | Refer to Section 28 for mitigation measures associated with: <ul style="list-style-type: none"> <li>Topography</li> <li>Water management</li> <li>Land use management</li> <li>Soil loss and stockpile management</li> <li>Loss of land capability and agricultural potential</li> <li>Flora and fauna</li> <li>Heritage and palaeontological</li> <li>Closure</li> <li>Visual</li> <li>Noise</li> <li>Air quality</li> </ul> | Refer to Section 28       | Refer to Section 28            |
| <b>NEMA (GNR 983 of 2014) as amended by GNR.327 of 2017 (G.G. 40772 of 07/04/2017) and GNR.706 of 2018 (G.G. 41766 of 13/07/2018): Listing Notice 1, Activity 34:</b> The expansion of existing facilities or infrastructure for any process or  | Construction | Changes to WRD height (excludes rehabilitated WRDs) – Not applicable  |   | Refer to Section 28       | Refer to Section 28            |

| Activity (Listed: NEMA and NEM:WA)  | Phase        | Size and scale of disturbance   | Mitigation measures   | Compliance with standards | Time period for implementation |
|---|--------------|---|---|---------------------------|--------------------------------|
| <p>activity where such expansion will result in the need for a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the release of emissions, effluent or pollution, excluding:(i) where the facility, infrastructure, process or activity is included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies;</p> <p>(ii) the expansion of existing facilities or infrastructure for the treatment of effluent, wastewater, polluted water or sewage where the capacity will be increased by less than 15 000 cubic metres per day; or</p> <p>(iii) the expansion is directly related to aquaculture facilities or infrastructure where the wastewater discharge capacity will be increased by 50 cubic meters or less per day.</p> |              |   |   |                           |                                |
| <p><b>NEMA (GNR 983 of 2014) as amended by GNR.327 of 2017 (G.G. 40772 of 07/04/2017) and GNR.706 of 2018 (G.G. 41766 of 13/07/2018): Listing Notice 1, Activity 9:</b> The development of infrastructure exceeding 1 000 m in length for the</p>   | Construction | Establishment of a pipeline to transport abstracted water from the decommissioned Middelplaats Mine to MMT – 4 km | <p>Refer to Section 28 for mitigation measures associated with:</p> <ul style="list-style-type: none"> <li>• Topography</li> <li>• Water management</li> <li>• Land use management</li> </ul> | Refer to Section 28       | Refer to Section 28            |

| Activity (Listed: NEMA and NEM:WA)   | Phase  | Size and scale of disturbance  | Mitigation measures   | Compliance with standards | Time period for implementation |
|--|--|--|---|---------------------------|--------------------------------|
| <p>bulk transportation of water or stormwater:</p> <p>i) With an internal diameter of 0,36 m or more; or</p> <p>(ii) With a peak throughput of 120 l/s or more.</p> <p>excluding where:</p> <p>(a) Such infrastructure is for bulk transportation of water or stormwater or stormwater drainage inside a road reserve or railway line reserve; or</p> <p>(b) Where such development will occur within an urban area.</p>   |  |  | <ul style="list-style-type: none"> <li>• Soil loss and stockpile management</li> <li>• Loss of land capability and agricultural potential</li> <li>• Flora and fauna</li> <li>• Heritage and palaeontological</li> <li>• Closure</li> <li>• Visual</li> <li>• Noise</li> <li>• Air quality</li> </ul> |                           |                                |
| <p><b>NEMA (GNR 984 of 2014) as amended by GNR.325 of 2017 (G.G. 40772 of 07/04/2017: Listing Notice 2, Activity 17:</b> Any activity including the operation of that activity which requires a mining right as contemplated in section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including -</p> <p>(a) associated infrastructure, structures and earthworks, directly related to the extraction of a mineral resource; or</p> <p>(b) the primary processing of a mineral resource including winning, extraction, classifying, concentrating, crushing, screening or washing; but excluding the</p> | <p>Construction</p> <p>Operational</p> <p>Decommissioning</p> <p>Closure</p> | <ul style="list-style-type: none"> <li>• Sale of waste rock as aggregate – Not applicable</li> <li>• Re-processing of material located in Adams Pit – 14 ha</li> </ul> |   | Refer to Section 28       | Refer to Section 28            |

| Activity (Listed: NEMA and NEM:WA)  | Phase        | Size and scale of disturbance  | Mitigation measures  | Compliance with standards | Time period for implementation |
|---|--------------|--|--|---------------------------|--------------------------------|
| secondary processing of a mineral resource, including the smelting, beneficiation, reduction, refining, calcining or gasification of the mineral resource in which case activity 6 in this Notice applies.  |              |  |  |                           |                                |
| <b>NEM: WA (GNR 921 of 2013) as amended by GNR.332 of 2014 (G.G. 37604 of 02/05/2014), GNR.633 of 2015 (G.G. 39020 of 24/07/2015) and GNR.1094 of 2017 (G.G. 41175 of 11/10/2017): Category A, Activity 13:</b> The expansion of a waste management activity listed in Category A or B of this Schedule which does not trigger an additional waste management activity in terms of this Schedule.               | Construction | <ul style="list-style-type: none"> <li>Changes to WRD height (excludes rehabilitated WRDs).</li> </ul> | Refer to Section 28 for mitigation measures associated with: <ul style="list-style-type: none"> <li>Topography</li> <li>Water management</li> <li>Land use management</li> <li>Soil loss and stockpile management</li> <li>Loss of land capability and agricultural potential</li> <li>Flora and fauna</li> <li>Heritage and palaeontological</li> </ul> | Refer to Section 28       | Refer to Section 28            |
| <b>NEM: WA (GNR 921 of 2013) as amended by GNR.332 of 2014 (G.G. 37604 of 02/05/2014), GNR.633 of 2015 (G.G. 39020 of 24/07/2015) and GNR.1094 of 2017 (G.G. 41175 of 11/10/2017): Category B, Activity 11:</b> The establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a mining right, exploration right or production right in terms of the MPRDA. | Operational  | <ul style="list-style-type: none"> <li>Sale of waste rock as aggregate.</li> </ul>                     | <ul style="list-style-type: none"> <li>Closure</li> <li>Visual</li> <li>Noise</li> <li>Air quality</li> </ul>  | Refer to Section 28       | Refer to Section 28            |



## 27. IMPACT MANAGEMENT OUTCOMES

Table 27-1 below provides a description of the outcomes and objective of management actions in order to manage, remedy, control or modify potential impacts. The management actions identified to achieve these outcomes and objectives are described in Section 28. Refer to Appendix D for further detail.

**Table 27-1: Description of impact management outcomes**

| Activity   | Potential Impact   | Affected Aspect          | Phase   | Management actions Type | Standard to be Achieved (Impact management outcome/objectives) |
|--|--|--------------------------|---|-------------------------|--|
| <ul style="list-style-type: none"> <li>Establishment of mining related infrastructure</li> <li>Establishment of dewatering boreholes and pipeline</li> </ul>   | Soil erosion   | Soil and land capability | Construction<br>Operation<br>Decommissioning<br>Closure | Refer to Section 28     | Refer to Section 12  |
| <ul style="list-style-type: none"> <li>Establishment of mining related infrastructure</li> <li>Establishment of dewatering boreholes and pipeline</li> </ul>   | Soil compaction  |                          |   |                         |  |
| <ul style="list-style-type: none"> <li>Establishment of mining related infrastructure</li> </ul>   | Soil contamination   |                          |   |                         |  |
| <ul style="list-style-type: none"> <li>Establishment of mining related infrastructure</li> <li>Establishment of dewatering boreholes and pipeline</li> </ul>   | Loss of agriculture and land capability  |                          |   |                         |  |
| <ul style="list-style-type: none"> <li>Top-cut stockpile</li> <li>Crushing and screening plant</li> <li>Borehole drilling</li> <li>Dewatering pipeline</li> <li>Offices, stockpile area and contractor laydown</li> <li>Railway loop, road, and security checkpoint</li> </ul> | Floral habitat and diversity<br>Floral SCC<br>Loss of faunal habitat and ecological structure<br>Important faunal species of | Biodiversity             | Construction<br>Operation<br>Decommissioning<br>Closure | Refer to Section 28     | Refer to Section 12  |
|  |  |                          |   |                         |  |
|  |  |                          |   |                         |  |
|  |  |                          |   |                         |  |

| Activity   | Potential Impact   | Affected Aspect | Phase   | Management actions Type | Standard to be Achieved<br>(Impact management<br>outcome/objectives) |
|--|--|-----------------|---|-------------------------|--|
|  | conservational concern   |                 |   |                         |  |
| • Establishment of mining related infrastructure | Contamination of surface water resources affecting third party use                 | Surface water   | Construction<br>Operation<br>Decommissioning<br>Closure | Refer to Section 28     | Refer to Section 12  |
| • Establishment of mining related infrastructure | Soil erosion and sedimentation   |                 |   |                         |  |
| • Establishment of mining related infrastructure | Alteration of natural drainage patterns affecting flow water in downstream systems |                 |   |                         |  |
| • Establishment of mining related infrastructure | Contamination of groundwater affecting third party use                             | Groundwater     | Construction<br>Operation<br>Decommissioning<br>Closure | Refer to Section 28     | Refer to Section 12  |
| • Establishment of mining related infrastructure | Development of the conde of drawdown because of mining                             |                 |   |                         |  |
| • Establishment of mining related infrastructure | Increase in ambient air concentrations   | Air quality     | Construction<br>Operation<br>Decommissioning<br>Closure | Refer to Section 28     | Refer to Section 12  |
| • Establishment of mining related infrastructure | Increase in disturbing noise levels affecting                                      | Noise           | Construction<br>Operation<br>Decommissioning            | Refer to Section 28     | Refer to Section 12  |

| Activity   | Potential Impact  | Affected Aspect                     | Phase   | Management actions Type | Standard to be Achieved<br>(Impact management<br>outcome/objectives) |
|--|---|-------------------------------------|---|-------------------------|--|
|  | potential human<br>receptors  |                                     | Closure   |                         |  |
| <ul style="list-style-type: none"> <li>Establishment of mining related infrastructure</li> </ul> | Loss or damage to<br>heritage and/or<br>palaeontological<br>resources     | Heritage and/or<br>palaeontological | Construction<br>Operation<br>Decommissioning<br>Closure | Refer to Section 28     | Refer to Section 12  |
| <ul style="list-style-type: none"> <li>Establishment of mining related infrastructure</li> </ul> | Alteration of the<br>visual<br>environment<br>affecting sense of<br>place | Visual                              | Construction<br>Operation<br>Decommissioning<br>Closure | Refer to Section 28     | Refer to Section 12  |

## 28. IMPACT MANAGEMENTN ACTIONS

Management actions identified to prevent, reduce, control or remedy the assessed impacts are presented in Table 28-1 below. The action plans include the timeframes for implementing the management actions together with a description of how management actions comply with relevant standards. Management actions and recommendations identified by specialists have been summarised and are included in the table below. The following includes the original relevant 2005 EMPR chapters from the Jones and Wagener Consulting Civil Engineers Report. Everything that has been removed is demarcated by ~~strike through~~ and everything that has been added is denoted by being underlined.

**Table 28-1: Description of impact management actions**

| Activity   | Potential Impact | Management actions   | Time Period for Implementation  | Compliance with Standards   |
|--|------------------|--|---|---|
| Site preparation<br>Earthworks<br>Civil works<br>Mineralise management<br>Stormwater management<br>Transport system<br>Continued use of existing services<br>Site management<br>Demolition<br>Rehabilitation, maintenance and aftercare<br>Site support services | Topography       | <ul style="list-style-type: none"> <li><u>Minimise the area of the disturbance by designing and constructing the most compact infrastructure practically possible.</u></li> <li><u>Rehabilitate in accordance with the approved mine closure plan to ensure a suitable post-closure land use is achieved.</u></li> <li><u>The project area will be fenced off to prevent inadvertent access by third parties and animals;</u></li> <li><u>Access control will be implemented to ensure access is only granted to those who have authorisation;</u></li> <li><u>Barriers will be erected around all hazardous excavations;</u></li> <li><u>Warning signage will be erected at all hazardous excavations; and</u></li> <li><u>Where the proposed project has caused injury to third parties or animals, appropriate compensation will be provided;</u></li> <li><u>Care must be taken to ensure that third-party infrastructure, such as telephone lines, etc. are not damaged during the construction phase.</u></li> </ul>   | On-going for all, except decommissioning and closure related actions, only when required. | Not applicable  |
| Site preparation<br>Earthworks<br>Civil works<br>Mineralise management<br>Stormwater management<br>Transport system<br>Continued use of existing services<br>Site management<br>Demolition<br>Rehabilitation, maintenance and aftercare<br>Site support services | Water management | <ul style="list-style-type: none"> <li><del>The rehabilitated Mamatwan area will be gently undulating, with no major natural drainage systems on-site, resulting in a non-free draining landscape. The final rehabilitation plan will be designed such as to ensure a free draining landform as</del></li> <li>The full depth of available soils and subsoils will be placed on to the hard rock spoils (as far as is practical) to limit ingress.</li> <li><u>In most areas, it is anticipated that a suitable cover will establish naturally. This will be assisted by harvesting seed and plant material by cutting and processing natural veld adjacent to the site and distributing this over the areas to be rehabilitated.</u></li> <li><del>All available topsoil areas will be seeded prior to the rainy season to ensure maximum drainage from these areas of clean water back into the catchment system without excessive suspended solids</del></li> <li>The accumulation of significant volumes in the open pit areas will be avoided to limit contact time with exposed minerals. Any inflows (excess water) into the open pits will be handled as part of the overall mine water balance and pumped to Adam's Pit, and/or similar alternative, for reuse in the process plant.</li> <li>All dirty storm water will be collected and pumped to <del>Adam's Pit</del> <u>the Pollution Control Dam</u> for reuse in the process plant. No contaminated water will be allowed to enter the natural hydrological system.</li> <li>As much of the pit as is practical will be backfilled during the operational phase and the invert level of the rehabilitated surface will be raised to be within 25 to 30m of the natural ground surface (above the regional groundwater level) to limit evapo-concentration. Stockpile material will not be deposited above the water table during backfilling of the open pit, in order to prevent groundwater contamination. <del>The rehabilitation of the defunct tailings dams this being undertaken in order to reduce the extent of the groundwater impacts from these areas. The mitigation options to address the pollution plume associated with these tailings will be evaluated once the point source has been addressed.</del></li> <li>Proper bunding facilities will be established in all areas where organic (hydrocarbon) contaminants may originate. Spillages will be managed and rectified in accordance with the mine's standard operating procedures.</li> <li>Standard operating procedures for all point pollution sources (sewage effluent, waste disposal, refuelling points, oil storage, etc.) will be reviewed on an ongoing basis and revised when required.</li> <li>An ongoing water quality monitoring programme for both surface and groundwater will be implemented to detect any unacceptable deterioration of the water quality in the water resources.</li> <li><u>Drip trays should be placed under all standing machinery.</u></li> </ul> | On-going for all, except decommissioning and closure related actions, only when required. | <p>Compliance to stormwater management measures and maintenance of GN 704.</p> <p>Compliance with conditions set out in the IWUL in terms of the NWA.</p> |

| Activity   | Potential Impact    | Management actions   | Time Period for Implementation  | Compliance with Standards |
|--|---------------------|--|---|---------------------------|
|  |                     | <ul style="list-style-type: none"> <li>Oil recovered from any vehicle or machinery on-site should be collected, stored and disposed of by accredited vendors for recycling.</li> <li>Traffic and movement over stabilised areas should be controlled (minimised and kept to specific paths), and damage to stabilised areas should be repaired timeously.</li> <li>A water quality monitoring plan must be formulated and incorporated into the existing plan before construction.</li> <li>Construction must be undertaken during the dry season as far as practical. This will significantly reduce the potential for sedimentation through erosion due to construction activities.</li> <li>Concurrent rehabilitation of disturbed land and revegetation should be carried out to minimise the amount of time that bare soils are exposed to the erosive effects of rain and subsequent runoff.</li> <li>The development of a stormwater infrastructure will result in positive impacts such as pollution control however clean water must be released into the environment to minimize alteration of natural drainage flow.</li> <li>Mamatwan should continue groundwater monitoring per existing monitoring protocols for the existing monitoring network.</li> <li>All potentially affected boreholes will be included in the water monitoring programme for boreholes located both on and off the mine site. This will be carried out where private landowners allow for access to their boreholes.</li> <li>If any mine related loss of water supply through a reduction in quality is experienced by third party borehole users, Mamatwan will provide compensation which could include an alternative water supply of equivalent water quality.</li> <li>Should any off-site contamination be detected, the mine will immediately notify DWS. The mine, in consultation with DWS and an appropriately qualified person, will then notify potentially affected users, identify the source of contamination, identify measures for the prevention of this contamination (in the short term and the long term) and then implement these measures.</li> <li>At decommissioning, the potential pollution sources, if found to be causing pollution, (residual waste rock left on surface) will either be removed or rehabilitated to manage rainfall and seepage.</li> </ul>  |   |                           |
| Site preparation<br>Earthworks<br>Civil works<br>Mineralise management<br>Stormwater management<br>Transport system<br>Continued use of existing services<br>Site management<br>Demolition<br>Rehabilitation, maintenance and aftercare<br>Site support services | Land use management | <ul style="list-style-type: none"> <li>Implement the soil conservation procedure as per the EMPR.</li> <li>Establish short term perennial vegetation that will stabilise the site but allow the indigenous vegetation to establish over the site;</li> <li>Use existing established roads;</li> <li>Ensure vegetation clearing is undertaken in phases;</li> <li>Limit vegetation clearance to only the areas where the infrastructure will be constructed;</li> <li>Avoid parking of vehicles and equipment outside of designated parking areas;</li> <li>Plan vegetation clearance for dry seasons (late autumn, winter and early spring); and</li> <li>Re-establish vegetation along the railway infrastructure to reduce the impact of run-off from the compacted surface of the railway area.</li> <li>Land clearance must only be undertaken immediately prior to construction activities within the development footprint; and</li> <li>Level any remaining topsoil that was removed from the railway area and that remained on the surface instead of allowing small stockpiled of soil to remain on the surface.</li> <li>Conduct potentially polluting activities (i.e., loading, hauling, tipping, transportation, handling and storage) in a manner that pollutants are contained at source and do not pollute soils. In this regard:</li> <li>Service all vehicles and mobile equipment regularly in workshops, service bays and wash bays with contained impermeable, floors, dirty water collection facilities and oil traps;</li> <li>Design and operate all new and used chemical, fuel and oil storage and handling facilities in a manner that all spillages are contained in impermeable areas and cannot be released into the environment;</li> <li>Report ad hoc spills of potentially polluting substances (whether in dirty areas or in the environment) to the environmental lead or specialist immediately and clean up and/or remediate immediately;</li> <li>Implement and maintain a dirty water management system;</li> <li>Implement the waste management practices, as per the IWWMP and EMPR.</li> <li>Educate and train all employees (temporary and permanent) and contractors in pollution prevention; and</li> <li>Implement formalised action plans to enable fast and efficient reaction to contain and remediate pollution incidents.</li> <li>Take into account the requirements for long term soil pollution prevention, land function and confirmatory monitoring in the design of any permanent and potentially polluting structures; and</li> <li>Implement the emergency response procedure in the event any major spillage incident</li> <li>Rehabilitation will be undertaken concurrent to mining operations where practical, based on the rehabilitation plan developed for the mine. However, due to the location of the crusher, no concurrent backfill and rehabilitation of</li> </ul> | On-going for all, except decommissioning and closure related actions, only when required. | Not applicable            |



| Activity   | Potential Impact   | Management actions   | Time Period for Implementation  | Compliance with Standards |
|--|--|--|---|---------------------------|
|  |  | <p><u>the opencast pit can be undertaken. Additional unavailable areas include the footprints of permanent infrastructure, including but not limited to offices, workshops, plant areas and stockpiles.</u> The mining plan/ schedule will be optimised to facilitate continuous rehabilitation.</p> <ul style="list-style-type: none"> <li>The material will be, as far as is practical, only handled once. Further, the overburden will be placed back into the pit in the same stratigraphy as is present prior to mining.</li> <li>The full depth of available soils and subsoils will be placed on to the hard rock spoils, as far as is practical, so as to limit ingress.</li> <li>The calcrete material will be placed over the hard rock spoils in order to facilitate the development of an aquiclude over the spoils.</li> <li>Slopes will generally be flatter than 12°, but steeper than 0.5%. Vegetation that is local to the area will be established to limit the risk of erosion.</li> <li>The areas will be revegetation as soon as possible to limit dust and erosion.</li> <li>The mining plan/schedule will ensure optimal placement of excavated material to facilitate concurrent rehabilitation.</li> <li>The mining plan/schedule will be updated on a continuous (monthly) basis to ensure best practice.</li> <li>Rehabilitation monitoring and auditing will be implemented to ensure conformance to this objective and the rehabilitation plan.</li> <li>Topsoil does not exist on the site in terms of the conventional understanding of topsoil. The upper materials do not have high nutrient values, and their primary value is due to the presence of seed bank. A minimum layer of 200mm of soil will be stripped prior to mining and stockpiled (or directly placed where possible) for final rehabilitation.</li> <li>Where soil stockpiled is used as a “topsoil” layer, tests will be conducted to determine if nutrients or fertilisers need to be added. These tests will be undertaken as and when required.</li> <li>Sampling and analysis of the placed topsoil will be carried out on a two yearly basis in order to determine the need for fertiliser application.</li> <li>Material beneath ore and overburden stockpiles will be sampled once these are removed to assess the extent to which it is contaminated, and if necessary, soil will be placed into the pit.</li> <li><u>Temporary erosion control measures may be used to protect the disturbed soils until adequate vegetation has established.</u></li> <li><u>All disturbed areas can be re-vegetated with an appropriate indigenous veld reclamation mix, if necessary, to re-establish a protective cover, to minimise soil erosion.</u></li> <li><u>Avoid vehicular movement on arable soils as far as practically possible.</u></li> <li><u>Compacted soils adjacent to disturbed areas should be ripped at 25cm as soon as possible to alleviate compaction and potential crusting.</u></li> <li><u>Contractors and mining crew conducting the works on site should be informed about approved waste disposal facilities.</u></li> </ul> |   |                           |
| Site preparation<br>Earthworks<br>Civil works<br>Mineralise management<br>Stormwater management<br>Transport system<br>Continued use of existing services<br>Site management<br>Demolition<br>Rehabilitation, maintenance and aftercare<br>Site support services | Soil Loss and Stockpile Management                             | <ul style="list-style-type: none"> <li><u>Stockpiles should be revegetated to establish a vegetation cover as an erosion control measure. These stockpiles should also be kept alien vegetation free at all times to prevent loss of soil quality.</u></li> <li><u>Temporary berms can be constructed, around stockpile areas whilst vegetation cover has not established to avoid soil loss through erosion.</u></li> <li><u>The stockpiled soil should only be used for intended purpose of rehabilitation at closure of mine operation. Soil stockpiles should be clearly demarcated with No Go areas and monitored regularly.</u></li> <li><u>Dumping of waste material next to or on the stockpiles must be prohibited at all times. Integrated soil stockpile management plans and monitoring programmes as well as an employee awareness programme must be put in place to significantly reduce the risk of soil stockpile robbery and/or contamination.</u></li> <li><u>The recovered soils should be re-used to rehabilitate the development footprint following mine closure.</u></li> </ul>   | On-going for all, except decommissioning and closure related actions, only when required. | Not applicable            |
| Site preparation<br>Earthworks<br>Civil works<br>Mineralise management   | Loss of Land Capability and Agricultural Potential Management. | <ul style="list-style-type: none"> <li><u>During the decommissioning phase the footprint should be thoroughly cleaned, and all waste material should be removed to a suitable disposal facility.</u></li> <li><u>The footprint should be ripped to alleviate compaction where necessary.</u></li> <li><u>Stored topsoil should be replaced (if any) and the footprint graded to a smooth surface.</u></li> </ul>   | On-going for all, except decommissioning and closure related actions, only when required. | Not applicable            |

| Activity   | Potential Impact | Management actions  | Time Period for Implementation  | Compliance with Standards   |
|--|------------------|---|---|---|
| Stormwater management<br>Transport system<br>Continued use of existing services<br>Site management<br>Demolition<br>Rehabilitation, maintenance and aftercare<br>Site support services   |                  | <ul style="list-style-type: none"> <li><u>The landscape should be backfilled and reprofiled to mimic the natural topography for potential agricultural activities and grazing opportunities post mining. If possible, ensure a continuation of the pre mining surface drainage pattern.</u></li> <li><u>Slopes of the backfilled surface should change gradually since abrupt changes in slope gradient increase the susceptibility for erosion initiation.</u></li> <li><u>The topsoil should be ameliorated according to soil chemical analysis taken on the undisturbed areas.</u></li> <li><u>The soil fertility status should be determined by soil chemical analysis after levelling (before seeding/re-vegetation). Soil amelioration should be done according to the soil analyses as recommended by a soil specialist, to correct the pH and nutrition status before revegetation.</u></li> <li><u>The footprint should be re-vegetated with a grass seed mixture as soon as possible, preferably in spring and early summer to stabilise the soil and prevent soil loss during the rainy season.</u></li> <li>In most areas, it is anticipated that a suitable cover will establish naturally. This will be assisted by harvesting seed and plant material by cutting and processing natural veld adjacent to the site and distributing this over the rehabilitated areas.</li> <li>If monitoring shows that the establishment of vegetation is not satisfactory, the top 15cm of soil will be analysed, upgraded and seeded either with a seed mixture of local indigenous plant species, or with a short term perennial that will allow prevention of erosion and the establishment of indigenous vegetation.</li> <li>Due to the dry climate and sandy soil it is anticipated that some difficulties will be experienced in obtaining a good germination and initial cover. Therefore, certain areas may need to be re-seeded if the initial establishment proves to be inadequate.</li> <li>The success of the revegetation program will be based not only on basal cover, but also on the diversity of species and the extent to which there are local indigenous species. Satellite imagery and aerial photography will be used to monitor the effects of mining on vegetation and the status of revegetation on an annual basis.</li> <li>An eradication program will be initiated on the mine. The invader plants will be eradicated on an ongoing basis during the life of the mine and following rehabilitation until a suitable self-sustaining vegetation cover is achieved in rehabilitated areas.</li> <li>Newly disturbed areas will be checked for the emergence of seedlings, which will be removed and manually monitored.</li> <li>A monitoring programme to determine conformance to these objectives will be initiated, including monitoring of the success of removal (follow-up investigations).</li> <li>In areas included in the proposed mining plan, the natural vegetation will be retained as long as possible before topsoiling commences in order to limit dust and erosion.</li> <li>In areas not impacted by the mining activities, the natural vegetation will be maintained by implementing the following: <ul style="list-style-type: none"> <li><u>Fire breaks are made by clearing vegetation, and these are also used for security patrols.</u></li> <li><u>No grazing is allowed.</u></li> <li><u>Vehicle movement is restricted to existing roads.</u> <del>burning programmes rotational grazing programmes</del></li> <li><del>alien vegetation programme</del></li> <li><del>restricting vehicle movement to existing roads.</del></li> </ul> </li> </ul> |   |   |
| Site preparation<br>Earthworks<br>Civil works<br>Mineralise management<br>Stormwater management<br>Transport system<br>Continued use of existing services<br>Site management<br>Demolition<br>Rehabilitation, maintenance and aftercare<br>Site support services | Fauna and Flora  | <ul style="list-style-type: none"> <li><del>During the spring and summer months, surveys will be undertaken for <i>Nymphaea capensis</i> (chinese lantern) and <i>Acacia erioloba</i> (camel thorn) which are listed as a protected species. If found, a permit will be applied for to remove these species.</del></li> <li><u>Minimise loss of indigenous vegetation where possible through effective planning and limiting the development footprint to what is essential. The designs must further adhere to all legislation and all possible precautions taken to prevent potential spills and /or leaks.</u></li> <li><u>It is recommended that prior to the commencement of construction activities the entire construction servitude be fenced off, and clearly demarcated to limit footprint creep and edge effects.</u></li> <li><u>It is recommended that prior to any construction/ earth moving activities are to take place, a detailed walkdown of all-natural areas falling within the final expansion footprint area be undertaken and all protected floral species be marked.</u></li> <li><u>The walkdown should be undertaken during the summer season (February/March) when most herbaceous floral species will be in flower, and accurate identification will be easier.</u></li> <li><u>Once all floral SCC and NCNCA protected floral species within the development footprint has been identified, a rescue and relocation plan should be designed specifically to each species. Rescue and relocation activities need to take place prior to commencement of any expansion activities. Rescue and relocation need to be overseen by a suitably qualified contractor/ mine employee. The success of relocation actions need to be monitored quarterly for a minimum period of three years post-relocation.</u></li> </ul>   | On-going for all, except decommissioning and closure related actions, only when required. | <p>Permit applications will have to be made to the DAFF and DENC to obtain the required permission to remove protected species in terms of the NFA and the NCNCA respectively.</p> <p>The management action to implement an alien invasive species programme is in accordance with the NEMBA Alien and Invasive Species Regulations (2016) that requires the control of invasive species.</p> |

| Activity | Potential Impact | Management actions  | Time Period for Implementation | Compliance with Standards |
|----------|------------------|---|--------------------------------|---------------------------|
|          |                  | <ul style="list-style-type: none"> <li>• <u>The necessary permits need to be obtained from DOFF and NCDENC prior to the implementation of rescue and relocation activities.</u></li> <li>• <u>An AIP Management/Control Plan should be compiled for implementation.</u></li> <li>• <u>During the surveying and site-pegging phase of surface infrastructure, all potential floral SCC as well as protected floral species that will be affected by surface infrastructure must be marked and, where possible, relocated to suitable habitat surrounding the disturbance footprint. The removal and/or rescue and relocation should be overseen by a qualified specialist, in association with a suitably qualified horticulturist. The relevant permits must be applied for from the various authorities prior to the commencement of the construction phase.</u></li> <li>• <u>Following heavy rains, access roads are to be inspected for signs of erosion, which if found, must be immediately rectified through the appropriate erosion control measures.</u></li> <li>• <u>It is recommended that prior to the commencement of construction activities the entire proposed top cut be fenced off and clearly demarcated, any burrows should be monitored after fencing has been established to ensure no SCC are utilizing the area. If SCC are noted permits for their removal are necessary.</u></li> <li>• <u>Where possible, and feasible, all access roads should be kept to existing roads so to reduce fragmentation of existing natural habitat.</u></li> <li>• <u>Development should consider sensitive habitats for fauna within the study area.</u></li> <li>• <u>Prior to the commencement of construction activities on site a rehabilitation plan should be developed for implementation throughout the development phases.</u></li> <li>• <u>As part of the planning and preparation phase, a Fire Management Plan and Erosion plan should be developed and be in place before construction activities can commence.</u></li> <li>• <u>Design of infrastructure should be environmentally sound, and all possible precautions taken to prevent potential spills and /or leaks.</u></li> <li>• <u>At all times, ensure that sound environmental management is in place during the planning phase.</u></li> <li>• <u>The footprint areas of all surface infrastructure must be minimised to what is absolutely essential and within the designated and approved MMT expansion activities boundary.</u></li> <li>• <u>Vegetation outside of the footprint area is not to be cleared.</u></li> <li>• <u>Vegetation clearance and commencement of construction activities should either be scheduled to coincide with low rainfall conditions when erosive stormwater is anticipated to be limited or alternatively stormwater controls must be established at the start of construction and dust suppression implemented.</u></li> <li>• <u>Excavated topsoil must be stored with associated native vegetation debris for subsequent use in rehabilitation.</u></li> <li>• <u>Any railway infrastructure and mining related activities including stockpiles should be placed within transformed areas or where possible, existing infrastructure should be used.</u></li> <li>• <u>No collection/ trapping or hunting of faunal SCCs may be allowed by any construction personnel.</u></li> <li>• <u>Should any other faunal species protected under National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) or the Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) (NCNCA) be encountered within the study area authorisation to relocate such species must be obtained from the NCDENC or the Department of Environmental Affairs (DEA).</u></li> <li>• <u>Edge effect control needs to be implemented to ensure no further degradation and potential loss of faunal SCC outside of the proposed project footprint area.</u></li> <li>• <u>Should any SCC be observed on the site a biodiversity specialist should be contacted in order to map the best way forward.</u></li> <li>• <u>Prior to vegetation clearing activities in the Kathu Bushveld habitat, the site should be inspected for the presence of burrowing scorpion burrows, pythons and Aardvark. If located, these species should be carefully excavated ensuring no harm to fauna and relocated to similar surrounding habitat outside of the footprint area.</u></li> <li>• <u>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 construction site during clearing and construction activities, they are to be carefully and safely moved to an area of similar habitat outside of the disturbance footprint.</u></li> <li>• <u>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 should be contacted to affect the relocation of the species, should it not move off on its own.</u></li> <li>• <u>Should any snakes be encountered, either a suitably trained staff member or expert should be contacted to capture and relocate the specimen. No harm should be done to any snakes located within the study area.</u></li> <li>• <u>All soils compacted as a result of construction activities falling outside of the project area should be ripped and profiled. Special attention should be paid to alien and invasive control within these areas.</u></li> </ul> |                                |                           |

| Activity   | Potential Impact         | Management actions   | Time Period for Implementation  | Compliance with Standards |
|--|--------------------------|--|---|---------------------------|
|  |                          | <ul style="list-style-type: none"> <li><u>No collection of firewood (as this often provides microhabitats for small insect and arachnids) or faunal SCC is allowed by mining personnel.</u></li> <li><u>As part of a Biodiversity Action Plan (BAP), faunal monitoring should be done every two years.</u></li> <li><u>No collection of floral SCC or medicinal floral species within the site boundary must be allowed by construction personnel.</u></li> <li><u>Any natural areas beyond the expansion footprint, that have been affected by the construction and operational activities, must be rehabilitated using indigenous species.</u></li> <li><u>An effective dust management plan must be designed and implemented in order to mitigate the impact of dust on flora through the construction and operation phase.</u></li> <li><del>The mine area is fenced and mine security personnel are permanently on duty to secure the area from poaching. Regular patrols are also conducted to destroy snares. No hunting is allowed.</del></li> <li><u>No illicit fires must be allowed during the construction and operational phases of the proposed expansion activities.</u></li> <li><u>Fire breaks should be maintained during the operational phase.</u></li> <li><u>Adequate stormwater management must be incorporated into the design of the proposed development in order to prevent erosion of topsoil and the loss of floral habitat through the discharge of dirty water into the receiving environment. In this regard, special mention is made of:</u> <ul style="list-style-type: none"> <li>Sheet runoff from cleared areas, paved surfaces and access roads needs to be curtailed; and</li> <li>Runoff from paved surfaces should be slowed down by the strategic placement of bioswales.</li> </ul> </li> <li><u>All rehabilitated areas should be rehabilitated to a point where natural processes will allow the ecological functioning and biodiversity of the area to be re-instated as per the post-closure objective.</u></li> <li><u>Rehabilitation efforts must be implemented for a period of at least five years after decommissioning and closure.</u></li> <li><u>Edge effects of decommissioning and closure activities, such as erosion and alien plant species proliferation, which may affect adjacent sensitive habitat, need to be strictly managed adjacent to the expansion footprint.</u></li> <li><u>Ongoing alien and invasive vegetation monitoring and eradication should take place throughout the closure/ decommissioning phase of the development, and the Mamatwan Operations and immediate surrounding area (50 m from the perimeters) should be regularly checked during the decommissioning phase for alien vegetation proliferation to prevent spread into surrounding natural area.</u></li> <li><u>Rehabilitation must be implemented at all times, and disturbed areas must be rehabilitated as soon as such areas become available. This will not only reduce the total disturbance footprint but will also reduce the overall rehabilitation effort and cost.</u></li> <li><u>An environmental awareness campaign will be launched, both internally and externally (local communities) as described later in this document.</u></li> </ul> |   |                           |
| Site preparation<br>Earthworks<br>Civil works<br>Mineralise management<br>Stormwater management<br>Transport system<br>Continued use of existing services<br>Site management<br>Demolition<br>Rehabilitation, maintenance and aftercare<br>Site support services | Social impact management | <ul style="list-style-type: none"> <li>The intent of the mine management will be to continue with the socio-economic upliftment of the local communities until closure.</li> <li>Contractors and workers will be required to reside either in Kuruman, Kathu or Hotazel and no "squatting" on the adjoining properties will be allowed.</li> <li>The mine will provide suitable security measures to ensure that site visitors are properly monitored.</li> <li>No loitering by the employees outside the designated working hours will be allowed in the vicinity of the mine.</li> <li>To enhance the benefits of the mine development to the local area and to reduce pressure associated with influx of outsiders to the area, there is preferential employment of locals. The contractors are encouraged to preferentially employ local people.</li> <li>No new buildings or structures will be constructed unless unavoidable. Use will be made of the existing buildings, roads and other infrastructure or facilities.</li> <li>No unnecessary features e.g. stockpiles will be created and care will be taken that no structure will change the original topography permanently.</li> <li><u>Lighting of any new infrastructure will avoid impact to local visual receptors by installing directional lighting as far as possible.</u></li> <li>Dust around the surface roadways is controlled by means of water spray. A detailed dust suppression procedure will be developed and implemented prior to mining. The procedure will include all areas associated with the mining operations, including access and haul roads, mine residue deposits, process plant areas, opencast mining activities and rehabilitation and revegetation activities.</li> <li>Trucks and vehicles are maintained to ensure exhaust emissions. New vehicles purchased must comply with maximum permissible diesel exposure standards.</li> <li>Reduction of wind blown dust will be achieved by ensuring that rehabilitation and vegetation follows mining undue delay. Practical limitations do result in some lag between placement and rehabilitation of spoils.</li> </ul>   | On-going for all, except decommissioning and closure related actions, only when required. | Not applicable.           |

| Activity   | Potential Impact                              | Management actions  | Time Period for Implementation  | Compliance with Standards  |
|--|---|---|---|--|
|  |   | <ul style="list-style-type: none"> <li>General good housekeeping will be maintained in all areas prone for dust release. Regular inspection and maintenance routines will be implemented in these areas to address spillages on ground level and along conveyors, thereby preventing the re- suspension of settled dust.</li> <li>The mine will implement a dust monitoring program consisting of a bucket collection system. Monitoring will take place on a monthly basis, <del>and the composition of the dust will also be determined.</del></li> <li><del>Noise measurements will be taken annually according to the procedures outlined in the SABS code 0103 in order to evaluate the impact of the mining. The target will be that adjacent residences should not experience more than a 5dBA increase over the background levels.</del></li> <li>All employees are subjected to an annual audiometric assessment conducted at the Hotazel clinic.</li> <li>Where over exposure cannot be rectified, employees are issued with variphone and disposable hearing protection units. <u>Train staff on noise control plan during health and safety briefings.</u></li> <li><u>Avoid clustering of equipment near receptors.</u></li> <li><u>Ensure periods of respite are provided in case of unavoidable maximum noise level events.</u></li> <li><u>Ensure high level of maintenance on all equipment. Any change in the noise emission characteristics of equipment should serve as trigger for withdrawing it for maintenance.</u></li> <li><u>Other non-routine noisy activities such as construction, decommissioning, start-up and maintenance, should be limited to day-time hours.</u></li> <li><u>Machines should intermittently be shut down between work periods and not left running unnecessarily.</u></li> <li><u>Equipment generating noise directionally should be orientated so the noise is directed away from the sensitive receptors.</u></li> <li><u>Regular and effective maintenance of equipment and plants must be carried out.</u></li> <li>In the unlikely event of any archaeological resources being found during mining activities, the mine will immediately cease mining in that area and will appoint an archaeologist to investigate the occurrence.</li> <li>The mine is committed to holding a meeting with the interested and affected parties listed in the stakeholder register (and with any others that express an interest in attending such meetings that have a relevant involvement with the mine) at two yearly intervals.</li> </ul> |   |  |
| Site preparation<br>Earthworks<br>Civil works<br>Mineralise management<br>Stormwater management<br>Transport system<br>Continued use of existing services<br>Site management<br>Demolition<br>Rehabilitation, maintenance and aftercare<br>Site support services | Heritage And Palaeontology                    | <p><u>In the event of a chance find, the following actions should be taken:</u></p> <ul style="list-style-type: none"> <li><u>A heritage practitioner should be appointed to develop a heritage induction program and conduct training for the ECO, as well as team leaders, in the identification of heritage resources and artefacts.</u></li> <li><u>An appropriately qualified archaeologist must be identified to be called upon in the event that any possible heritage resources or artefacts are identified. If the newly discovered heritage resources prove to be of archaeological or palaeontological significance, a Phase 2 rescue operation may be required subject to permits issued by SAHRA.</u></li> <li><u>Should an archaeological site or cultural material be discovered during any project phase, the area should be demarcated, and activities be halted.</u></li> <li><u>The qualified archaeologist will then need to come out to the site and evaluate the extent and importance of the heritage resources and make the necessary recommendations for mitigating the find and impact on the heritage resource.</u></li> <li><u>South32 must have a contingency plan so that operations/activities could move elsewhere temporarily away from the activity area while the material and data are recovered.</u></li> <li><u>Construction can commence as soon as the site has been cleared and signed off by the archaeologist</u></li> </ul>   | On-going for all, except decommissioning and closure related actions, only when required. | Compliance with the National Heritage Resource Act (No. 25 of 1999) in the event of any chance finds |
| Site preparation<br>Earthworks<br>Civil works<br>Mineralise management<br>Stormwater management<br>Transport system<br>Continued use of existing services<br>Site management<br>Demolition   | Closure (long-term) objectives and strategies | <ul style="list-style-type: none"> <li>The final surface area will not be freedraining, due to the prohibitively high cost associated with backfilling of the pit. However, the length and extent of the void will be minimised by finishing off and backfilling part of the highwall during the operational phase. The final void will be approximately 1.7 to 2km long, by 0.4km in width (as measured at surface)</li> <li>On closure, the remaining void will be shaped with side slopes of 1:5 on the highwalls, and an invert level within 25 to 30m of the natural surface. This is to ensure that the pit floor after rehabilitation is above the regional groundwater table.</li> <li>The rest of the rehabilitated pit area will be flat, similar to the existing topography, with slopes draining away from the “final void” area. The overburden will be placed back to line and levelled similar to the surrounding topography. Slopes will be flatter than 1:5, but generally a fall of 0.5% or more will be targeted to ensure drainage off the rehabilitated area.</li> <li>Permanent stockpiles will be flattened to 1:3 slopes with benches where necessary, covered with 0.5m of soil and vegetated.</li> </ul>  | On-going for all, except decommissioning and closure related actions, only when required. | Not applicable   |



| Activity   | Potential Impact | Management actions  | Time Period for Implementation | Compliance with Standards |
|--|------------------|---|--------------------------------|---------------------------|
| Rehabilitation,<br>maintenance and<br>aftercare<br>Site support services |                  | <ul style="list-style-type: none"> <li>• Temporary stockpiles will be removed and the base area cleared from all the remaining ore. The base area will then be ripped to a depth of <math>\pm 1.0\text{m}</math> and covered with soil where necessary to return back to its natural state.</li> <li>• All overburden material will be placed back into the pit post mining.</li> <li>• Soils contaminated by operations will also be placed back into the pit.</li> <li>• Water control systems will be implemented where required in order to prevent erosion on slopes. However, based on the slopes and the successful establishment of vegetation, no additional measures are expected to be required.</li> <li>• All compacted areas will be ripped and levelled in order to re-establish a growth medium.</li> <li>• Development of a post-closure water balance for Mamatwan Mine (including geohydrology and geochemistry).</li> <li>• Implementation of the required monitoring programme to calibrate the post-closure model, including quality, quantity, water-levels and geochemical sampling.</li> <li>• Ongoing evaluation and reassessment of alternative options for the final water use and required associated water quality, together with the technologies required to achieve the required quality.</li> <li>• Active involvement in regional integrated water management plans in the catchment management area.</li> <li>• Define, in consultation with all I&amp;APs, the final (post-closure) land use. The target land <del>capability</del> use is grazing.</li> <li>• Develop a final land use plan and implementation programme, taking into account important issues such as ongoing operational and maintenance requirements and long-term responsibilities and ownership.</li> <li>• Set final closure objectives and standards to ensure conformance to the final land use plan and the requirements of the I&amp;APs and relevant environmental legislation.</li> <li>• Develop a detailed <b>closure plan</b> for Mamatwan Mine five years prior to closure and obtain approval from the relevant authorities.</li> <li>• The Social and Labour Plan for Mamatwan Mine has been revised taking into consideration the negative impacts associated with mine closure.</li> <li>• The mine will continually review all of the available opportunities that are economically and practically viable with a view to minimising the impact on the communities established around the Hotazel area.</li> </ul> |                                |                           |

| Activity | Potential Impact | Management actions  | Time Period for Implementation  | Compliance with Standards          |
|----------|------------------|---|---|------------------------------------|
|          | Visual           | <ul style="list-style-type: none"> <li>• <u>The development footprint and disturbed areas surrounding the proposed top-cut stockpile should be kept as small as possible and the areas cleared of natural vegetation and topsoil must be kept to a minimum;</u></li> <li>• <u>All construction areas must be kept in a neat and orderly condition at all times;</u></li> <li>• <u>Existing vegetation, with particular reference to tall trees and larger shrubs adjacent to the R380 and in the vicinity of the proposed expansion activities must be retained, in order to partly obscure the view toward the proposed top-cut stockpile and railway loop;</u></li> <li>• <u>Should it be deemed feasible, the topsoil stockpile should be vegetated with indigenous species to reduce the visual impact of the soil contrast;</u></li> <li>• <u>Construction and operation activities should be limited to be undertaken between 6am and 6pm, in order to limit the need for bright floodlighting and the potential for skyglow;</u></li> <li>• <u>It is recommended that the mobile crushing and screening plant as well as the product stockpile stacker and reclaimer make use of neutral colours and the use of highly reflective material should be avoided. Any metal surfaces should be painted to fit in with the natural environment in a colour that blends in effectively with the background;</u></li> <li>• <u>All lights used for illumination at the mobile crushing and screening plant and product stockpile stacker and reclaimer (except for lighting associated with security) should be faced inwards and shielded to avoid light escaping above the horizon; and</u></li> <li>• <u>Security lighting required at night during the operational phase of the product stockpile stacker and reclaimer at the railway loop and mobile crushing and screening plant, should use minimum lumen or wattage in light fixtures. Furthermore, making use of motion detectors on security lighting, where possible, ensures that the site will remain in relative darkness, until lighting is required for security or operational purposes.</u></li> </ul> | On-going for all, except decommissioning and closure related actions, only when required. | Not applicable                     |
|          | Noise            | <ul style="list-style-type: none"> <li>• <u>In the quantification of noise emissions and simulation of noise levels as a result of the project, it was found that environmental noise evaluation criteria for residential, educational, and institutional receptors will be exceeded at the closest off-site noise sensitive receptor to the east of the Mamatwan Mine during the day.</u></li> <li>• <u>Train staff on noise control plan during health &amp; safety briefings.</u></li> <li>• <u>Avoid clustering of equipment near receptors.</u></li> <li>• <u>Ensure periods of respite are provided in the case of unavoidable maximum noise level events.</u></li> <li>• <u>Ensure high level of maintenance on all equipment. Any change in the noise emission characteristics of equipment should serve as trigger for withdrawing it for maintenance.</u></li> <li>• <u>Where possible, other non-routine noisy activities such as construction, decommissioning, start-up and maintenance, should be limited to day-time hours.</u></li> <li>• <u>As the site or activity is in close proximity to NSRs, equipment and methods to be employed should be reviewed to ensure the quietest available technology is used. Equipment with lower sound power levels must be selected in such instances and vendors/contractors should be required to guarantee optimised equipment design noise levels.</u></li> <li>• <u>As far as is practically possible, source of significant noise should be enclosed. The extent of enclosure will depend on the nature of the machine and their ventilation requirements.</u></li> <li>• <u>Machines used intermittently should be shut down between work periods and not left running unnecessarily. This will reduce noise and conserve energy.</u></li> <li>• <u>Equipment from which noise generated is known to be particularly directional, should be orientated so that the noise is directed away from NSRs.</u></li> <li>• <u>A noise complaints register must be kept.</u></li> </ul>  | On-going for all, except decommissioning and closure related actions, only when required. | Compliance with SANS 10103 (2008). |

| Activity | Potential Impact | Management actions   | Time Period for Implementation  | Compliance with Standards   |
|----------|------------------|--|---|---|
|          | Air Quality      | <ul style="list-style-type: none"> <li>• <u>Air quality impacts during construction would be reduced through basic control measures such as limiting the speed of haul trucks, limiting unnecessary travelling of vehicles on unpaved roads and applying water sprays on regularly travelled, unpaved roads.</u></li> <li>• <u>When haul trucks need to use public roads, the vehicles need to be cleaned of all mud and the material transported must be covered to minimise windblown dust.</u></li> <li>• <u>The access road to the sinter plant needs to be kept clean to minimise carry-through of mud to the public roads.</u></li> <li>• <u>Regular water sprays on unpaved roads to ensure at least 75% control efficiency. Literature indicates an application rate &gt;2 litre/m<sup>2</sup>/hour should achieve this.</u></li> <li>• <u>Monthly physical inspection of road surface, daily visual observation of entrained dust emissions from unpaved road surfaces.</u></li> <li>• <u>Controlled blasting techniques to be used to ensure minimal dust generation.</u></li> <li>• <u>Blasting only to be conducted on cloudless days, as practical.</u></li> <li>• <u>Addition of chemical surfactants to water sprays to lower water surface tension and increase binding properties.</u></li> <li>• <u>Drill rigs to be fitted with dust suppression to achieve 97% control efficiency.</u></li> <li>• <u>Increase in-pit material moisture content.</u></li> <li>• <u>Drop height from excavator into haul trucks to be kept at a minimum for ore and waste rock.</u></li> <li>• <u>Tipping onto ROM storage piles to be controlled through water sprays, should visible amounts of dust be generated. This should result in a 50% control efficiency.</u></li> <li>• <u>Keep material handling by dozers and wheeled loaders moist to achieve a control efficiency of 50%, especially in dry periods.</u></li> <li>• <u>Regular clean-up at loading areas.</u></li> <li>• <u>Water sprays at ROM stockpile can achieve 50% control efficiency. Increase in moisture content provides higher threshold friction velocity and ensures that particulates are not as easily entrained due to high surface winds.</u></li> <li>• <u>Reshape all disturbed areas to their natural contours.</u></li> <li>• <u>Cover disturbed areas with previously collected topsoil and replant native species.</u></li> <li>• <u>Rock cladding with larger pieces of waste rock is recommended to reduce wind erosion emissions from the overburden storage piles.</u></li> <li>• <u>Revegetation of overburden stockpile is recommended.</u></li> <li>• <u>Water sprays at mobile crushers to achieve at last 50% control efficiency.</u></li> <li>• <u>Dust pollution has been associated with poor photosynthetic functionality in plants. There is evidence of dust pollution leading to a reduction in chlorophyll, including chlorophyll degradation and reduced photosynthetic activity resulting from dust deposition on leaf surfaces. Dust deposition also result in stomata clogging, which causes a decreased rate of carbon dioxide exchange, carbon assimilation, transpiration, and therefore decreased net photosynthesis.</u></li> <li>• <u>An effective dust management plan must be designed and implemented in order to mitigate the impact of dust on flora throughout the construction and operational phase.</u></li> </ul> | On-going for all, except decommissioning and closure related actions, only when required. | <p>Compliance to National Dust Control Regulations (GNR. 827) (NDCR) and guidelines as contained in the South African National Standards for Ambient air quality: Limits for common pollutants (SANS 1929:2010)</p> <p>Compliance to ambient air quality standards.</p> <p>National Atmospheric Emission Reporting Regulations in terms of the NEM:AQA requires that holders of mining rights register on the National Atmospheric Emissions Inventory System (NAEIS) and to ensure that annual monitoring reports are uploaded onto the NAEIS.</p> |

## 29. FINANCIAL PROVISION

### 29.1 DETERMINATION OF THE AMOUNT OF THE FINANCIAL PROVISION

#### 29.1.1 Closure objectives description and the alignment with the baseline environment

The preliminary closure objectives and principles specific to the project activities/infrastructure have been developed against the background of the mine location in the Kuruman region of the Northern Cape Province, and include the following objectives:

- that environmental damage is minimised to the extent that it is acceptable to all parties involved;
- that contamination beyond the mine site by surface run-off, groundwater movement and wind will be prevented;
- that mine closure is achieved efficiently, cost effectively and in compliance with the law;
- that the social and economic impacts resulting from mine closure are managed in such a way that negative socio-economic impacts are minimised; and
- rehabilitate the land to achieve an end use of grazing to the extent reasonably possible.

The closure target outcomes for the site are therefore assumed to be as follows:

- to achieve chemical, physical and biological stability for an indefinite, extended time period over all disturbed landscapes and residual mining infrastructure;
- to protect groundwater, soils and other natural resources from loss of current utility value or environmental functioning;
- to limit the rate of emissions into the atmosphere of particulate matter to the extent that degradation of the surrounding areas' land capability or environmental functioning does not occur;
- to maximise visual 'harmony' with the surrounding landscape; and
- to create a final land use that has economic, environmental and social benefits for future generations that outweigh the long-term aftercare costs associated with the mine.

#### 29.1.2 Confirmation that closure objectives have been consulted with I&APs

The closure objectives are outlined in this EIAR which will be made available to I&APs, including landowners for review and comment (Section 7.2).

To date no comments regarding the closure objectives (see Section 29.1.1) have been received from I&APs, including landowners (see Section 7.2).

#### 29.1.3 Rehabilitation plan

Rehabilitation will be undertaken concurrently with mining operations, based on the rehabilitation plan developed for the mine. The mining plan/ schedule will be optimised to facilitate continuous rehabilitation. The strategy for continuous rehabilitation is as follows:

- Waste rock will be placed back into the pits to 25 m below original ground level.

- The full depth of available soils and subsoils will be placed on to the hard rock spoils, as far as is practical, so as to limit ingress.
- The calcrete material will be placed over the hard rock spoils in order to facilitate the development of an aquiclude over the spoils.
- Vegetation that is local to the area will be established to limit the risk of erosion.
- The mining plan/schedule will ensure optimal placement of waste rock to facilitate concurrent rehabilitation.
- The mining plan/schedule will be updated on an annual basis.
- Rehabilitation monitoring and auditing will be implemented to ensure conformance to this objective and the rehabilitation plan.

The approach to rehabilitating is not specifically documented in the approved 2005 EMPR. The planned re-processing of material within is however in line with the approved 2005 EMPR strategy which specifies the need for concurrent rehabilitation during on-going mining activities.

#### **29.1.4 Compatibility of the rehabilitation plan with the closure objectives**

It can be confirmed that the rehabilitation plan is compatible with the closure objectives given that the closure objectives were considered during the determination of the rehabilitation plan.

#### **29.1.5 Calculate and state the quantum of the financial provision**

The MMT updates the EIAR financial provision on an annual basis. The current financial provision, as of 21 September 2021, provides for an amount of **R 13,900,305.00** exclusive of VAT. This amount will be incorporated into the overall MMT mine-closure plan and the annual financial provision updates. Layout/activity changes that have already taken place (and are not part of the approved EMPR) have been previously included in the South32 financial provision (see Appendix L).

#### **29.1.6 Confirmation that the financial provision will be provided**

The funding of the financial provision is a combination of trust fund and bank guarantees.



### 30. MECHANISMS FOR MONITORING COMPLIANCE AND PERFORMANCE AGAINST THE EMPR

Environmental impacts requiring monitoring are listed in Table 30-1 below.

As a general approach, MMT will ensure that the monitoring programmes comprise the following:

- Adherence to a formal monitoring procedure;
- Use of appropriately calibrated equipment by personnel trained to use the equipment;
- The preservation of samples according to laboratory specifications by personnel trained to use the equipment, where samples require analysis;
- The identification of monitoring parameters in consultation with a specialist in the relevant field and/or the relevant authority;
- The amendment of monitoring parameters, where necessary, following the initial monitoring results and in consultation with a specialist and/or the relevant authority; and
- The interpretation of data and reporting of trends will be undertaken by an appropriately qualified person.

The objective of the environmental monitoring system is to:

- Prevent and/or minimize the environmental impact associated with the current mining operation
- Ensure that the environmental management system at Mamatwan Mine perform according to specifications
- Ensure conformance with the environmental objectives
- Ensure timeous implementation of the environmental strategies and implementation programme
- Act as a pollution early warning system
- Obtain the necessary data required to address knowledge gaps
- Check compliance with license requirements
- Ensure consistent auditing and reporting protocols.

Table 30-1 outlines the monitoring requirements associated with the proposed project. It is important to note that a comprehensive monitoring system was developed for the MMT and includes a detailed environmental monitoring system and an implementation, auditing, and reporting protocol. The monitoring system will be implemented as part of MMT's ongoing monitoring schedule, and all existing monitoring and reporting procedures will be revised and updated to reflect the requirements of this system. EMP performance assessments, as required in terms of the MPRDA, will be performed on a biennial basis and submitted to the DMRE for distribution to other relevant authorities. The monitoring system will be reviewed on an annual basis and revised if necessary. This detailed monitoring system is included in the stand-alone EMPr included in Appendix S.

**Table 30-1: Monitoring of compliance and performance specific to the proposed project**

| Activity  | Impacts requiring monitoring            | Functional requirements for monitoring   | Roles and responsibilities | Monitoring and reporting frequency and time period for management actions   |
|---|---|--|----------------------------|---|
| <b>Surface water</b>  |   |  |                            |   |
| <ul style="list-style-type: none"> <li>Establishment of a top-cut stockpile and associated mobile crushing and screening plant</li> <li>Establishment of stormwater management infrastructure</li> <li>Changes to waste rock dump height</li> <li>Establishment of a pipeline to transport abstracted water from Middelplaats Mine to MMT</li> <li>Upgrading the railway and railway loadout station</li> </ul> | Alteration of natural drainage patterns | So as to allow more informed management decisions at MMT regarding the volume of water used for specific purposes within MMT mine area, flow meters will be used within the distribution system. | Environmental Department   | Mass water balance to be updated on an annual basis for the duration of the mine. This information must be submitted to the DWS on an annual basis. |

| Activity  | Impacts requiring monitoring | Functional requirements for monitoring   | Roles and responsibilities  | Monitoring and reporting frequency and time period for management actions   |
|---|------------------------------|--|---|---|
| <ul style="list-style-type: none"> <li>Establishment of a top-cut stockpile and associated mobile crushing and screening plant</li> <li>Establishment of stormwater management infrastructure</li> <li>Changes to waste rock dump height</li> <li>Establishment of a pipeline to transport abstracted water from Middelplaats Mine to MMT</li> <li>Upgrading the railway and railway loadout station</li> </ul> |                              | Cleared and compacted areas where the infrastructure will be built. The downstream areas of dams and road crossings. Soil erosion and sedimentation monitoring in all soil erosion potential sources   | Monitoring of erosion should occur during construction after every rainstorm or flood event, and during the operational phase monthly during first the wet season or during routine maintenance inspections, as applicable. | After every major rainstorm / flood. Monthly monitoring report compiled by the appointed ECO during the construction phase.   |
|   | Surface water                | Ten water quality monitoring points have been established as shown in Figure 30-1. Ensure that water quality monitoring is implemented up and downstream at the periphery of the 200 m working area.   | Monitoring should be undertaken quarterly.  | Reporting should be undertaken after each sampling activity.  |
|   | Surface water                | Monitoring must be undertaken at precisely the same locality as the pre-construction, operation and closure phases monitoring. Ensure that monitoring is implemented up and downstream at the periphery of the 100 m working area.   | Once a month for six months after completion of construction.   | Monthly report should be compiled.  |
| <ul style="list-style-type: none"> <li>Establishment of a top-cut stockpile and associated mobile crushing and screening plant</li> <li>Establishment of stormwater management infrastructure</li> </ul>  | Surface water                | Roads and areas where vehicles commute and areas where chemical storage containers are located.  | Identification of any leakage events should occur monthly during the rehabilitation and construction phase, or directly after a leakage has been detected and   | Monthly monitoring report compiled by the appointed ECO during the construction, operational and closure phases; and Report should be compiled for three phases of the project. |
|   |                              | Areas where leakage is visible/detected. A leak and spill management plan must be formulated to monitor and detect as soon as possible. Site walkovers to determine the condition of facilities and identify any leaks or overflows, blockages, overflows, and system malfunctions for immediate remedial action |   |   |

| Activity  | Impacts requiring monitoring | Functional requirements for monitoring   | Roles and responsibilities                               | Monitoring and reporting frequency and time period for management actions |             |
|---|------------------------------|--|--|---|-------------|
| <ul style="list-style-type: none"><li>Changes to waste rock dump height</li><li>Establishment of a pipeline to transport abstracted water from Middelplaats Mine to MMT</li><li>Upgrading the railway and railway loadout station</li></ul>   |                              |  | for the operational phase, during maintenance activities |   |             |
|   | Surface water                | Inspection of the temporary channels, and bridges for signs of erosion, cracking and silting to ensure the performance of these remains acceptable.  | Daily during maintenance                                 | Daily. Should erosion occur, measures should be reinstated.               |             |
| Surface water monitoring parameters   |                              |  |  |   |             |
| <ul style="list-style-type: none"><li>Establishment of a top-cut stockpile and associated mobile crushing and screening plant</li><li>Establishment of stormwater management infrastructure</li><li>Changes to waste rock dump height</li><li>Upgrading the railway and railway loadout station</li></ul> | Surface water                | The monitoring plan should be reviewed periodically to ensure appropriateness of the sites and sampling frequency during operation. The parameters of concern are provided in the table below and these constituents should be included in all surface water monitoring. |  | Environmental department  | Refer above |
|   |                              | Parameters   |  |   |             |
|   |                              | pH   | Nitrate as N   |   |             |
|   |                              | Electrical conductivity  | Ammonia  |   |             |
|   |                              | Total dissolved solids   | Potassium  |   |             |
|   |                              | Total suspended solids   | Nickel   |   |             |
|   |                              | Aluminium  | Manganese  |   |             |
|   |                              | Calcium  | Magnesium  |   |             |
|   |                              | Fluoride as F  | Iron   |   |             |
|   |                              | Total alkalinity as CaCO <sub>3</sub>  | Copper   |   |             |
|   |                              | Chloride as Cl   | Lead   |   |             |
|   |                              | Sulphate as SO <sub>4</sub>  | Sodium   |   |             |

| Activity  | Impacts requiring monitoring           | Functional requirements for monitoring   |               | Roles and responsibilities | Monitoring and reporting frequency and time period for management actions |   |              |          |             |              |          |             |              |         |             |              |         |             |              |          |             |              |          |             |                          |   |
|---|--|--|---------------|----------------------------|---|---|--------------|----------|-------------|--------------|----------|-------------|--------------|---------|-------------|--------------|---------|-------------|--------------|----------|-------------|--------------|----------|-------------|--------------------------|---|
|   |  | Uranium  | <i>E.coli</i> |                            |   |   |              |          |             |              |          |             |              |         |             |              |         |             |              |          |             |              |          |             |                          |   |
| Groundwater monitoring  |  |  |               |                            |   |   |              |          |             |              |          |             |              |         |             |              |         |             |              |          |             |              |          |             |                          |   |
| <ul style="list-style-type: none"><li>Re-processing of material located in Adams Pit.</li></ul> | Contamination of groundwater resources | <p>Some of the boreholes included in the monitoring network might be damaged/lost due to Mamatwan pit expansion and WRD/backfill expansion.</p> <p>Therefore, SLR recommends that replacement boreholes, as well as cone of drawdown and contaminant plume monitoring boreholes to be drilled and added to the monitoring network.</p> <p>Figure 19 1 shows the existing and the proposed groundwater monitoring boreholes for the Mamatwan Monitoring System. Unfortunately, the Tshipi Mine property and WRD are situated on the Western side of Mamatwan boundary. If suitable location can be found, then it is advisable to locate one monitoring borehole on the Western side of Mamatwan Pit.</p> <p>Additional monitoring boreholes</p> <table><thead><tr><th>Name</th><th>X</th><th>Y</th></tr></thead><tbody><tr><td>Monitoring 1</td><td>-2237.85</td><td>-3026946.57</td></tr><tr><td>Monitoring 2</td><td>-1303.49</td><td>-3031070.54</td></tr><tr><td>Monitoring 3</td><td>-744.83</td><td>-3029613.59</td></tr><tr><td>Monitoring 4</td><td>-789.03</td><td>-3030028.59</td></tr><tr><td>Monitoring 5</td><td>-1236.85</td><td>-3027486.59</td></tr><tr><td>Monitoring 6</td><td>-1019.53</td><td>-3028895.89</td></tr></tbody></table> <p>Please note that the proposed locations must be verified to confirm accessibility, and that the locations are safe (they will not be covered by waste).</p> |               | Name                       | X   | Y | Monitoring 1 | -2237.85 | -3026946.57 | Monitoring 2 | -1303.49 | -3031070.54 | Monitoring 3 | -744.83 | -3029613.59 | Monitoring 4 | -789.03 | -3030028.59 | Monitoring 5 | -1236.85 | -3027486.59 | Monitoring 6 | -1019.53 | -3028895.89 | Environmental Department | <p>The MMT groundwater water quality monitoring to be undertaken on a quarterly basis.</p> <p>Monitoring reports need to be submitted to the DWS as per the conditions of the IWUL, on an annual basis. Monitoring reports need to cater for any reporting requirements stipulated in the IWUL.</p> |
| Name  | X                                      | Y  |               |                            |   |   |              |          |             |              |          |             |              |         |             |              |         |             |              |          |             |              |          |             |                          |   |
| Monitoring 1  | -2237.85                               | -3026946.57  |               |                            |   |   |              |          |             |              |          |             |              |         |             |              |         |             |              |          |             |              |          |             |                          |   |
| Monitoring 2  | -1303.49                               | -3031070.54  |               |                            |   |   |              |          |             |              |          |             |              |         |             |              |         |             |              |          |             |              |          |             |                          |   |
| Monitoring 3  | -744.83                                | -3029613.59  |               |                            |   |   |              |          |             |              |          |             |              |         |             |              |         |             |              |          |             |              |          |             |                          |   |
| Monitoring 4  | -789.03                                | -3030028.59  |               |                            |   |   |              |          |             |              |          |             |              |         |             |              |         |             |              |          |             |              |          |             |                          |   |
| Monitoring 5  | -1236.85                               | -3027486.59  |               |                            |   |   |              |          |             |              |          |             |              |         |             |              |         |             |              |          |             |              |          |             |                          |   |
| Monitoring 6  | -1019.53                               | -3028895.89  |               |                            |   |   |              |          |             |              |          |             |              |         |             |              |         |             |              |          |             |              |          |             |                          |   |



| Activity  | Impacts requiring monitoring | Functional requirements for monitoring   | Roles and responsibilities | Monitoring and reporting frequency and time period for management actions |   |                                 |                              |                                 |            |              |                |                             |               |              |                |               |                 |                 |   |  |  |
|---|------------------------------|--|----------------------------|---|---|---------------------------------|------------------------------|---------------------------------|------------|--------------|----------------|-----------------------------|---------------|--------------|----------------|---------------|-----------------|-----------------|---|--|--|
|   |                              | <p>Water quality analyses results should be classified in terms of the SANS 241:2015 Water Quality Standards and the DWAF Target Quality Range for Livestock Watering (1996) and the DWS WQRO as stipulated in the IWUL. The monitoring results should be assessed by a suitably qualified professional registered with the South African Council for Natural Scientific Professional. The parameters that need to be analysed for are summarised in the table below.</p> <table><tr><td>pH</td></tr><tr><td>Conductivity in mS/m at 25 ° c</td></tr><tr><td>Total dissolved solids (TDS) at 180 ° c</td></tr><tr><td>Alkalinity as CaCO<sub>3</sub></td></tr><tr><td>Carbonate as CO<sub>3</sub></td></tr><tr><td>Bicarbonate as HCO<sub>3</sub></td></tr><tr><td>Boron as B</td></tr><tr><td>Nitrate as N</td></tr><tr><td>Chloride as Cl</td></tr><tr><td>Sulphate as SO<sub>4</sub></td></tr><tr><td>Fluoride as F</td></tr><tr><td>Sodium as Na</td></tr><tr><td>Potassium as K</td></tr><tr><td>Calcium as Ca</td></tr><tr><td>Magnesium as Mg</td></tr><tr><td>Manganese as Mn</td></tr><tr><td>Full metal scan - Inter Coupled Plasma Scan (ICP) (via Mass Spectrometry (MS)</td></tr></table> | pH                         | Conductivity in mS/m at 25 ° c  | Total dissolved solids (TDS) at 180 ° c | Alkalinity as CaCO <sub>3</sub> | Carbonate as CO <sub>3</sub> | Bicarbonate as HCO <sub>3</sub> | Boron as B | Nitrate as N | Chloride as Cl | Sulphate as SO <sub>4</sub> | Fluoride as F | Sodium as Na | Potassium as K | Calcium as Ca | Magnesium as Mg | Manganese as Mn | Full metal scan - Inter Coupled Plasma Scan (ICP) (via Mass Spectrometry (MS) |  |  |
| pH  |                              |  |                            |   |   |                                 |                              |                                 |            |              |                |                             |               |              |                |               |                 |                 |   |  |  |
| Conductivity in mS/m at 25 ° c  |                              |  |                            |   |   |                                 |                              |                                 |            |              |                |                             |               |              |                |               |                 |                 |   |  |  |
| Total dissolved solids (TDS) at 180 ° c                                       |                              |  |                            |   |   |                                 |                              |                                 |            |              |                |                             |               |              |                |               |                 |                 |   |  |  |
| Alkalinity as CaCO <sub>3</sub>   |                              |  |                            |   |   |                                 |                              |                                 |            |              |                |                             |               |              |                |               |                 |                 |   |  |  |
| Carbonate as CO <sub>3</sub>  |                              |  |                            |   |   |                                 |                              |                                 |            |              |                |                             |               |              |                |               |                 |                 |   |  |  |
| Bicarbonate as HCO <sub>3</sub>   |                              |  |                            |   |   |                                 |                              |                                 |            |              |                |                             |               |              |                |               |                 |                 |   |  |  |
| Boron as B  |                              |  |                            |   |   |                                 |                              |                                 |            |              |                |                             |               |              |                |               |                 |                 |   |  |  |
| Nitrate as N  |                              |  |                            |   |   |                                 |                              |                                 |            |              |                |                             |               |              |                |               |                 |                 |   |  |  |
| Chloride as Cl  |                              |  |                            |   |   |                                 |                              |                                 |            |              |                |                             |               |              |                |               |                 |                 |   |  |  |
| Sulphate as SO <sub>4</sub>   |                              |  |                            |   |   |                                 |                              |                                 |            |              |                |                             |               |              |                |               |                 |                 |   |  |  |
| Fluoride as F   |                              |  |                            |   |   |                                 |                              |                                 |            |              |                |                             |               |              |                |               |                 |                 |   |  |  |
| Sodium as Na  |                              |  |                            |   |   |                                 |                              |                                 |            |              |                |                             |               |              |                |               |                 |                 |   |  |  |
| Potassium as K  |                              |  |                            |   |   |                                 |                              |                                 |            |              |                |                             |               |              |                |               |                 |                 |   |  |  |
| Calcium as Ca   |                              |  |                            |   |   |                                 |                              |                                 |            |              |                |                             |               |              |                |               |                 |                 |   |  |  |
| Magnesium as Mg   |                              |  |                            |   |   |                                 |                              |                                 |            |              |                |                             |               |              |                |               |                 |                 |   |  |  |
| Manganese as Mn   |                              |  |                            |   |   |                                 |                              |                                 |            |              |                |                             |               |              |                |               |                 |                 |   |  |  |
| Full metal scan - Inter Coupled Plasma Scan (ICP) (via Mass Spectrometry (MS) |                              |  |                            |   |   |                                 |                              |                                 |            |              |                |                             |               |              |                |               |                 |                 |   |  |  |
| Biodiversity  |                              |  |                            |   |   |                                 |                              |                                 |            |              |                |                             |               |              |                |               |                 |                 |   |  |  |

| Activity   | Impacts requiring monitoring                                 | Functional requirements for monitoring   | Roles and responsibilities | Monitoring and reporting frequency and time period for management actions |
|--|--|--|----------------------------|---|
| <ul style="list-style-type: none"> <li>Establishment of a top-cut stockpile and associated mobile crushing and screening plant</li> <li>Establishment of stormwater management infrastructure</li> <li>Establishment of a pipeline to transport abstracted water from Middelplaats Mine to MMT</li> <li>Upgrading the railway and railway loadout station</li> </ul> | Physical destruction and general disturbance of biodiversity | <p>The monitoring system currently used involves the use of satellite imagery and aerial photography, which are calibrated to the existing conditions on the ground through traditional vegetation sampling techniques. The satellite imagery estimates and quantifies the dynamics in vegetation cover and health, while the aerial photography is used to monitor dynamics of the woody component in terms of bush encroachment crown cover, and also the amount of bare soil present. These techniques will be used to monitor the effects of mining on vegetation and the status of revegetation.</p> <p>Permanent monitoring plots must ideally be established in areas surrounding the expansion activities, particularly to the north and east of the top cut stockpile. These plots should be designed in such a way to accurately monitor the following parameters:</p> <ul style="list-style-type: none"> <li>Recruitment of indigenous species and of alien and invasive species, particularly the establishment of <i>Prosopis glandules</i>;</li> <li>Alien vs Indigenous plant ratio, especially <i>Vachellia erioloba</i> vs. <i>P. glandules</i>;</li> <li>Erosion levels and the efficacy of erosion control measures; and</li> <li>Monitoring to be undertaken annually for the first three years of the operational phase. Should no significant recruitment of additional AIPs be observed during this time, monitoring can be undertaken every two years for the remainder of the operational phase, as well as three years post closure.</li> </ul> <p>Monitoring of footprint area as well as a 50 m buffer surrounding the footprint area should persist throughout the operational phase to ensure these areas are not adversely affected by the mining operations.</p> | Environmental Department   | Monitoring will take place on an annual basis.                            |

| Activity   | Impacts requiring monitoring | Functional requirements for monitoring   | Roles and responsibilities | Monitoring and reporting frequency and time period for management actions  |
|--|------------------------------|--|----------------------------|--|
|  |                              | <p>Monitoring of concurrent rehabilitation must also take place throughout all phases of the proposed mining development and for a period of five years after decommissioning and closure of each rehabilitated or infrastructure area;</p> <p>The rehabilitation plan should be continuously updated in accordance with the monitoring results in order to ensure that optimal rehabilitation measures are employed.</p> <p>Results of the monitoring activities must be taken into account during all phases of the proposed mining expansion activities and action must be taken to mitigate impacts as soon as negative effects from these activities become apparent.</p> <p>The method of monitoring must be designed to be subjective and repeatable in order to ensure consistent results.</p> |                            |  |
| <b>Air Quality</b>   |                              |  |                            |  |
| <ul style="list-style-type: none"> <li>Establishment of a top-cut stockpile and associated mobile crushing and screening plant</li> <li>Re-processing of material located in Adams Pit.</li> </ul> | Air pollution                | <p>The approved 2005 EMPR, does not specify where dust buckets need to be positioned. It follows that for the purpose of this EIAR, dust fallout monitoring will be undertaken in accordance with existing practices. This includes nine single dust buckets within and around the MMT and one directional dust bucket. The location of the dust fallout buckets is illustrated in Figure 30-1.</p> <p>Ambient air quality monitoring can serve to meet various objectives, such as:</p> <ul style="list-style-type: none"> <li>Compliance monitoring;</li> <li>Validate dispersion model results;</li> <li>Use as input for health risk assessment;</li> <li>Assist in source apportionment;</li> </ul>   | Environmental Department   | <p>Monitoring reports need to be uploaded onto the National Emissions Inventory System on annual basis.</p> <p>Dust fallout monitoring must be undertaken on a monthly basis for the duration of the mine.</p> |

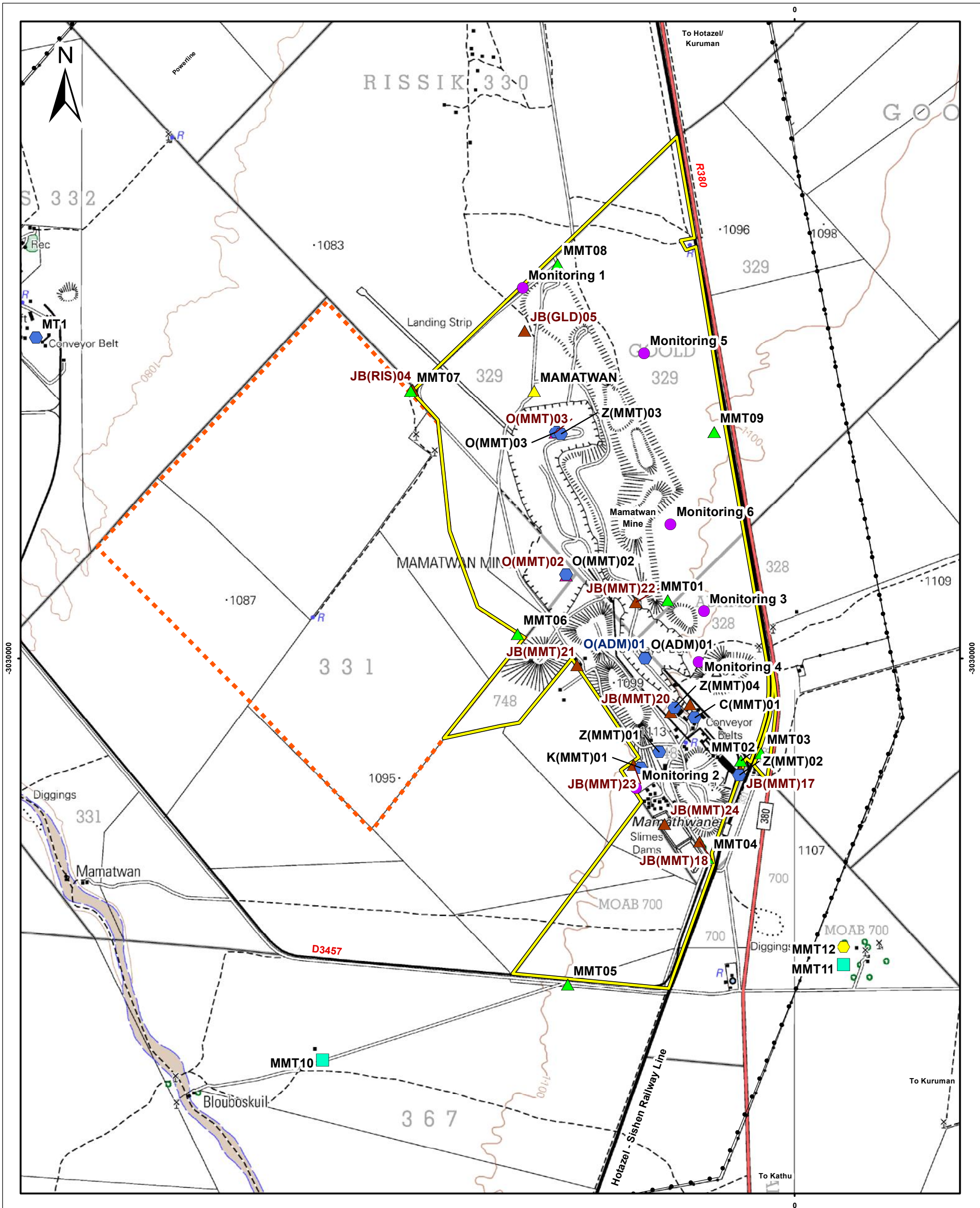
| Activity | Impacts requiring monitoring | Functional requirements for monitoring  | Roles and responsibilities | Monitoring and reporting frequency and time period for management actions |
|----------|------------------------------|---|----------------------------|---|
|          |                              | <ul style="list-style-type: none"> <li>Temporal and spatial trend analysis;</li> <li>Source quantification; and,</li> <li>Tracking progress made by control measures.</li> </ul> <p>To ensure that mitigation is effective, it is recommended that the dustfall monitoring network at the mine be expanded to include single dust buckets at AQSR 4 and AQSR 5. It is also recommended that PM10 sampling be conducted at AQSR 5 (or AQSR 6 if it is more secure). This can be done as an annual campaign before the project commences (as part of the baseline) and again once mitigated project operations are in place.</p> <p>Periodic inspections and audits are essential for progress measurement, evaluation and reporting purposes. It is recommended that site inspections and progress reporting be undertaken at regular intervals (at least quarterly), with annual environmental audits being conducted. Annual environmental audits should be continued at least until closure. Results from site inspections and monitoring efforts should be combined to determine progress against source- and receptor-based performance indicators. Progress should be reported to all IAPs, including authorities and persons affected by pollution.</p> <p>The criteria to be taken into account in the inspections and audits must be made transparent by way of minimum requirement checklists included in the management plan. Corrective action or the implementation of contingency measures must be proposed to the stakeholder forum in the event that progress towards targets is indicated by the quarterly review to be unsatisfactory.</p> |                            |   |

| Activity   | Impacts requiring monitoring | Functional requirements for monitoring  | Roles and responsibilities | Monitoring and reporting frequency and time period for management actions |
|--|------------------------------|---|----------------------------|---|
|  |                              | <p>Stakeholder forums provide possibly the most effective mechanisms for information dissemination and consultation. Management plans should stipulate specific intervals at which forums will be held and provide information on how people will be notified of such meetings. Given the proximity of the study site to the nearby farmsteads, it is recommended that such meetings be scheduled and held at least on an annual basis. A complaints register must be kept at all times.</p> <p>The budget should provide a clear indication of the capital and annual maintenance costs associated with dust control measures and dust monitoring plans. It may be necessary to make assumptions about the duration of aftercare prior to obtaining closure. This assumption must be made explicit so that the financial plan can be assessed within this framework. Costs related to inspections, audits, environmental reporting and I&amp;APs liaison should also be indicated where applicable. Provision should also be made for capital and running costs associated with dust control contingency measures and for security measures. The financial plan should be audited by an independent consultant, with reviews conducted on an annual basis.</p> |                            |   |
| <b>Noise</b>   |                              |   |                            |   |
| <ul style="list-style-type: none"> <li>Establishment of a top-cut stockpile and associated mobile crushing and screening plant</li> <li>Upgrading the railway and railway loadout station</li> </ul> | Noise                        | <p>Regular and effective maintenance of equipment and plants are essential to noise control. Increases in equipment noise are often indicative of eminent mechanical failure. Also, sound reducing equipment/materials can lose effectiveness before failure and can be identified by visual inspection.</p> <p>Noise generated by vibrating machinery and equipment with vibrating parts can be reduced through the use of vibration isolation mountings or proper balancing. Noise generated by friction in conveyor rollers, trolley etc. can be reduced by sufficient lubrication.</p>  | Environmental department   | On receipt of noise related complaints.                                   |



| Activity | Impacts requiring monitoring | Functional requirements for monitoring   | Roles and responsibilities | Monitoring and reporting frequency and time period for management actions |
|----------|------------------------------|--|----------------------------|---|
|          |                              | <p>In the event that noise related complaints are received, short term ambient noise measurements should be conducted as part of investigating the complaints. The results of the measurements should be used to inform any follow up interventions. The investigation of complaints should include an investigation into equipment that likely result or resulted in noise levels annoying to the community. This could be achieved with source noise measurements.</p> <p>The following procedure should be adopted for all noise surveys:</p> <ul style="list-style-type: none"> <li>Any surveys should be designed and conducted by a trained specialist.</li> <li>Sampling should be carried out using a Type 1 SLM that meets all appropriate IEC standards and is subject to annual calibration by an accredited laboratory.</li> <li>The acoustic sensitivity of the SLM should be tested with a portable acoustic calibrator before and after each sampling session.</li> <li>Samples sufficient for statistical analysis should be taken with the use of portable SLM's capable of logging data continuously over the period. Samples representative of the day- and night-time acoustic environment should be taken.</li> <li>The following acoustic indices should be recoded and reported: LAeq (T), statistical noise level LA90, LAFmin and LAFmax, octave band or 3rd octave band frequency spectra.</li> <li>The SLM should be located approximately 1.5 m above the ground and no closer than 3 m to any reflecting surface.</li> <li>Efforts should be made to ensure that measurements are not affected by the residual noise and extraneous influences, e.g. wind, electrical interference and any other non-acoustic interference, and that the</li> </ul> |                            |   |

| Activity | Impacts requiring monitoring | Functional requirements for monitoring   | Roles and responsibilities | Monitoring and reporting frequency and time period for management actions |
|----------|------------------------------|--|----------------------------|---|
|          |                              | <p>instrument is operated under the conditions specified by the manufacturer. It is good practice to avoid conducting measurements when the wind speed is more than 5 m/s, while it is raining or when the ground is wet.</p> <ul style="list-style-type: none"> <li>• A detailed log and record should be kept. Records should include site details, weather conditions during sampling and observations made regarding the acoustic environment of each site.</li> </ul> |                            |   |



### Legend

- Mamatwan Mining Right Area
- Tshipi Mining Right Area
- Main Roads
- Power Line
- Rivers

### Mamatwan Monitoring Points

- ▲ Groundwater Monitoring Points
- ▲ Pit Water Monitoring Points
- ▲ Single Bucket Monitoring Stations
- ▲ Dustwatch Monitoring Stations
- Surface Water Monitoring Points
- Proposed Dust Buckets
- Proposed Groundwater Monitoring Points
- Proposed PM<sub>10</sub> Sampling Location

0 500 1 000 Meters

Scale: 1:25 200 @ A3  
Projection: Transverse Mercator  
Datum: WGS1984, Lo23

Mamatwan Mining

Figure 30-1

### Monitoring Programme



SLR Consulting (Africa) (Pty) Ltd  
P O Box 1596, Cramerville, 2060, South Africa  
Tel: +27 (11) 467-0945 Fax: +27 (11) 467-0978

720.19136.00002

2022/02/11

### 30.1 FREQUENCY OF PERFORMANCE ASSESSMENT REPORT

MMT will for the period during which the environmental authorisation and the EMPR is valid, submit environmental audit reports to the DMRE.

These audits will focus on the mine's compliance with the conditions of the environmental authorisation and the commitments in the EMPR. These audits will be undertaken by a qualified independent person and will comply with the relevant NEMA Regulations 2014 (as amended).

The environmental manager will conduct internal management audits against the commitments in the EMPR in accordance with an annual audit plan. During the operational phase, these audits will be conducted on a quarterly basis. The audit findings will be documented for both record keeping purposes and for informing continual improvement.

### 30.2 CLOSURE COST REPORTING

The financial provision for the mine will be updated on an annual basis and submitted to the DMRE for the duration of the operation in accordance with the relevant legislation.

## 31. ENVIRONMENTAL AWARENESS PLAN

### 31.1 MANNER IN WHICH APPLICANT INTENDS TO INFORM EMPLOYEES OF THE ENVIRONMENTAL RISKS

Mamatwan Mine has a well-established internal and external communication strategy that was developed and successfully implemented as part of an integrated management system of the mine. MMT is in the process of implementing OHSAS18001. The environmental awareness plan forms a major part of the communication strategy, together with other issues such as health, safety, operations, productions, etc. The communication strategy is reviewed on a regular basis (at least annually) and revised if necessary.

This section includes the environmental awareness plan for the MMT. The plan describes how employees are informed of:

- Environmental risks, which may result from the EIAR work and the manner in which the risk must be dealt with in order to avoid pollution or degradation of the environment;
- The training required for general environmental awareness; and
- The dealing of emergency situations and remediation measures for such emergencies.

All contractors that conduct work on behalf of MMT are bound by the content of the EMPR and a contractual condition to this effect will be included in all such contracts entered by the mine. The responsibility for ensuring contractor compliance with the EMPR will remain with MMT.

The purpose of the environmental awareness plan is to ensure that all personnel and management understand the general environmental requirements of the site. In addition, greater environmental awareness must be communicated to personnel involved in specific activities, which can have a significant impact on the environment, and ensure that they are competent to carry out the EIAR tasks on the basis of appropriate education, training and/or experience. The section below summarises key aspects of the Emergency Preparedness and response, reporting defects, incident and accidents and accidents review and communication of HMM. A full copy is included as an appendix in the stand-alone EMPR include in Appendix S.

#### 31.1.1 Sustainability policy

South32's sustainability policy addresses both environmental and social needs. The contents of the policy is presented below.

"South32 affirms its purpose to make a difference by developing natural resources, improving people's lives now and for generations to come. South32 is committed to Sustainable Development, defined as supporting the needs of the present without compromising the ability of future generations to meet the EIAR own needs.

- We monitor the external environment for opportunities to invest and develop natural resources that deliver shared value for society.
- We work to achieve positive social, environmental, and economic outcomes as a result of our decisions.
- We commit to respecting human rights in accordance with the UN Guiding Principles on Business and Human Rights in all of our stakeholder relationships. Our approach is guided by international human rights principles included in the Universal Declaration of Human Rights and other core international standards including the International Labour Organisation Declaration on Fundamental Principles and



Rights at Work, the International Council for Mining and Metals Sustainable Development Framework and the Voluntary Principles on Security and Human Rights.

- We support employment and community practises which empower people to make choices and have control over the EIAR process of development as it affects the EIAR lives, beliefs, institutions, well-being and the lands they occupy or otherwise use.
- We identify and control risks, and continually improve our management of safety, health, environment and social impacts, through systematic management systems and processes.
- We practise responsible stewardship for the commodities we extract as well as the natural resources we consume.
- We develop and participate in conservation and rehabilitation activities to ensure ecosystems continue providing value to future generations.
- To meet the challenge of climate change, we work to reduce our greenhouse gas emissions. We continually assess our risks and opportunities to protect and create value and monitor our impact to ensure we do not compromise the ecosystems which provide resilience against climate change for our host communities.
- We uphold stringent health, safety, environment, community and governance standards in all jurisdictions in which we operate.
- We publicly report our progress and encourage high standards of transparency and accountability in our business governance, risk and government interactions.”

### 31.1.2 Steps to achieve the environmental policy objectives

MMT’s environmental policy is realised by setting specific and measurable objectives. It is proposed that new objectives are set throughout the life of mine, but initial objectives are as follows:

- Management of environmental responsibilities:
  - MMT will establish and appoint Managers at senior mine management level, who will be provided with all necessary resources to carry out the management of all environmental aspects of the site irrespective of other responsibilities, for example:
    - Compliance with environmental legislation and EMPR commitments;
    - Implementing and maintaining an environmental management system with the assistance of the appointed Environmental specialists, Superintendents and Health, Safety and Environmental (HSE) Leads;
    - Developing environmental emergency response procedures and coordinating personnel during incidents;
    - Manage routine environmental monitoring and data interpretation;
    - Environmental trouble shooting and implementation of remediation strategies; and
    - Closure planning.
- Communication of environmental issues and information:
  - Meetings, consultations and progress reviews will be carried out, specifically:
    - Discussions of environmental issues and feedback on environmental projects will form part of the annual work plan of the HSE committee who will report periodically to the board of the company;

- Progress reports on the achievement of policy objectives and level of compliance with the approved EMPR will be provided to the DMRE;
  - Ensuring environmental issues are raised at daily production meetings, monthly mine management meetings and all relevant mine wide meetings at all levels; and
  - Ensuring environmental issues are discussed at all general liaison meetings with local communities and other interested and affected parties, where possible.
- Environmental awareness training:
  - MMT will provide environmental awareness training to individuals at a level of detail specific to the requirements of the EIAR job, but will generally comprise:
    - Basic awareness training for all prior to granting access to site (e.g. short video presentation requiring registration once completed). Employees and contractors who have not attended the training will not be allowed on site;
    - Specific environmental awareness training will be provided to personnel whose work activities can have a significant impact on the environment (e.g. workshops, waste handling and disposal, sanitation, etc.).
- Review and update the environmental topics identified in the EMPR;
- Design the mine to minimise the impact on the environment and to accomplish closure/rehabilitation objectives; and
- Maintain records of all environmental training, monitoring, incidents, corrective actions and reports.

### 31.1.3 Training objectives of the environmental awareness plan

The environmental awareness plan ensures that training needs are identified, and that appropriate training is provided. The environmental awareness plan communicates:

- The importance of conformance with the environmental policy, procedures and other requirements of good environmental management;
- The significant environmental impacts and risks of individuals work activities and explain the environmental benefits of improved performance;
- The individual's roles and responsibilities in achieving the aims and objectives of the environmental policy; and
- The potential consequences of not complying with environmental procedures.

#### 31.1.3.1 General contents of the environmental awareness plan

To achieve the objectives of the environmental awareness plan, the general contents of the training plans are as follows:

- Basic training plan applicable to all personnel entering the site:
  - Short (15 min) presentation to indicate the site layout and activities at specific business units together with the EIAR environmental aspects and potential impacts; and
  - Individuals to sign off with site security on completion in order to gain access to the site.
- General training plan applicable to all personnel:
  - General understanding of the environmental setting of the mine (e.g. third-party receptors and proximity to natural resources such as rivers);

- Understanding the environmental impact of individuals activities on site (e.g. excessive production of waste, poor housekeeping, energy consumption, water use, noise, etc.);
- Indicate potential site-specific environmental aspects and the EIAR impacts;
- Identifying poor environmental management and stopping work which presents significant risks; and
- Reporting incidents.
- Specific training plan:
  - Specific environmental aspects and impacts such as:
    - Spillage of hydrocarbons at workshops;
    - Poor waste management such as mixing hazardous and general waste (including rubble and used conveyor belts) s, inappropriate storage and stockpiling large amounts of waste;
    - Poor housekeeping practices;
    - Poor working practices (e.g. not carrying out oil changes in designated bunded areas);
    - Excessive noise generation and unnecessary use of hooters; and
    - Protection of heritage resources (including palaeontological resources).
- MMT's duty of care (specifically with respect to waste management); and

Key personnel will be required to undergo formal, external environmental management training (e.g. how to operate the environmental management system, waste management and legal compliance).

In addition to the above MMT will:

- Promote environmental awareness using relevant environmental topic posters displayed at strategic locations on the mine and toolbox talks.
- Participate and organise events which promote environmental awareness, some of which will be tied to national initiatives e.g. National Arbour Week, World Environment Day and National Water Week.

## 31.2 MANNER IN WHICH RISKS WILL BE DEALT WITH TO AVOID POLLUTION OR DEGRADATION

### 31.2.1 On-going monitoring and management actions

The monitoring programme as described in Section 30 will be undertaken to provide early warning systems necessary to avoid environmental emergencies.

### 31.2.2 Procedures in case of environmental emergencies

Emergency procedures apply to incidents that are unexpected and that may be sudden, and which lead to serious danger to employees/contractors, the public and/or potentially serious pollution of, or detriment to the environment (immediate and delayed). In case of environmental emergencies MMT will comply with South32's Crisis and Emergency Management procedure. In addition, MMT will implement the general and activity-specific procedures described in the sections below.

#### 31.2.2.1 General emergency procedure

For all environmental emergencies, MMT will:

- Cordon off the area to prevent unauthorised access and tampering of evidence;
- Undertake actions defined in the emergency plan to limit/contain the impact of the emergency;
- If residue facilities/dams, storm water diversions, etc. are partially or totally failing and this cannot be prevented, the emergency siren is to be sounded (nearest one available);
- Take photographs and samples as necessary to assist in investigation;
- Ensure compliance with Section 30 of the NEMA such that:
  - the Environmental specialists, Superintendents and HSE Leads must immediately notify the Director-General (DHSWS, DMRE and Inspectorate of Mines, as appropriate), the South African Police Services, the relevant fire prevention service, the provincial head of DMRE, the head of the local municipality, the head of the regional DHSWS office and any persons whose health may be affected of:
    - the nature of the incident;
    - any risks posed to public health, safety and property;
    - the toxicity of the substances or by-products released by the incident; and
    - any steps taken to avoid or minimise the effects of the incident on public health and the environment.
  - the HSE Department must as soon as is practical after the incident:
    - Take all reasonable measures to contain and minimise the effects of the incident including its effects on the environment and any risks posed by the incident to the health, safety and property of persons;
    - Undertake clean up procedures;
    - Remedy the effects of the incident; and
    - Assess the immediate and long-term effects of the incident (environment and public health).
  - within 14 days the HSE department must report to the Director-General DHSWS and DEA, the provincial head of DMRE, the regional manager of the DMRE, the head of the local and district municipality, the head of the regional DHSWS office such information as is available to enable an initial evaluation of the incident, including:
    - The nature of the incident;
    - The substances involved and an estimation of the quantity released;
    - The possible acute effects of the substances on the persons and the environment (including the data needed to assess these effects);
    - Initial measures taken to minimise the impacts;
    - Causes of the incident, whether direct or indirect, including equipment, technology, system or management failure; and
    - Measures taken to avoid a recurrence of the incident.

### 31.2.2.2 Identification of emergency situations

The mandatory South32 code of practice on emergency preparedness and response is included as an appendix to the stand-alone EMP include in Appendix S.

### 31.2.3 Technical, management and financial options

Technical, management and financial options that will be put into place to deal with the remediation of impacts in cases of environmental emergencies are described below.

- The applicant will appoint a competent management team with the appropriate skills to develop and manage a mine of this scale and nature;
- To prevent the occurrence of emergency situations, the mine will implement as a minimum the mine plan and management actions as included in this EMPR;
- The mine will maintain an environmental management system where all operations identify, report, investigate, address and close out environmental incidents;
- As part of its annual budget, the mine will allow a contingency for handling of any risks identified and/or emergency situations; and
- Where required, the mine will seek input from appropriately qualified people.

## 31.3 EMERGENCY CONTINGENCY PLAN

The environmental management programme and associated management options are intended to minimise environmental risk as far as possible. However, should circumstances lead to unacceptable risks, emergency systems and procedures have been designed and will be implemented in the case of an emergency to prevent or minimise the consequential environmental damage. The emergency contingency plan addresses any reasonably anticipated failure (most probable risk) for the existing and future mining activities and focuses on environmental emergencies. The plan would be formalised in the mine's emergency procedures as soon as the EMP has been approved.

The most crucial aspect of the emergency system is the identification and communication of the emergency to the appropriate persons. Consequently, the names of the appropriate contact person together with their contact numbers would be prominently displayed around the facility. The contact details will be updated on a regular basis. First-party employees (such as security, safety superintendents, mine overseers, environmental officers) will be trained to respond to the responsible personnel in the event of an emergency.

Each person's responsibility would be cleared with him/her beforehand and a copy of the emergency contingency plan would be distributed to each person, including the responsible and/or affected persons not associated with the mine, i.e.:

- disaster management and firefighting agencies,
- downstream water supply authorities,
- downstream users that could be affected in the case of an emergency such as neighbouring mines, farmers and local communities,
- relevant government authorities such as DWAF and DME, and
- approved professional person (engineer).



It must be ensured that operating and supervisory staff is familiar with the emergency plan, and that the content thereof is understood and familiar to them. The emergency procedures will therefore be included in the induction programme of Mamatwan Mine. Regular training sessions in this regard on a more business-specific basis will be performed. On order to ensure that the emergency procedure is effective, regular mock exercises will be initiated.

The emergency contingency plan will be updated as circumstances change or operating procedures are amended, and as a minimum in the event of:

- any additional recommendations made by a professional engineer (annual safety inspections) or environmental auditors;
- any change in operational procedures and/or management of the mining activity;
- the identification of any issues of concern or additional risks as a result of regular inspections and/or monitoring results; and
- any unplanned or unforeseen emergency situation.

The emergency contingency plan for Mamatwan Mine is detailed overleaf.

### 31.4 EMERGENCY SITUATIONS AND PROCEDURES

A document on Emergency response procedures for Hotazel Manganese Mines is included in Appendix A. This document includes emergency preparedness and response, reporting defects, incidents and accidents and accident review and communication.

### 31.5 WARNING SYSTEM

The list of responsible persons/authorities who should issue warnings and take certain actions in the event of an emergency situation is provided in Appendix B. The Appendix B provides the Mandatory Code of Practice on Emergency Preparedness and Response. All information around protocol for emergencies is provided within this document.

## **32. SPECIFIC INFORMATION REQUIRED BY THE COMPETENT AUTHORITY**

All information required by the competent authority has been included within this report and it is anticipated that the EIAR and EMPR will provide sufficient input to the DMRE decision making.

### 33. UNDERTAKING

I, Sharon Meyer, the EAP responsible for compiling this EIAR, undertake that:

- The information provided herein is correct;
- Comments and inputs from I&APs and commenting authorities have been included and correctly recorded in this EIAR;
- Inputs and recommendations from the specialist reports have been included where relevant; and
- Any information provided to I&APs and any responses to comments or inputs made is correct or was correct at that time.



Signature of EAP

10/02/2022  
Date

OREN JAN VAN VREDE  
COMMISSIONER OF OATHS  
EX OFFICIO  
PROFESSIONAL  
ACCOUNTANT (S.A.)

FOURWAYS MANOR OFFICE PARK  
UNIT 7, FOURWAYS  
☎(011) 467 - 0945

10 Feb 2022

## 34. REFERENCES

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## Appendix A: Curriculum vitae of the project team

- Rob Hounsome
- Sharon Meyer



## Appendix B: DEA Screening Tool

## Appendix C: Public participation Process

- Letter from Land Claims Commissioner 1
- Project Database
- Copy of the BID in English, Afrikaans and Setswana.
- Proof of Commenting Authorities and I&AP Notification
- Site notice placed in March 2020 and 2021 (English, Afrikaans and Setswana) and photographic evidence of site notices including a map illustrating the location where site notices were placed.
- Advertisements placed in the Kathu Gazette and the Kalahari Bulletin in March 2020 and the placement of advertisements in the Kathu Gazette and Noordkaap Bulletin in 2021.
- Copy of the Non-Technical Scoping Report Summary (English, Afrikaans and Setswana).
- Proof of distribution of the Scoping Report
- Copies of correspondence received during the review period of the Scoping Report.
- Proof of Final Scoping Report submission on DMRE SAMRAD portal.
- Proof of distribution of the EIA and EMPr
- Comments received from IAPs during the review of the EIA and EMPr

## Appendix D: Detailed Impact Assessment

The potential impacts described in this appendix have been identified by the Environmental Impact Assessment (EIA) project team with input from specialists, regulatory authorities and I&APs. The sequence in which these issues are listed are in no order of priority or importance. The assessment and rating of potential impacts have been provided by specialists. These are attached as appendices to the EIA and Environmental Management Programme (EMPr). The impacts are assessed cumulatively where the potential impacts assessed represent the cumulative impact of the proposed project in the context of the baseline environment, i.e. with existing impacts. The potential impacts are firstly rated with the assumption that no mitigation measures are applied and then secondly with mitigation, unless otherwise stated. The mitigated assessment assumes that technical design controls, as included in the project scope would be included in the detailed design of the project and implemented when the project components are constructed and operated.

Note that impacts of very low or negligible significance have not been assessed within this appendix.

### IMPACT ON BIOPHYSICAL ENVIRONMENT

#### ISSUE: SOIL EROSION

##### Description of Impact

The parameters determining the extent and severity of soil erosion are highly complex, with water and wind as the main geomorphic agents. Soil erosion is largely dependent on land use and soil management and is generally accelerated by human activities. In absence of detailed South African guidelines on erosion classification, the erosion potential and interpretation are based on field observations and the observed soil profile characteristics. In general, soils with a high clay content have a high-water holding capacity and are less prone to erosion in comparison to sandy textured soils, which are more susceptible to erosion.

The proposed mining related development would be located on flat and gently sloping terrain, which limits the erosion risk. If the top cut stockpile incline, height and management (i.e. revegetation) is kept within the acceptable ranges in compliance with the Chamber of Mines guidelines (2007), the risk of soil erosion has likely increased due to decrease in vegetation basal cover associated with vegetation clearing and disturbance as a result of current mining and related activities, and the soils are exposed to wind and stormwater. Soil erosion impact is considered moderate for all soil types in the area. The significance of soil erosion impact rating is illustrated in the tables below.

##### Impact Assessment for Soil Erosion

|                 | Pre-Mitigation Impacts                                | Post-Mitigation Impacts |
|-----------------|---|-------------------------|
| <b>Activity</b> | <b>Establishment of mining related infrastructure</b> |                         |
| Probability     | H   | H                       |
| Intensity       | M   | M                       |
| Spatial extent  | M   | L                       |
| Duration        | H   | H                       |
| Consequence     | Medium  | Medium                  |

|                 | Pre-Mitigation Impacts  | Post-Mitigation Impacts |
|-----------------|---|-------------------------|
| Significance    | Medium  | Medium                  |
| <b>Activity</b> | <b>Establishment of the dewatering boreholes and pipeline</b> |                         |
| Probability     | H   | H                       |
| Intensity       | M   | M                       |
| Spatial extent  | M   | L                       |
| Duration        | H   | H                       |
| Consequence     | Medium  | Medium                  |
| Significance    | Medium  | Medium                  |

## ISSUE: SOIL COMPACTION

### Description of Impact

Heavy equipment traffic during top cut stockpiling is anticipated to cause significant soil compaction. The severity of this impact is rated moderate post mitigation for soils such as Ermelo, Hutton and Witbank soil forms due to the loamy sand texture. Whereas compaction on areas that will be traversed by the proposed pipeline route option is considered to be of a very low significance post mitigation. As the proposed pipeline will be constructed on top of the ground surface, limited soil disturbances are foreseen.

### Impact Assessment for Soil Compaction

|                 | Pre-Mitigation Impacts  | Post-Mitigation Impacts |
|-----------------|---|-------------------------|
| <b>Activity</b> | <b>Establishment of mining related infrastructure</b>         |                         |
| Probability     | H   | H                       |
| Intensity       | M   | M                       |
| Spatial extent  | M   | L                       |
| Duration        | H   | H                       |
| Consequence     | Medium  | Medium                  |
| Significance    | Medium  | Medium                  |
| <b>Activity</b> | <b>Establishment of the dewatering boreholes and pipeline</b> |                         |
| Probability     | M   | M                       |
| Intensity       | L   | L                       |
| Spatial extent  | M   | L                       |
| Duration        | M   | M                       |
| Consequence     | Medium  | Low                     |
| Significance    | Low   | Very Low                |

## ISSUE: POTENTIAL SOIL CONTAMINATION

### Description of impact

All the identified soil forms are considered equally predisposed to potential contamination, as contamination sources are generally unpredictable and often occur as accidental spills or leaks for mining operations. The significance of soil contamination is considered medium post-mitigation for all identified soil forms, largely depending on the nature, volume or concentration of the contaminant of concern. Sources of contamination include spillage of hydrocarbons resulting from leakages from machinery, seepage of nitrates from blasting and ore spillages during transportation. Therefore, strict waste management protocols and an activity specific Environmental Management Programme (EMP) should be adhered to during mining activities.

### Impact Assessment for Soil Contamination

|                 | Pre-Mitigation Impacts                                | Post-Mitigation Impacts |
|-----------------|---|-------------------------|
| <b>Activity</b> | <b>Establishment of mining related infrastructure</b> |                         |
| Probability     | H   | H                       |
| Intensity       | M   | M                       |
| Spatial extent  | M   | L                       |
| Duration        | H   | H                       |
| Consequence     | Medium  | Medium                  |
| Significance    | Medium  | Medium                  |

## ISSUE: LOSS OF AGRICULTURAL LAND CAPABILITY

### Description of impact

The proposed mining related activities and the associated pipeline is not anticipated to result in significant loss of agricultural land potential since the proposed mining related infrastructure is located within the focus areas which have already been withdrawn from agricultural related land uses. However, the cultivation agricultural importance soils (i.e. Ermelo and Hutton soil forms) occurring focus areas will be impacted specifically by the proposed railway loop and top cut stockpile. The preferred pipeline route will be located along the dirt road which constitutes already disturbed soils (Witbank soil forms). Witbank soil forms are of low and/or no importance on the agricultural production, and as such the impacts on these soils are anticipated to be low post-mitigation. If the pipeline route alternatives 2 and 3 were to be considered, agriculturally important soils (Hutton soil form) would be impacted to a limited extent along the pipeline route. However, prevailing climatic conditions are not conducive to cultivated agriculture, thus these soils are not anticipated to contribute to the food production grid.

### Impact Assessment for Agricultural Land Capability

|                 | Pre-Mitigation Impacts                                | Post-Mitigation Impacts |
|-----------------|---|-------------------------|
| <b>Activity</b> | <b>Establishment of mining related infrastructure</b> |                         |
| Probability     | H   | H                       |
| Intensity       | M   | M                       |
| Spatial extent  | M   | L                       |
| Duration        | H   | H                       |



|                 | Pre-Mitigation Impacts  | Post-Mitigation Impacts |
|-----------------|---|-------------------------|
| Consequence     | Medium  | Medium                  |
| Significance    | Medium  | Medium                  |
| <b>Activity</b> | <b>Establishment of the dewatering boreholes and pipeline</b> |                         |
| Probability     | M   | M                       |
| Intensity       | L   | L                       |
| Spatial extent  | M   | L                       |
| Duration        | M   | M                       |
| Consequence     | Medium  | Low                     |
| Significance    | Low   | Very Low                |

## ISSUE: FLORAL HABITAT AND DIVERSITY

### Description of Impact

Based on the impact assessment results it is evident that the most significant impacts will occur during the construction and operational phase where vegetation clearing will result in a loss of floral habitat, diversity and species of conservation concern (SCC). Of importance is the design and implementation of an Alien Invasives Plant (AIP) control plan during the planning phase. Permits to remove / destroy, as well as rescue and relocate floral SCC should be obtained during the planning phase.

The habitat sensitivity associated with the study area ranges from intermediate to low. The water pipeline route, as well as the top-cut stockpile, crushing and screening plant and the railway loop fall within the Kathu Bushveld Habitat which is considered to be of intermediate floral sensitivity. The habitat to the south east of the railway is within the Degraded Bushveld Habitat unit, classified to be of moderately low sensitivity. The south western area is considered to be transformed habitat.

The most significant impact is expected to arise from the development of the top-cut stockpile due to the large development footprint located within a habitat of increased sensitivity. The pipeline route is situated within an existing road reserve, where edge effect impacts need to be considered. From a floral perspective the upgrade of the railway loop will impact on the floral ecology of the area as a result of vegetation clearing.

### Impact Assessment for Floral Habitat and Biodiversity

|                 | Pre-Mitigation Impacts   | Post-Mitigation Impacts |
|-----------------|--------------------------|-------------------------|
| <b>Activity</b> | <b>Top-cut stockpile</b> |                         |
| Probability     | H                        | M                       |
| Intensity       | H                        | M                       |
| Spatial extent  | M                        | L                       |
| Duration        | H                        | M                       |
| Consequence     | High                     | High                    |
| Significance    | High                     | Medium                  |

|                 | Pre-Mitigation Impacts                                | Post-Mitigation Impacts |
|-----------------|---|-------------------------|
| <b>Activity</b> | <b>Top-cut stockpile</b>                              |                         |
| <b>Activity</b> | <b>Crushing and Screening Plant</b>                   |                         |
| Probability     | M   | L                       |
| Intensity       | H   | M                       |
| Spatial extent  | L   | VL                      |
| Duration        | M   | L                       |
| Consequence     | High  | Medium                  |
| Significance    | Medium  | Very Low                |
| <b>Activity</b> | <b>Borehole Drilling</b>                              |                         |
| Probability     | VL  | VL                      |
| Intensity       | L   | VL                      |
| Spatial extent  | VL  | VL                      |
| Duration        | VL  | VL                      |
| Consequence     | Medium  | Low                     |
| Significance    | Very Low  | Insignificant           |
| <b>Activity</b> | <b>Dewatering Pipeline</b>                            |                         |
| Probability     | M   | L                       |
| Intensity       | H   | M                       |
| Spatial extent  | L   | VL                      |
| Duration        | M   | L                       |
| Consequence     | High  | Medium                  |
| Significance    | Medium  | Low                     |
| <b>Activity</b> | <b>Offices, stockpile area and contractor laydown</b> |                         |
| Probability     | L   | L                       |
| Intensity       | L   | L                       |
| Spatial extent  | M   | L                       |
| Duration        | L   | L                       |
| Consequence     | Low   | Low                     |
| Significance    | Low   | Very Low                |
| <b>Activity</b> | <b>Railway Loop, road and security checkpoint</b>     |                         |
| Probability     | H   | M                       |
| Intensity       | H   | M                       |
| Spatial extent  | M   | L                       |
| Duration        | H   | M                       |
| Consequence     | High  | High                    |
| Significance    | High  | Medium                  |

## ISSUE: FLORAL SCC

### Description of Impact

During the field assessment a number of NFA and NCNCA protected floral species were observed throughout the study area. Removal or destruction of any of these species will require permits from DOFF and NCDENC. Due to the drought onsite conditions at the time of the field assessment, identification of all protected herbaceous species/individuals was difficult. A summer walk down of all final development areas will need to be carried out and protected individuals should be marked. Failure to initiate a summer walkdown and implement a subsequent rescue and relocation will result in the permanent loss of these protected floral species.

None of the species associated with the study area are considered threatened and are generally species with large distribution ranges within the Northern Cape and the country as a whole. Loss of individuals from the study area is therefore not considered detrimental for the conservation of these species within the province. Loss of individuals should still be minimised through a search and rescue plan and the minimisation of the development footprint as far as practical.

### Impact Assessment for Floral SCC

|                 | Pre-Mitigation Impacts              | Post-Mitigation Impacts |
|-----------------|-------------------------------------|-------------------------|
| <b>Activity</b> | <b>Top-cut stockpile</b>            |                         |
| Probability     | M                                   | L                       |
| Intensity       | H                                   | M                       |
| Spatial extent  | M                                   | L                       |
| Duration        | M                                   | L                       |
| Consequence     | High                                | Medium                  |
| Significance    | Medium                              | Low                     |
| <b>Activity</b> | <b>Crushing and Screening Plant</b> |                         |
| Probability     | L                                   | L                       |
| Intensity       | M                                   | M                       |
| Spatial extent  | M                                   | L                       |
| Duration        | M                                   | L                       |
| Consequence     | Medium                              | Medium                  |
| Significance    | Low                                 | Low                     |
| <b>Activity</b> | <b>Borehole Drilling</b>            |                         |
| Probability     | VL                                  | VL                      |
| Intensity       | L                                   | VL                      |
| Spatial extent  | VL                                  | VL                      |
| Duration        | VL                                  | VL                      |
| Consequence     | Medium                              | Low                     |

|                 |   |               |
|-----------------|---|---------------|
| Significance    | Very Low  | Insignificant |
| <b>Activity</b> | <b>Dewatering Pipeline</b>                            |               |
| Probability     | H   | L             |
| Intensity       | H   | M             |
| Spatial extent  | L   | VL            |
| Duration        | M   | L             |
| Consequence     | High*   | Medium        |
| Significance    | Medium  | Low           |
| <b>Activity</b> | <b>Offices, stockpile area and contractor laydown</b> |               |
| Probability     | L   | L             |
| Intensity       | L   | L             |
| Spatial extent  | M   | L             |
| Duration        | L   | L             |
| Consequence     | Low   | Low           |
| Significance    | Low   | Very Low      |
| <b>Activity</b> | <b>Railway Loop, road and security checkpoint</b>     |               |
| Probability     | M   | L             |
| Intensity       | H   | M             |
| Spatial extent  | M   | L             |
| Duration        | M   | L             |
| Consequence     | High  | Medium        |
| Significance    | Medium  | Low           |

*\*note that the EAP has reduced this from Very High, as the species of concern are widespread and the consequence of the loss of individuals on site has no impact on the conservation of the species within the province.*

## ISSUE: LOSS OF FAUNAL HABITAT AND ECOLOGICAL STRUCTUREDESCRIPTION OF IMPACT

### Description of Impact

Construction of most of the railway loop and the pipeline route, as well as the development of the top cut stockpile, will result in the loss of faunal habitat of intermediate sensitivity within the natural Kathu Bushveld. Construction of the preferred pipeline route will occur adjacent a gravel road within Kathu Bushveld, which has a reduced sensitivity due to the existing constant road traffic which has likely resulted in disturbances to reduce habitat suitability. For the linear developments, i.e. the railway loop and the pipeline route, activities are anticipated to have less of an impact to the faunal assemblages as they generally have smaller footprints that do not encompass whole habitat units and thus leave enough suitable habitat adjacent the development. Similarly, the impacts are predominantly of a short duration, during the construction phase and once installed (specifically associated with the pipelines) the natural habitat can be re-established. The development of the top cut stockpile will have a medium impact on the local fauna as

evidence of several faunal species was observed here and the impact will be long lasting. With the implementation of mitigation measures, the impact significance will be reduced within all habitat units.

#### Impact Assessment for Faunal Habitat and Ecological Structure

|                 | Pre-Mitigation Impacts                                | Post-Mitigation Impacts |
|-----------------|---|-------------------------|
| <b>Activity</b> | <b>Top-cut stockpile</b>                              |                         |
| Probability     | H   | M                       |
| Intensity       | H   | H                       |
| Spatial extent  | VL  | VL                      |
| Duration        | M   | M                       |
| Consequence     | Medium  | Medium                  |
| Significance    | Medium  | Medium                  |
| <b>Activity</b> | <b>Crushing and Screening Plant</b>                   |                         |
| Probability     | L   | VL                      |
| Intensity       | M   | M                       |
| Spatial extent  | VL  | VL                      |
| Duration        | M   | VL                      |
| Consequence     | Medium  | Medium                  |
| Significance    | Medium  | Very Low                |
| <b>Activity</b> | <b>Borehole Drilling</b>                              |                         |
| Probability     | VL  | VL                      |
| Intensity       | L   | VL                      |
| Spatial extent  | VL  | VL                      |
| Duration        | VL  | VL                      |
| Consequence     | Very Low  | Very Low                |
| Significance    | Very Low  | Insignificant           |
| <b>Activity</b> | <b>Dewatering Pipeline</b>                            |                         |
| Probability     | M   | L                       |
| Intensity       | L   | L                       |
| Spatial extent  | L   | VL                      |
| Duration        | M   | L                       |
| Consequence     | Low   | Low                     |
| Significance    | Low   | Very Low                |
| <b>Activity</b> | <b>Offices, stockpile area and contractor laydown</b> |                         |
| Probability     | L   | L                       |
| Intensity       | L   | L                       |
| Spatial extent  | VL  | VL                      |



|                 | Pre-Mitigation Impacts                            | Post-Mitigation Impacts |
|-----------------|---|-------------------------|
| Duration        | L   | L                       |
| Consequence     | Low   | Low                     |
| Significance    | Very Low  | Very Low                |
| <b>Activity</b> | <b>Railway Loop, road and security checkpoint</b> |                         |
| Probability     | M   | L                       |
| Intensity       | H   | M                       |
| Spatial extent  | VL  | VL                      |
| Duration        | M   | L                       |
| Consequence     | High  | High                    |
| Significance    | Medium  | Low                     |

## ISSUE: IMPORTANT FAUNAL SPECIES OF CONSERVATION CONCERN

### Description of Impact

Eight protected faunal species may inhabit different regions of the study area. *Chamaeleo dilepis* (Common flap-neck chameleon), *Python sebae* (African rock python), *Orycteropus afer* (Aardvark) have suitable habitat within the Kathu bushveld. *Opisthophthalmus ater* (Steinkopf Burrowing Scorpion), *Aquila verreauxii* (Black eagle), *Anthus crenatus* (African Rock Pipit) and the Burrowing scorpions: *Opisthophthalmus carinatus* and *Opisthophthalmus wahlbergii* have a high likelihood of occurring in both the Kathu and Degraded Bushveld and within the Transformed habitat units.

*Chamaeleo dilepis* (Common flap-neck chameleon) will occupy the Kathu Bushveld where shrubby habitat will favour its arboreal lifestyle and insect abundance (prey) was at its highest abundances. *Orycteropus afer* (Aardvark) utilise a broad array of habitats within the region. Within the study area the Kathu Bushveld was the primary vegetation unit in which signs of Aardvark were observed. This species appeared to be completely absent from the disturbed Kathu bushveld and the transformed habitat units, keeping away from any form of disturbance to the veld. *Python sebae* (African rock python) are likely to mimic the distribution of Aardvark within the Kathu Bushveld as they will utilise burrows discarded by Aardvarks.

Contrary to logic the SCC's *Aquila verreauxii* (Black eagle) and *Anthus crenatus* (African Rock Pipit) are likely to utilise the Degraded and Transformed habitat units. *Aquila verreauxii* (Verreaux's eagle) will utilise the transformed unit to actively search out its primary prey item (Rock Hyrax) which have inhabited the waste rock dumps and soil stockpiles. A possible breeding pair of *Anthus crenatus* (African Rock Pipit) had been observed within the Northeastern portion of the study area in both the degraded and transformed habitat units where the mining activities have created suitable habitat beyond its normal range. The Burrowing scorpions will find suitable habitat throughout the site, utilising degraded and natural areas where suitable burrowing substrate is available.

The impact associated with the loss of habitat for the above-mentioned species is of Very Low to Medium significance during the construction and operational phase and Very Low to Medium significance during the rehabilitation phase, prior to the implementation of mitigation measures. With the implementation of

mitigation measures, the impact significance of the loss of important species may be further reduced, as mitigation measures will ensure that habitat for these species will be better protected.

#### Impact Assessment for Faunal SCC

|                 | Pre-Mitigation Impacts                                | Post-Mitigation Impacts |
|-----------------|---|-------------------------|
| <b>Activity</b> | <b>Top-cut stockpile</b>                              |                         |
| Probability     | M   | L                       |
| Intensity       | M   | M                       |
| Spatial extent  | VL  | VL                      |
| Duration        | M   | M                       |
| Consequence     | High*   | High*                   |
| Significance    | Medium  | Medium                  |
| <b>Activity</b> | <b>Crushing and Screening Plant</b>                   |                         |
| Probability     | L   | VL                      |
| Intensity       | M   | M                       |
| Spatial extent  | VL  | VL                      |
| Duration        | L   | VL                      |
| Consequence     | High*   | High*                   |
| Significance    | Medium  | Very Low                |
| <b>Activity</b> | <b>Borehole Drilling</b>                              |                         |
| Probability     | H   | H                       |
| Intensity       | M   | VL                      |
| Spatial extent  | VL  | VL                      |
| Duration        | VL  | M                       |
| Consequence     | Very Low  | Very Low                |
| Significance    | Very Low  | Very Low                |
| <b>Activity</b> | <b>Dewatering Pipeline</b>                            |                         |
| Probability     | M   | L                       |
| Intensity       | L   | L                       |
| Spatial extent  | L   | VL                      |
| Duration        | M   | L                       |
| Consequence     | Low   | Low                     |
| Significance    | Low   | Very Low                |
| <b>Activity</b> | <b>Offices, stockpile area and contractor laydown</b> |                         |
| Probability     | L   | L                       |
| Intensity       | M   | VL                      |
| Spatial extent  | VL  | VL                      |

|                 | Pre-Mitigation Impacts                            | Post-Mitigation Impacts |
|-----------------|---|-------------------------|
| Duration        | H   | H                       |
| Consequence     | Low   | Low                     |
| Significance    | Very Low  | Very Low                |
| <b>Activity</b> | <b>Railway Loop, road and security checkpoint</b> |                         |
| Probability     | H   | H                       |
| Intensity       | M   | L                       |
| Spatial extent  | VL  | VL                      |
| Duration        | H   | H                       |
| Consequence     | Medium  | Low                     |
| Significance    | Medium  | Low                     |

*\*note that the EAP has reduced this from Very High to High as the loss of an individual will not affect the conservation of the species within the province.*

## ISSUE: CONTAMINATION OF SURFACE WATER RESOURCES AFFECTING THIRD PARTY USE

### Description of Impact

Several contamination sources exist in all project activities and in various phases that have the potential to contaminate surface water resources in unmitigated scenario. In the construction, decommissioning and closure phases these potential pollution sources are temporary and diffuse in nature. Although these sources may be temporary, the potential pollution may be long term. The operational phase will present the longer-term potential pollution sources.

### Impact Assessment for Surface Water Contamination

|                | Pre-Mitigation Impacts | Post-Mitigation Impacts |
|----------------|------------------------|-------------------------|
| <b>Phase</b>   | <b>Construction</b>    |                         |
| Probability    | M                      | L                       |
| Intensity      | M                      | L                       |
| Spatial extent | M                      | L                       |
| Duration       | H                      | H                       |
| Consequence    | Medium                 | Low                     |
| Significance   | Medium                 | Low                     |
| <b>Phase</b>   | <b>Operation</b>       |                         |
| Probability    | M                      | L                       |
| Intensity      | M                      | L                       |
| Spatial extent | M                      | L                       |
| Duration       | H                      | H                       |
| Consequence    | High                   | Medium                  |

|                 | Pre-Mitigation Impacts             | Post-Mitigation Impacts |
|-----------------|------------------------------------|-------------------------|
| Significance    | High                               | Medium                  |
| <b>Activity</b> | <b>Decommissioning and Closure</b> |                         |
| Probability     | M                                  | L                       |
| Intensity       | M                                  | L                       |
| Spatial extent  | L                                  | VL                      |
| Duration        | M                                  | L                       |
| Consequence     | Medium                             | Medium                  |
| Significance    | Medium                             | Low                     |

## ISSUE: SOIL EROSION AND SEDIMENTATION

### Description of Impact

Site clearing, digging of trenches and topsoil removal will be undertaken during construction of various infrastructures such as the beneficiation plant, offices, workshops, the discard stockpile, and open pit might lead to erosion and consequently siltation of watercourses.

The project could cause water resources pollution through sediment transport and other chemical parameters from runoff from the surface operations. The impact of sedimentation is directly linked to erosion, as eroded soil particles will end up in nearby watercourses as sedimentation. The resultant consequences of sedimentation may be elevated turbidity that is likely to impact macroinvertebrates and other aquatic species.

### Impact Assessment for Soil Erosion and Sedimentation

|                | Pre-Mitigation Impacts | Post-Mitigation Impacts |
|----------------|------------------------|-------------------------|
| <b>Phase</b>   | <b>Construction</b>    |                         |
| Probability    | M                      | L                       |
| Intensity      | M                      | L                       |
| Spatial extent | M                      | L                       |
| Duration       | M                      | L                       |
| Consequence    | Medium                 | Low                     |
| Significance   | Medium                 | Low                     |
| <b>Phase</b>   | <b>Operation</b>       |                         |
| Probability    | M                      | L                       |
| Intensity      | M                      | L                       |
| Spatial extent | M                      | L                       |
| Duration       | M                      | L                       |
| Consequence    | Medium                 | Low                     |
| Significance   | Medium                 | Low                     |

|                 | Pre-Mitigation Impacts             | Post-Mitigation Impacts |
|-----------------|------------------------------------|-------------------------|
| <b>Activity</b> | <b>Decommissioning and Closure</b> |                         |
| Probability     | M                                  | L                       |
| Intensity       | H                                  | M                       |
| Spatial extent  | M                                  | L*                      |
| Duration        | L                                  | M                       |
| Consequence     | Medium                             | Medium                  |
| Significance    | High                               | Medium                  |

*\*note that the EAP has reduced this to Low, while the specialist indicated an increase in extent post-mitigation.*

## ISSUE: ALTERATION OF NATURAL DRAINAGE PATTERNS AFFECTING FLOW OF WATER IN DOWNSTREAM SYSTEMS

### Description of Impact

Natural drainage across the project area is via preferential flow paths (natural drainage line). The development of the mine will alter the affected area's hydrologic response and, potentially, the entire catchment. Development of the mine and associated surface infrastructure implies that beneficial vegetation will be replaced by impervious surfaces, reducing the site's pre-developed evapotranspiration and infiltration rates. The proposed mine infrastructure covers 0.28% of quaternary catchment D41K.

With adequate rehabilitation and closure, some of the catchment is returned to self-sustaining systems, and natural drainage patterns will be restored.

### Impact Assessment for Alternation of Natural Drainage Patterns

|                | Pre-Mitigation Impacts | Post-Mitigation Impacts |
|----------------|------------------------|-------------------------|
| <b>Phase</b>   | <b>Construction</b>    |                         |
| Probability    | M                      | L                       |
| Intensity      | M                      | L                       |
| Spatial extent | M                      | L                       |
| Duration       | M                      | L                       |
| Consequence    | Medium                 | Low                     |
| Significance   | Medium                 | Low                     |
| <b>Phase</b>   | <b>Operation</b>       |                         |
| Probability    | M                      | VL                      |
| Intensity      | L                      | VL                      |
| Spatial extent | M                      | L                       |
| Duration       | M                      | L*                      |
| Consequence    | Medium                 | Very Low                |
| Significance   | Medium                 | Very Low                |



|                 | Pre-Mitigation Impacts             | Post-Mitigation Impacts |
|-----------------|------------------------------------|-------------------------|
| <b>Activity</b> | <b>Decommissioning and Closure</b> |                         |
| Probability     | M                                  | L                       |
| Intensity       | M                                  | L                       |
| Spatial extent  | L                                  | VL                      |
| Duration        | M                                  | L                       |
| Consequence     | Medium                             | Medium                  |
| Significance    | Medium                             | Low                     |

*\*EAP has reduced this to Low while the specialist indicated and increased duration post-mitigation.*

## ISSUE: CONTAMINATION OF GROUNDWATER AFFECTING THIRD PARTY USE

### Description of Impact

There are a number of sources in all mine phases that have the potential to pollute groundwater. Some sources are permanent (WRDs) and some sources are transient (starting later and at different time-steps) and becoming permanent (pit backfilling). Even though some sources are temporary in nature, related potential pollution can be long term. The operational phase will present more long-term potential sources (waste rock dumps and pit backfill, as the major source term) and the closure phase included in the period of simulation will present final landforms, such as the backfilled open pit may have the potential to pollute water resources through long term seepage and/or run-off.

The watercourses in the project area are not expected to be in hydraulic continuity with the main water table and therefore no groundwater related quality impacts are expected on rivers. This impact is therefore not assessed further, and the discussion below focusses on potential human health impacts.

### Impact Assessment for Groundwater Contamination

|                | Pre-Mitigation Impacts       | Post-Mitigation Impacts |
|----------------|------------------------------|-------------------------|
| <b>Phase</b>   | <b>Operation and Closure</b> |                         |
| Probability    | H                            | L                       |
| Intensity      | M                            | L                       |
| Spatial extent | M                            | M                       |
| Duration       | H                            | H                       |
| Consequence    | Medium                       | Medium                  |
| Significance   | Medium                       | Low                     |

## DEVELOPMENT OF THE CONE OF DRAWDOWN AS A RESULT OF MINING

### Description of Impact

During mining, groundwater will be removed from the open pit and also from the underground storage. The groundwater volumes removed are increasing as the open pit becomes deeper and larger. At the end

of the mining period, the removal of groundwater for the system will cease and the groundwater is allowed to recover.

#### Impact Assessment for development of Drawdown

|                | Pre Mitigation Impacts | Post-Mitigation Impacts |
|----------------|------------------------|-------------------------|
| Phase          | Operation and Closure  |                         |
| Probability    | H                      | M                       |
| Intensity      | M                      | L                       |
| Spatial extent | M                      | M                       |
| Duration       | H                      | H                       |
| Consequence    | Medium                 | Medium                  |
| Significance   | Medium                 | Low                     |

### IMPACT ON SOCIO-ECONOMIC ENVIRONMENT

#### ISSUE: INCREASE IN AMBIENT AIR CONCENTRATIONS

##### Description of Impact

The project activities present emission sources that can have a negative impact on ambient air quality and surrounding land uses in all project phases. The increase in materials handling operations (e.g. top-cut handling, increased train loading capacity, sale of waste rock as aggregate and re-processing of material in Adams pit) could result in an increase in particulate emissions. Other emission sources include land clearing activities for construction, wind erosion of disturbed areas, vehicle movement along unpaved roads and exhaust emissions. The sources are expected to be associated with the use of the expanded internal haul road, the establishment of stormwater management infrastructure and the establishment of the water pipelines from the decommissioned Middelpplaats Mine to MMT. The main contaminants of concern, as a result of the project, include particulate matter (PM) and dustfall.

The closest potentially sensitive receptors from the decommissioned Middelpplaats Mine include the farm workers and A. Pyper (located 4.7 km to the west of the central pit). The closest receptor from the MMT is Michael Kruger (1.8 km southeast of the sinter plant).

Dispersion modelling was undertaken by Airshed (2020/ 2021) to determine the highest daily and annual average ground level concentrations (GLCs). Pollutants with the potential to result in human health impacts which were assessed include PM<sub>2.5</sub> and PM<sub>10</sub>. Dustfall was assessed for its nuisance potential.

Baseline: Simulated PM<sub>10</sub> daily GLC), with no mitigation in place, are in non-compliance with the NAAQS for distances up to 4 km from the mining rights boundary (**Figure 34-1**). Simulated daily PM<sub>2.5</sub> GLCs, with no mitigation in place, are likely to be in non-compliance with the 2030 NAAQS for distances of up to 2 km from the mining rights boundary (**Figure 34-2**) and simulated maximum daily dustfall rates for baseline operations (unmitigated) are in compliance with the NDCR residential limit (600 mg/m<sup>2</sup>/day). **Figure 34-3** shows the simulated monthly baseline dustfall rates.

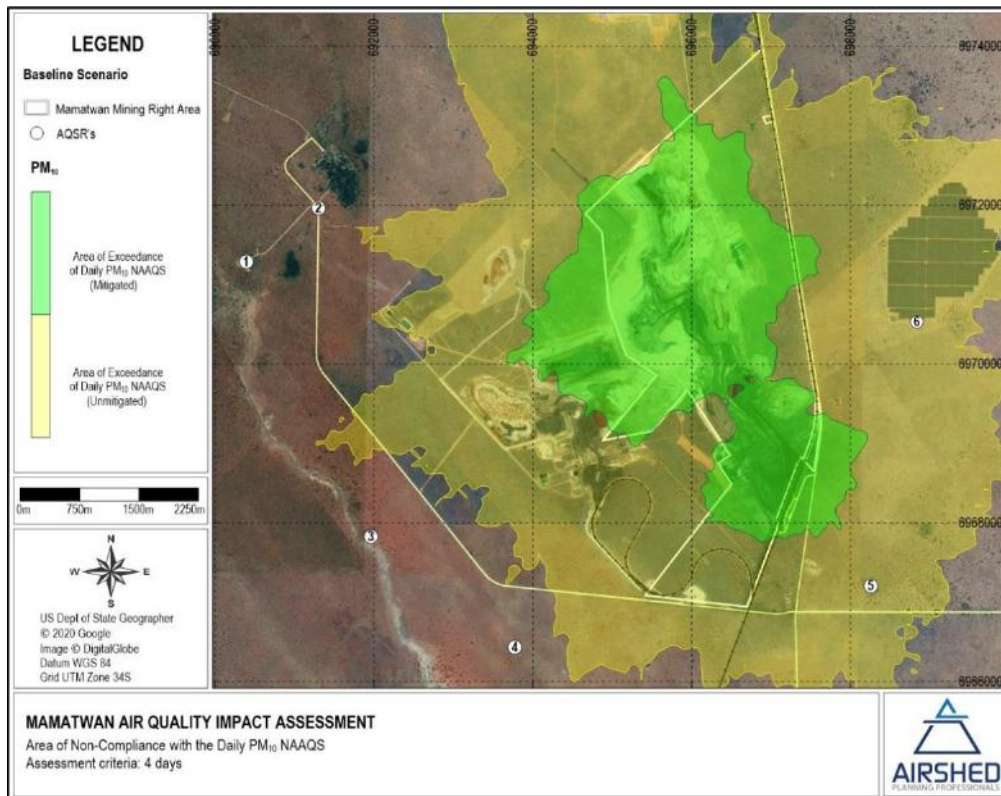


Figure 34-1 Baseline scenario – Area of non-compliance of daily PM10 NAAQS (all sources)

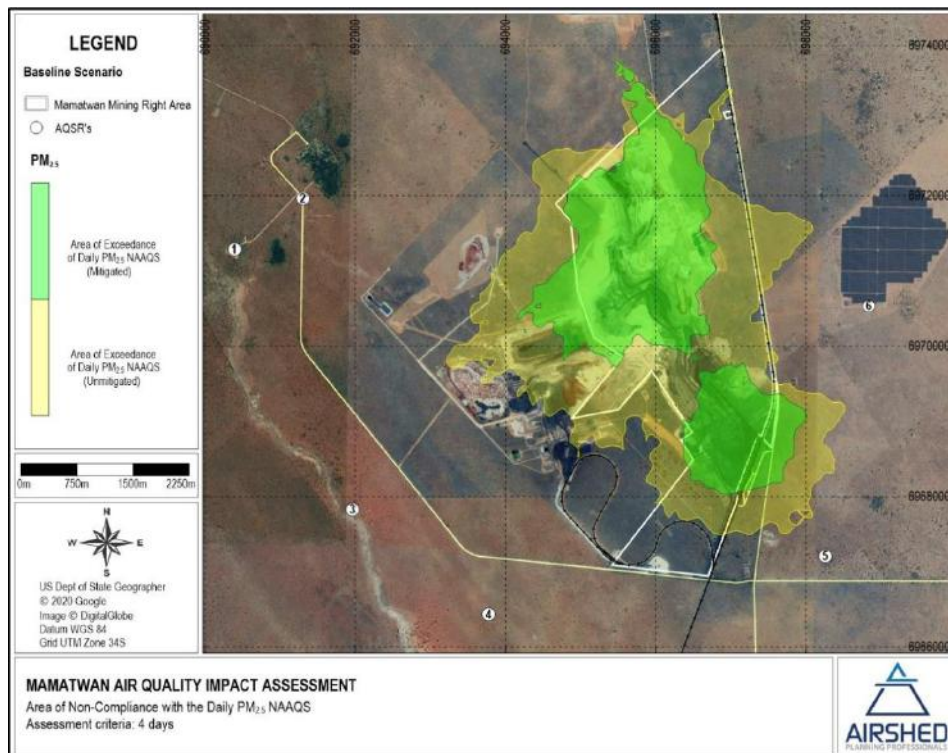


Figure 34-2 Baseline scenario – Area of non-compliance of daily PM2.5 NAAQS (all sources)

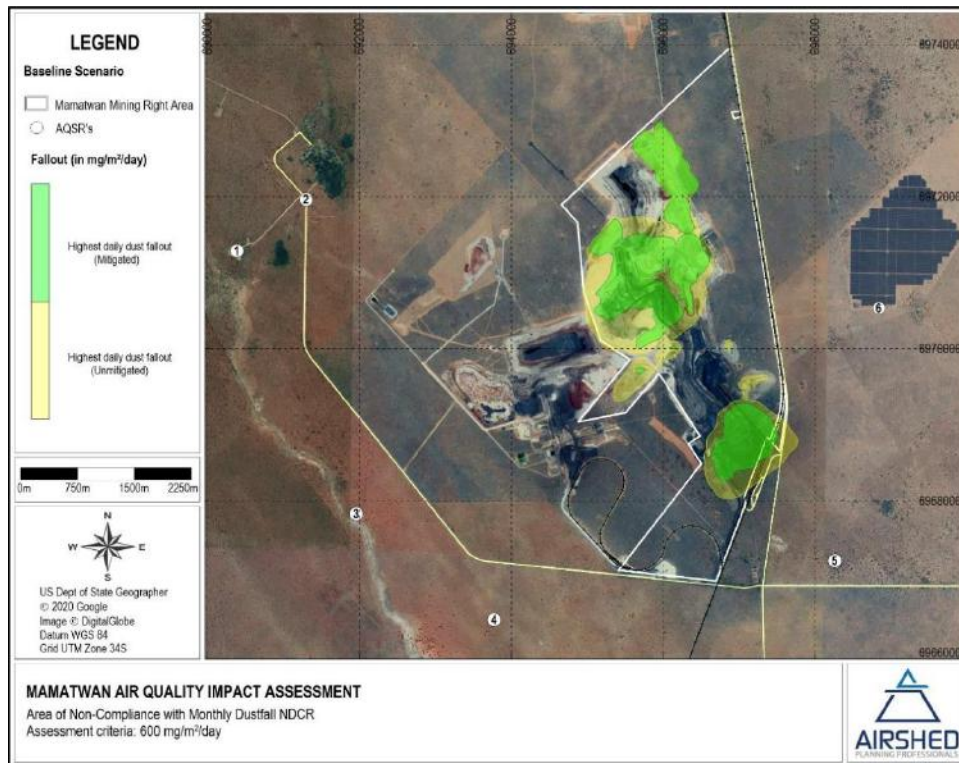


Figure 34-3 Baseline scenario – Area of non-compliance with monthly dustfall NDCR (all sources)

#### Impact Assessment for Change in Ambient Air Quality during Construction

|                 | Pre-Mitigation Impacts                | Post-Mitigation Impacts |
|-----------------|---------------------------------------|-------------------------|
| <b>Phase</b>    | <b>Construction (PM<sub>10</sub>)</b> |                         |
| Probability     | M                                     | M                       |
| Intensity       | M                                     | L                       |
| Spatial extent  | L                                     | L                       |
| Duration        | L                                     | L                       |
| Consequence     | Medium                                | Low                     |
| Significance    | Medium                                | Low                     |
| <b>Phase</b>    | <b>Operation (PM<sub>10</sub>)</b>    |                         |
| Probability     | M                                     | M                       |
| Intensity       | M                                     | VL                      |
| Spatial extent  | H                                     | M                       |
| Duration        | M                                     | M                       |
| Consequence     | High                                  | Low                     |
| Significance    | High                                  | Low                     |
| <b>Activity</b> | <b>Operation (PM<sub>2.5</sub>)</b>   |                         |
| Probability     | M                                     | M                       |
| Intensity       | M                                     | VL                      |
| Spatial extent  | H                                     | M                       |

|                 | Pre-Mitigation Impacts           | Post-Mitigation Impacts |
|-----------------|----------------------------------|-------------------------|
| Duration        | M                                | M                       |
| Consequence     | High                             | Low                     |
| Significance    | High                             | Low                     |
| <b>Activity</b> | <b>Operation (Dustfall)</b>      |                         |
| Probability     | M                                | M                       |
| Intensity       | L                                | L                       |
| Spatial extent  | L                                | L                       |
| Duration        | M                                | M                       |
| Consequence     | Low                              | Low                     |
| Significance    | Low                              | Low                     |
| <b>Activity</b> | <b>Closure (PM<sub>10</sub>)</b> |                         |
| Probability     | M                                | M                       |
| Intensity       | M                                | L                       |
| Spatial extent  | L                                | L                       |
| Duration        | L                                | L                       |
| Consequence     | Medium                           | Low                     |
| Significance    | Medium                           | Low                     |

## ISSUE: INCREASE IN DISTURBING NOISE LEVELS AFFECTING POTENTIAL HUMAN RECEPTORS

### Description of Impact

The propagation of noise generated during the operational phase was calculated with CadnaA in accordance with ISO 9613. Site specific acoustic parameters with source data were applied in the model.

The simulated equivalent continuous day-time rating level (LReq,d) of 55 dBA (IFC residential guideline level and SANS rating for urban districts) due to project operations extends ~340 m to the east of the Mamatwan mining right area for railway loadout station (with and without crushing and screening activities on the waste rock material). The simulated equivalent continuous day/night-time rating level (LReq,dn) of 55 dBA (SANS rating for urban districts) due to project operations extends ~30 m to the east of the Mamatwan mining right area for railway loadout station (with and without crushing and screening activities on the waste rock material).

The project activities are predicted to be within IFC residential and industrial guideline levels and SANS rating for urban and industrial districts at all potential NSRs. For a person with average hearing acuity an increase of less than 3 dBA in the general ambient noise level is not detectable. According to SANS 10103 (2008); 'little' to 'medium' reaction with 'sporadic' to 'widespread' complaints expected from the community for increased noise levels up to 10 dBA. 'Strong' reaction with 'threats of community action' is expected from the community for increased noise levels of between 10 dBA to 15 dBA. With the approach



adopted for the assessment the predicted increase in noise levels at all NSRs less than 1 dBA for all options simulated. The increase in noise levels at NSRs due to project operations should therefore not be detectable.

### Impact Assessment for Noise Disturbance

|                 | Pre-Mitigation Impacts | Post-Mitigation Impacts |
|-----------------|------------------------|-------------------------|
| <b>Phase</b>    | <b>Construction</b>    |                         |
| Probability     | M                      | M                       |
| Intensity       | L                      | L                       |
| Spatial extent  | M                      | L                       |
| Duration        | L                      | L                       |
| Consequence     | Low                    | Low                     |
| Significance    | Low                    | Very Low                |
| <b>Phase</b>    | <b>Operation</b>       |                         |
| Probability     | M                      | M                       |
| Intensity       | VL                     | VL                      |
| Spatial extent  | M                      | M                       |
| Duration        | H                      | H                       |
| Consequence     | Low                    | Low                     |
| Significance    | Low                    | Very Low                |
| <b>Activity</b> | <b>Closure</b>         |                         |
| Probability     | M                      | M                       |
| Intensity       | M                      | L                       |
| Spatial extent  | M                      | L                       |
| Duration        | L                      | L                       |
| Consequence     | Low                    | Low                     |
| Significance    | Low                    | Very Low                |

## ISSUE: LOSS OR DAMAGE TO HERITAGE AND/OR PALEONTOLOGICAL RESOURCES

### Description of Impact

It is possible that subsurface heritage resources will be exposed during construction and may be recoverable, keeping in mind delays can be costly during construction and as such must be minimised. Development surrounding infrastructure and construction of facilities results in significant disturbance, however foundation holes do offer a window into the past and it thus may be possible to rescue some of the data and materials. It is also possible that substantial alterations will be implemented during this phase of the project and these must be catered for. Temporary infrastructure, such as construction camps and laydown areas, is often changed or added to the project as required. In general, these are low impact developments as they are superficial, resulting in little alteration of the land surface, but still need to be catered for.

During the construction phase, it is important to recognize any significant material being unearthed, making the correct judgment on which actions should be taken. It is recommended that the following chance find procedure is implemented. The study area occurs within a greater archaeological site as identified during the fieldwork.

Clearing of vegetation can uncover the following:

- Stone artefact;
- Stone foundations;
- Ash middens associated with the farmsteads and homesteads that can contain bone, glass and clay ceramics, ash, metal objects such as spoons, forks, and knives; and
- Possible burials.

No heritage/cultural resources were identified within the proposed project areas. It follows that the assessment of the loss of heritage/cultural resources is not applicable to this HIA, however management actions are provided in the event of a chance find.

## ISSUE: ALTERATION OF THE VISUAL ENVIRONMENT AFFECTING SENSE OF PLACE

### Description of Impact

Since the proposed top-cut stockpile is situated adjacent to existing waste rock dumps which are of the same height, the visual impact is already present in the area and receptors (i.e. farmers and farm workers traveling along the R380 on a regular basis) within the vicinity thereof have grown accustomed to the dumps. As a result, the proposed establishment of the proposed top-cut stockpile is likely to have a minimal visual impact on the receiving environment. A visual impact will only be experienced if there are sensitive receptors present to experience the impact, thus in this context the receptors that are present are sparse and far from the proposed top-cut stockpile area, thus there are not likely to be many visual impacts experienced.

In addition to the sparse receptors the bushveld vegetation of the area limits the view of the observer to the immediate vicinity, rendering a very low visual intrusion of the proposed top-cut stockpile and mobile crushing and screening plant. It should be noted that the R380 roadway is situated directly east of the proposed expansion activities, thus the proposed expansion activities are in the foreground of motorists traveling along the road and will observe the proposed expansion activities. Due to the landscape already degraded by existing anthropogenic structures (OHPL, waste rock dumps, stockpiles etc.) the proposed MMT expansion activities will not have a significant visual impact on the R380 roadway. Additionally, the road is utilised predominantly by mine and farm workers which are accustomed to the existing mining infrastructure and they have momentary views of the surroundings. Furthermore, the proposed expansion activities are situated within the Gamagara Corridor which is the mining belt of the Northern Cape, thus it does not stray from the land use of the Corridor.

When considering the development phases of the proposed project, the construction and operational phase will have the highest visual intrusion due to the removal of vegetation and levelling of the ground in preparation for the proposed expansion activities, thus increased vehicular movement in the area. Additionally, the stockpiling of material and thus the increase in the height of the proposed top-cut stockpile

will also likely have a high visual intrusion. The points below briefly describe the visual impacts the proposed project will have during the mining and associated construction phase:

- The sense of place of the area will shift from calmness and tranquillity to busy due to vehicular and mine worker movement in the area during the preparation of the area and removal of vegetation for the proposed stockpiling and handling of material. The MMT will only be observable within a small radius and a short distance along the R380 roadway;
- Visual contrast to the surrounding environment may occur as the red / yellow mobile crushing and screening plant may be clearly noticeable from the green and brown background formed by the vegetation and the waste rock dumps;
- Direct visual exposure of the mining activities will occur for road users (mine workers, farmers and occasional tourists) traveling on the R380, as well as indirectly through fugitive dust generated by the earthworks and dumping of the top-cut stockpile material on a windy day. Fugitive dust generated from the workings at the mobile crushing and screening plant will also be visible from the R380 roadway;
- The only form of lighting that will be associated with the proposed top cut stockpile is in the event that the mine requires mining vehicles to dump the material at night on occasion, thus the visual impact associated with night time lighting is negligible.
- The product stockpile stacker and reclaimer associated with the railway loop and the mobile crushing and screening plant will have limited stationary security lighting, thus it is likely to contribute in a limited manner to the effects of skyglow, however the lighting associated with other infrastructure of the MMT and Thsipi Mine will be more visible due to the larger scale of these operations; and
- Since the proposed top-cut stockpile will be the same height as the existing adjacent waste rock dumps and similar in colour, the proposed top-cut stockpile will be indistinguishable from the surrounding environment, as is evident in Figure 6 below. Since the proposed project is situated within the mining belt of the Northern Cape (Gamagara Corridor) the project will not be discordant with the land use and landscape character of the area. Furthermore, due to the bushveld vegetation and distance of the sensitive receptors from the proposed project, situated further than 3km, the proposed top cut stockpile will not be visible to these receptors.

### Impact Assessment for Visual Effects

|                | Pre-Mitigation Impacts                 | Post-Mitigation Impacts |
|----------------|--|-------------------------|
| Phase          | All Phases (Day and Nighttime Impacts) |                         |
| Probability    | M                                      | M                       |
| Intensity      | L                                      | L                       |
| Spatial extent | L                                      | L                       |
| Duration       | L                                      | L                       |
| Consequence    | Low                                    | Low                     |
| Significance   | Low                                    | Very Low                |

## Appendix E: Geochemical Study and Waste Assessment

## Appendix F: Soils and Land Capability Study



## Appendix G: Biodiversity Study

## Appendix H: Surface Water Study

## Appendix I: Stormwater Management Plan

## Appendix J: Hydrocensus Study

## Appendix K: Groundwater Study



## Appendix L: Air Quality Study

## Appendix M: Noise Study

## Appendix N: Visual Study

## Appendix O: Heritage Study

## Appendix P: Palaeontological Desktop Review



## **Appendix Q: Geotechnical Assessment for the proposed railway loop**

## Appendix R: Financial Provision

## Appendix S: EMPr

## Appendix T: Composite map

|                |   |
|----------------|---|
| SLR Reference: | 720.19136.00002   |
| Title:         | Environmental Impact Assessment and Environmental Management Programme for the Changes to Infrastructure Layout and Activities at the Mamatwan Mine |
| Report Number: | 01  |
| Client:        | Hotazel Manganese Mines (Pty) Ltd   |

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## AFRICAN OFFICES

### South Africa

#### CAPE TOWN

T: +27 21 461 1118

#### JOHANNESBURG

T: +27 11 467 0945

#### DURBAN

T: +27 11 467 0945

### Ghana

#### ACCRA

T: +233 24 243 9716

### Namibia

#### WINDHOEK

T: + 264 61 231 287