CK:2014/103753/07 VAT: 4350268654

www.cigroup.za.com

cigroup DO IT RIGHT

CIG/ENVSOL/19/PROJ/0001

mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

FOR LISTED ACTIVITIES ASSOCIATED WITH MINING RIGHT AND/OR BULK SAMPLING ACTIVITIES INCLUDING TRENCHING IN CASES OF ALLUVIAL DIAMOND PROSPECTING

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

NAME OF COMPANY	North Block Complex (Pty) Ltd
CONTACT PERSON	Nokuthula Cebekulu
PHYSICAL ADDRESS	Spitzkop Road, Portion 5 of Paardeplaats Farm Belfast 1100
POSTAL ADDRESS	Universal Coal, North Block Complex Colliery, Paardeplaats Belfast 1100
TELEPHONE NUMBER	+27 (0) 10 900 0358
EMAIL ADDRESS	n.cebekhulu@universalcoal.com
FILE REFERENCE NUMBER SAMRAD	MP 30/5/1/2/2/10090 MR

Prepared for:

North Block Complex Pty Ltd

Universal Coal
NBC Colliery

Commodity Inspections Group (PTY) Ltd

51 Brunton Street, Foundersview South, Johannesburg, 1609, South Africa
PO Box 90482, Bertsham, 2013
010 592 1080
info@cigroup.za.com

QUALITY MANAGEMENT

Report Title	**Environmental Impact Assessment Report for the integrated Paardeplaats Section**		
Project Number	CIG/ENVSOL/19/PROJ/0001		
	Draft Report	**Final Report**	**Revision 1**
Date	**27 May 2021**		
Author	Renee Janse van Rensburg		
Reviewed By	Jacques Harris		
Authorised By	Jacques Harris		

DISCLAIMER

Information contained in this report is based on information received from the client and other external sources. Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by Commodity Inspections Group (Pty) Ltd (CIGroup) for incomplete or inaccurate data supplied by others. We are aware that there might have been project or operational changes since this report was submitted, however this report and its findings is based on the last information received from the client and/or the site visit undertaken. To the best of our knowledge the assumptions and findings are correct at the time of submission of the report. Should any of the assumption or findings prove to be incorrect subsequent to submission of the report we as the specialist cannot be held accountable. Note that whilst CIGroup has made every effort to obtain the correct information and to carry out an appropriate, independent, impartial and competent study, CIGroup cannot be held liable for any incident which directly or indirectly relates to the work in this document, and which may influence the client or on any other third party.

CONFIDENTIALITY

The content of this report will be kept confidential. Copies of the report will not be distributed to other parties except with the expressed permission of the client. The exception to this confidentiality being the requirement from the relevant authority or department and as a result of legislated public review requirements. Copyright is vested in CIGroup in terms of the Copyright Act (Act No. 98 of 1978) and no use, reproduction or duplication of this report may occur without the written consent of the author.

DECLARATION OF INDEPENDENCE

Commodity Inspections Group (Pty) Ltd (CIGroup), as the Environmental Assessment Practitioner specialists, were appointed to undertake a Section 102 Consolidation Process and an Integrated Environmental Authorisation (EA) application Scoping and Environmental Impact Reporting (S&EIR) Process and to develop the Environmental Scoping Report (ESR), Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) Reports for the North Block Complex (Pty) Ltd Integrated Paardeplaats Section Project. CIGroup does not have a vested interest in the proposed activity proceedings, will not engage in and have no conflicting interest in the undertaking of the activity. CIGroup has provided all information at their disposal regarding the Scoping Report, whether such information is favourable to the Client or not.

______________________________	27 May 2021
Renee Janse van Rensburg	Date
Environmental Compliance and Assessment Manager	
Environmental Solutions Division	
Commodity Inspections Group (Pty) Ltd	

EXECUTIVE SUMMARY

NBC consists of three (3) mining sections namely the Eerstelingsfontein Section, the Glisa Section, and the Paardeplaats Sections. The focus of this process will be on the Glisa and Paardeplaats Sections.

The Section 102 Consolidation and IEA application focus on the following:

1. **Consolidation of the Glisa Section MR and Environmental Management Plan (EMP) into the Paardeplaats Section (MP 30/5/1/2/2/10090 MR);**
2. **Inclusion of Portion 24 of the farm Paardeplaats 380 JT into the Paardeplaats Section MR; and**
3. **IEA for listed activities triggered in terms of the NEMA and NEM:WA within the MR areas and Portion 24 of the farm Paardeplaats 380 JT.**

For the purposes of distinction, the current mining Sections will be referred to in this report as the Glisa Section and Paardeplaats Section, Portion 24 of the farm Paardeplaats 380 JT will be referred to in this report as Portion 24, and the area applicable to the Section 102 Consolidation and IEA application (i.e. both Sections and Portion 24) will be referred to as the **Integrated Paardeplaats Section (MP 30/5/1/2/2/10090 MR)).**

NBC require the following changes to existing infrastructure:

- Expansion of the CSWP on Portion 3 and 4 of the farm Paardeplaats 380 JT;
- Expansion of the existing WTP pipeline network on all farm portions associated with the Integrated Paardeplaats Section; and
- Widening of haul roads between the mining sections and processing plants.

In order to ensure the continuation of mineral processing and water treatment activities for the Integrated Paardeplaats Section in support of the mining activities taking place, NBC require new infrastructure within the Integrated Paardeplaats Section in support operation activities in the Section. This new infrastructure includes the following:

- A RoM pad on Portion 3 and 4 of the farm Paardeplaats 380 JT;
- A PCD at the CSWP on Portion 3 and 4 of the farm Paardeplaats 380 JT;
- Additional stormwater management infrastructure including diversion channels around the CSWP, and diversion channels around the administrative, contractor, workshop, and security offices on Portion 3 and 4 of the farm Paardeplaats 380 JT;

- Rerouting of a powerline at the CSWP on Portion 3 and 4 of the farm Paardeplaats 380 JT to ensure a clear footprint area for the PCD;
- A RoM pad on Portion 24 of the farm Paardeplaats 380 JT;
- An additional crushing and screening plant on Portion 24 of the farm Paardeplaats 380 JT;
- A mining contractors office, workshop, and conservancy tank on Portion 24 of the farm Paardeplaats 380 JT;
- A PCD on Portion 24 of the farm Paardeplaats 380 JT;
- Stormwater management infrastructure, including diversion channels, for the above-mentioned infrastructure on Portion 24 of the farm Paardeplaats 380 JT;
- A powerline extension from the existing network to supply power to the infrastructure on Portion 24 of the farm Paardeplaats 380 JT;
- Pipelines between the PCD, Plant and the WTP on Portion 24 of the farm Paardeplaats 380 JT;
- A conveyor between the RoM Pad on Portion 24 of the farm Paardeplaats 380 JT and the CSWP on Portion 3 and 4 of the farm Paardeplaats 380 JT;
- An emulsion silo adjacent to the magazine yard on Portion 24 of the farm Paardeplaats 380 JT;
- Haul roads and a dewatering pipeline within the active mining area on Portion 30 of the farm Paardeplaats 380 JT and planned mining areas on Potion 13, 28, 29 and 40 of the the farm Paardeplaats 380 JT and Portion 2 and Remaining Extent of the farm Paardeplaats 425 JS;
- Backfill areas on Portion 1, 3, 4 and 5 of the farm Paardeplaats 380 JT; and
- Discard Management Facility (DMF) on Portion 24 of the farm Paardeplaats 380 JT.

Based on the above, the following Listed Activities apply to this application:

1. GNR 983, LN 1: Activity 10, 12, 14, 19, 24, 45, 46, 48 and 56;
2. GNR 984, LN 2: Activity 6, 15, 17 and 19;
3. GNR 985, LN 3: Activity 10, 14 and 18;
4. GNR 921, Category B: Activity 1, 10 and 11; and
5. GNR 921, Category C: Activity 1.

A number of specialist assessment report were utilised to define the baseline environmental attributes as well as to assess the potential impacts associated with the development. The impacts were assessed before and after implementation of mitigation actions. As can be seen in the figures that follow, the risks associated with each impact with or without impact mitigation action implementation show how, through the implementation of appropriate impact mitigation actions, the likelihood and consequence of identified impacts can be improved.

Without Mitigation		1 Insignificant	2 Minor	3 Moderate	4 Major	5 Catastrophic
5	Almost certain	0	1	2	25	18
4	Likely	0	1	6	34	3
3	Moderate	0	0	2	2	1
2	Unlikely	0	0	1	2	0
1	Rare	0	0	0	0	0

After Mitigation		1 Insignificant	2 Minor	3 Moderate	4 Major	5 Catastrophic
5	Almost certain	0	1	3	3	9
4	Likely	0	7	12	5	4
3	Moderate	1	14	11	9	0
2	Unlikely	5	7	3	2	0
1	Rare	0	0	2	0	0

Based on the information presented in this report, together with the consideration of all previous and current specialist reports, the reasoned opinion of the EAP is that the activities proposed and applied for should be authorised. Considering that the activities proposed have been selected to address historical environmental concerns and to contain environmental impacts related to coal handling, stockpiling, processing and waste disposal within an area that is already relatively degraded, support this opinion.

This document is the Environmental Impact Assessment Report (EIAR) structured in line with Chapter 6 of the Environmental Impact Assessment (EIA) Regulations, 2014 (GNR. 982), as amended, promulgated under the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) which prescribes the procedure and requirements for environmental authorisation applications. The EIAR is produced to present the Integrated Paardeplaats Section Consolidation Project and the associated environmental authorisations required by NBC.

This report serves as the Draft EIAR which is subjected to a 30-day public review period from 28 May 2021 – 27 June 2021. All comments received from Interested and Affected Parties (I&APs) and Registered I&APs on the Draft EIAR will be incorporated into the the Comments and Response Report of the Final EIAR and addressed where possible therein.

Kindly note that this application process and the requisite consultation and report review requirements are currently governed by the Directions Regarding Measures to Address, Prevent and Combat the Spread of Covid-19 Relating to National Environmental Management Permits and Licences (GNR 650), as amended, promulgated under the Disaster Management Act, 2002 (Act No. 57 of 2002) (DMA). Annexure 3 of GNR 650 specifies the services to be provided or obtained by proponents, applicants, Environmental Assessment Practitioners (EAPs), specialists, and professionals undertaking actions as part of the environmental authorisation process and organs of state as commenting authorities required in terms of the NEMA, the NEM:WA and the EIA Regulations 2014.

IMPORTANT NOTICE

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

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

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

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

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

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

PART A

SCOPE OF ASSESSMENT AND ENVIRONMENTAL IMPACT ASSESSMENT REPORT

1 THE OBJECTIVE OF THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

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

(a) determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;

(b) describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;

(c) identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;

(d) determine the—-

(i) nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and

(ii) degree to which these impacts—

(aa) can be reversed;

(ba) may cause irreplaceable loss of resources, and

(ca) can be avoided, managed or mitigated;

(e) identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;

(f) identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;

(g) identify suitable measures to manage, avoid or mitigate identified impacts; and

(h) identify residual risks that need to be managed and monitored.

2 CONTACT PERSON AND CORRESPONDENCE ADDRESS

2.1 Applicant

The applicant for this Integrated Environmental Authorisation (IEA) and Section 102 Consolidation application process is North Block Complex (Pty) Ltd (NBC). NBC is a subsidiary of Universal Coal Energy Holdings SA (UCEHSA), which is owned by Universal Coal Plc. Universal Coal acquired NBC, which was previously owned by Exxaro Coal Mpumalanga (Pty) Ltd, in November 2018. The contact details for NBC are provided in **Table 2.1**.

Table 2.1: Contact Details of the Applicant.

NAME OF COMPANY	North Block Complex (Pty) Ltd
CONTACT PERSON	Nokuthula Cebekulu
PHYSICAL ADDRESS	Spitzkop Road, Portion 5 of Paardeplaats Farm Belfast 1100
POSTAL ADDRESS	Universal Coal, North Block Complex Colliery, Paardeplaats Belfast 1100
TELEPHONE NUMBER	+27 (0) 10 900 0358
EMAIL ADDRESS	n.cebekhulu@universalcoal.com

2.2 Details of the EAP who Prepared the Report

In terms of Regulation 13 of the NEMA Environmental Impact Assessment (EIA) Regulations, 2014 (GNR. 982), as amended, an independent Environmental Assessment Practitioner (EAP) must be appointed by the applicant to manage the application. Commodity Inspections Group (Pty) Ltd (CIGroup) has been appointed by NBC as the independent environmental assessors responsible for conducting the required Environmental Licensing Processes and will be responsible for Report Development, Specialist Assessments, requisite Stakeholder Engagement Processes (SEP), and Authority and Government Department Liaison.

CIGroup's Environmental Compliance and Assessment Manager, Renee Janse van Rensburg, will be the project EAP are her contact details are provided in **Table 2.2**.

Table 2.2: Contact Details of the EAP.

NAME OF COMPANY	Commodity Inspections Group (Pty) Ltd
CONTACT PERSON	Renee Janse van Rensburg
PHYSICAL ADDRESS	51 Brunton Street, Foundersview South, Edenvale, 1609
POSTAL ADDRESS	PO Box 90482, Bertsham, Johannesburg, 2013
TELEPHONE NUMBER	+27 (0) 10 592 1080
EMAIL ADDRESS	reneejvr@cigroup.za.com

2.3 Expertise Of The EAP

The project EAP is compliant with the definition of an EAP as defined in Regulations 1 and 13 of the EIA Regulations, 2014, as well as Section 1 of the NEMA. This includes, inter alia, the requirement that the EAP is:

- Objective and independent;
- Has expertise in conducting EIAs;
- Complies with the NEMA, the environmental regulations and all other applicable legislation;
- Considers all relevant factors relating to the application; and
- Provides full disclosure to the applicant and the relevant environmental authority.

2.3.1 EAP Qualifications

The qualifications of the project EAP are presented in **Table 2.3** whilst proof of the qualifications are provided in **Appendix A**. The project EAP is responsible to ensure that Continued Professional Development (CPD) is prioritised. A summary of the project EAPs CPD the last five (5) years is provided in **Table 2.4**.

Table 2.3: Qualifications of the EAP.

YEAR OBTAINED	QUALIFICATION	TERTIARY INSTITUTION
2003	MSc (Environmental Management)	Rand Afrikaans University, now the University of Johannesburg
2001	BSc Honours (Geography & Environmental Management)	
2000	BSc (Earth Sciences)	

Table 2.4: CPD of the EAP.

YEAR COMPLETED	COURSE/PROGRAMME DETAILS
In Progress	Carbon Footprint Analyst
2020	Environmental Law Event
2020	Renewable Energy Workshop
2019	Environmental Law Update
2019	Transforming Our World: Achieving the Sustainable Development Goals
2019	The Business of Mining
2019	Mine Closure and Recent Case Law
2018	Environmental Law Event
2018	Environmental Law Update
2018	International Climate Change Law & Policy
2018	Understanding NEM:WA

YEAR COMPLETED	COURSE / PROGRAMME DETAILS
2017	National Adaptation Plans
2017	Environmental Law Update

2.3.2 Summary Of The EAPs Past Experience

The project EAP has over 19 years' experience in mining projects, integrated environmental, water and waste authorisation processes, environmental and water auditing and performance assessments, and the management of large inter-disciplinary specialist teams. She has the ability to develop and maintain relationships with authorities and significant experience in stakeholder engagement processes including consultation with responsive or hostile I&APs, Non-governmental Organisations (NGOs), and the general public. She has a proven track-record in obtaining positive environmental, water and waste authorisations. She is a registered EAP with the Environmental Assessment Practitioners Association of South Africa (EAPASA) and is a registered Professional Natural Scientist (Pr.Sci.Nat) with the South African Council for Natural Scientific Professions (SACNASP).

The project EAPs Curriculum Vitae detailing her expertise in EA processes is presented in **Appendix B** together with her professional registrations.

3 DESCRIPTION OF THE PROPERTY

NBC consists of three (3) mining sections namely the Eerstelingsfontein Section, the Glisa Section, and the Paardeplaats Section (**Figure 3.1**). The focus of this process will be on the Glisa and Paardeplaats Sections. **Table 3.1** presents the Glisa and Paardeplaats Sections Mining Right (MR), Environmental Authorisation (EA), and Integrated Water Use License (IWUL) reference numbers as issued in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA), the National Environmental Management Act, 1998 (Act No. 107 of 1998), and where applicable, the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM:WA), and the National Water Act, 1998 (Act No. 36 of 1998) (NWA) respectively.

Table 3.1: Glisa and Paardeplaats Mining Sections.

REFERENCE	GLISA SECTION	PAARDEPLAATS SECTION
MR:	MP 30/5/1/2/1/236 MR	MP 30/5/1/2/2/10090 MR
EA:	17/2/3N-4, 17/2/3N-235, & 17/2/3GNK13	-
IWUL:	License No.: 06/B41A/ABCFGIJ/1002 File No.: 27/2/2/B141/3/9	06/B41A/CGIJ/8880

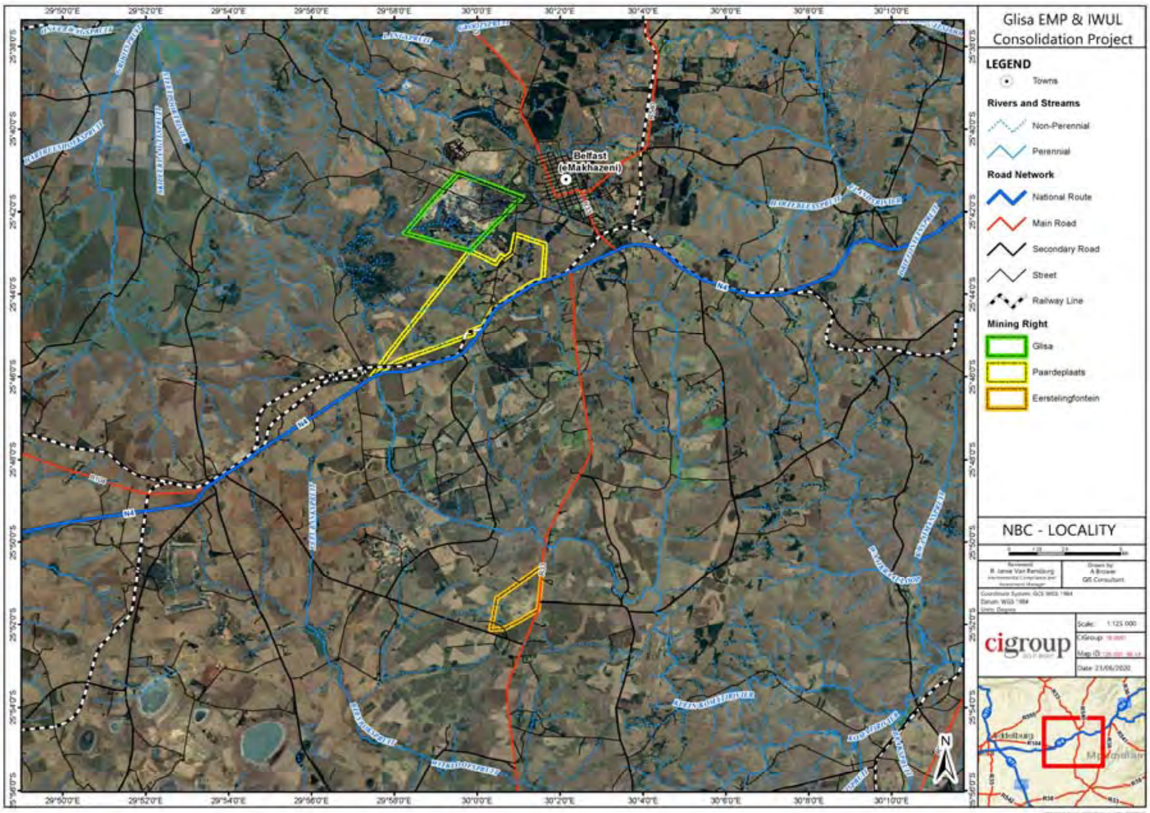

Figure 3.1: Location of the NBC Glisa, Paardeplaats and Eerstelingsfontein Sections.

The Section 102 Consolidation and IEA application focus on the following:

4. **Consolidation of the Glisa Section MR and Environmental Management Plan (EMP) into the Paardeplaats Section (MP 30/5/1/2/2/10090 MR);**
5. **Inclusion of Portion 24 of the farm Paardeplaats 380 JT into the Paardeplaats Section MR; and**
6. **IEA for listed activities triggered in terms of the NEMA and NEM:WA within the MR areas and Portion 24 of the farm Paardeplaats 380 JT.**

Figure 3.2 presents the individual areas associated with the consolidation and IEA application process, namely the Glisa Section MR area, the Paardeplaats Section MR area and Portion 24 of the farm Paardeplaats 380 JT. For the purposes of distinction, the current mining Sections will be referred to in this report as the Glisa Section and Paardeplaats Section, Portion 24 of the farm Paardeplaats 380 JT will be referred to in this report as Portion 24, and the area applicable to the Section 102 Consolidation and IEA application (i.e. both Sections and Portion 24) will be referred to as the **Integrated Paardeplaats Section (MP 30/5/1/2/2/10090 MR)** (**Figure 3.3**).

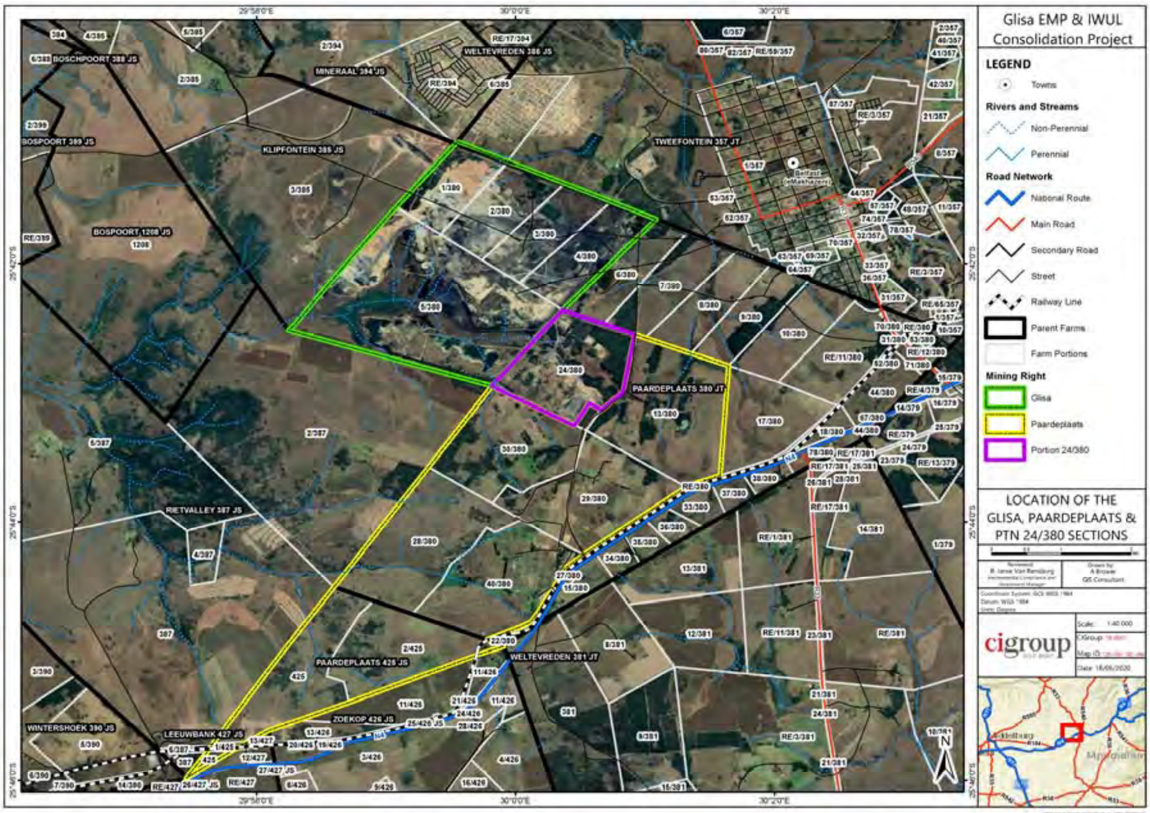

Figure 3.2: Location of the Glisa Section, Paardeplaats Section and Portion 24.

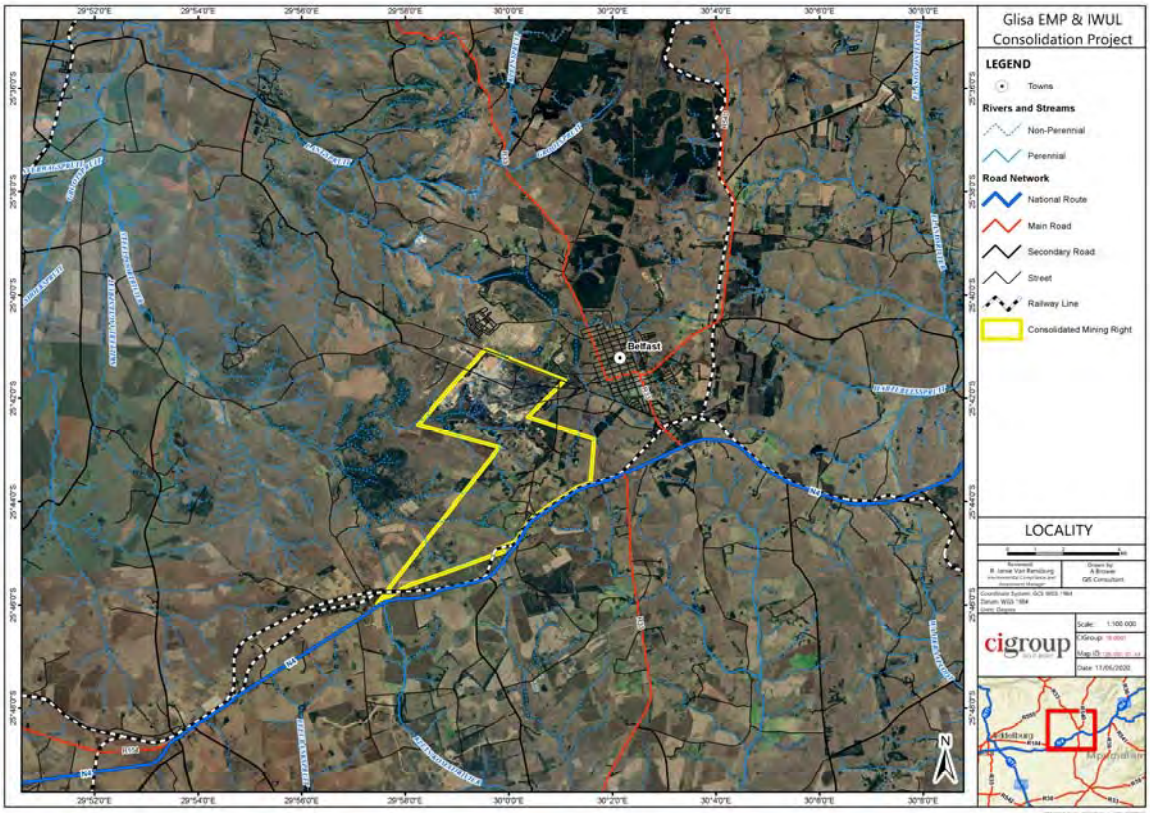

Figure 3.3: Location of the Integrated Paardeplaats Section.

3.1 Property Description

A total of thirteen (13) farm portions relate to the Integrated Paardeplaats Section. Portion 1, 2, 3, 4, and 5 of the farm Paardeplaats 380 JT, apply to the Glisa Section MR, whilst the Remaining Extent of Portion 13, Portion 28, 29, 30 and 40 of the farm Paardeplaats 380 JT, and the Remaining Extent (RE) and Portion 2 of the farm Paardeplaats 425 JS, apply to the Paardeplaats Section (**Table 3.2**). Portion 24 of the farm Paardeplaats 380 JT is the additional portion being requested through this process (**Table 3.2**).

Table 3.2: Property Details for the Integrated Paardeplaats Section.

FARM NAMES	Paardeplaats 380 JT & Paardeplaats 425 JS		
APPLICATION AREA	2,463.78 hectares (ha)		
MAGISTERIAL DISTRICT	Nkangala District Municipality (DM) and the Emakhazeni Local Municipality (LM)		
DISTANCE AND DIRECTION FROM NEAREST TOWN	5 kilometres (km) South of the town of eMakhazeni (Belfast) and approximately 1 km South of the closest formal settlement, Siyathuthuka Township		
21 DIGIT SURVEYOR GENERAL CODE FOR EACH FARM PORTION	Paardeplaats 380 JT	Portion 1	T0JT00000000038000001
	Paardeplaats 380 JT	Portion 2	T0JT00000000038000002
	Paardeplaats 380 JT	Portion 3	T0JT00000000038000003
	Paardeplaats 380 JT	Portion 4	T0JT00000000038000004
	Paardeplaats 380 JT	Portion 5	T0JT00000000038000005
	Paardeplaats 380 JT	Portion 13	T0JT00000000038000013
	Paardeplaats 380 JT	Portion 24	T0JT00000000038000024
	Paardeplaats 380 JT	Portion 28	T0JT00000000038000028
	Paardeplaats 380 JT	Portion 29	T0JT00000000038000029
	Paardeplaats 380 JT	Portion 30	T0JT00000000038000030
	Paardeplaats 380 JT	Portion 40	T0JT00000000038000040
	Paardeplaats 425 JS	Remaining Extent	T0JS00000000042500000
	Paardeplaats 425 JS	Portion 2	T0JS00000000042500002

3.2 Locality Map

The Integrated Paardeplaats Section farm portions are presented in **Figure 3.4**, whilst the location of the Integrated Paardeplaats Section within the District and Local Municipalities is presented in **Figure 3.5**. Both maps are provided in **Appendix C**.

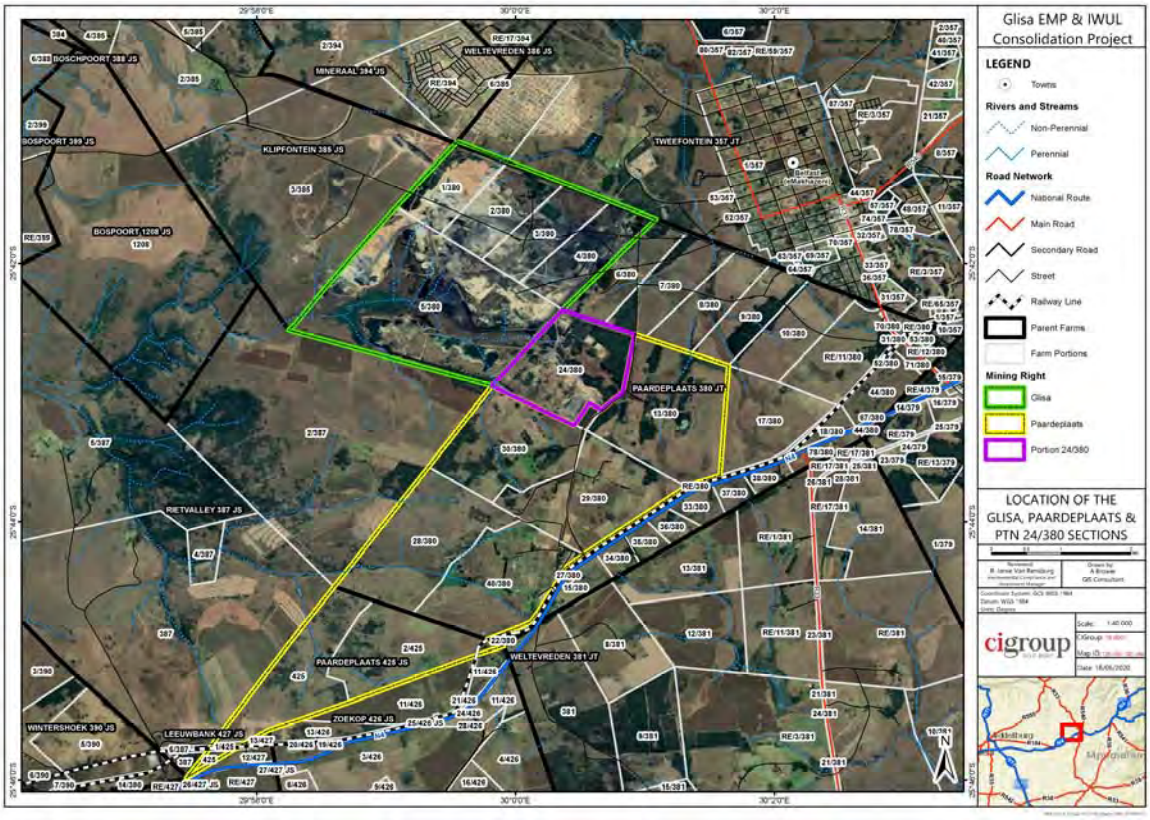

Figure 3.4: Farm Portions Applicable to the Integrated Paardeplaats Section.

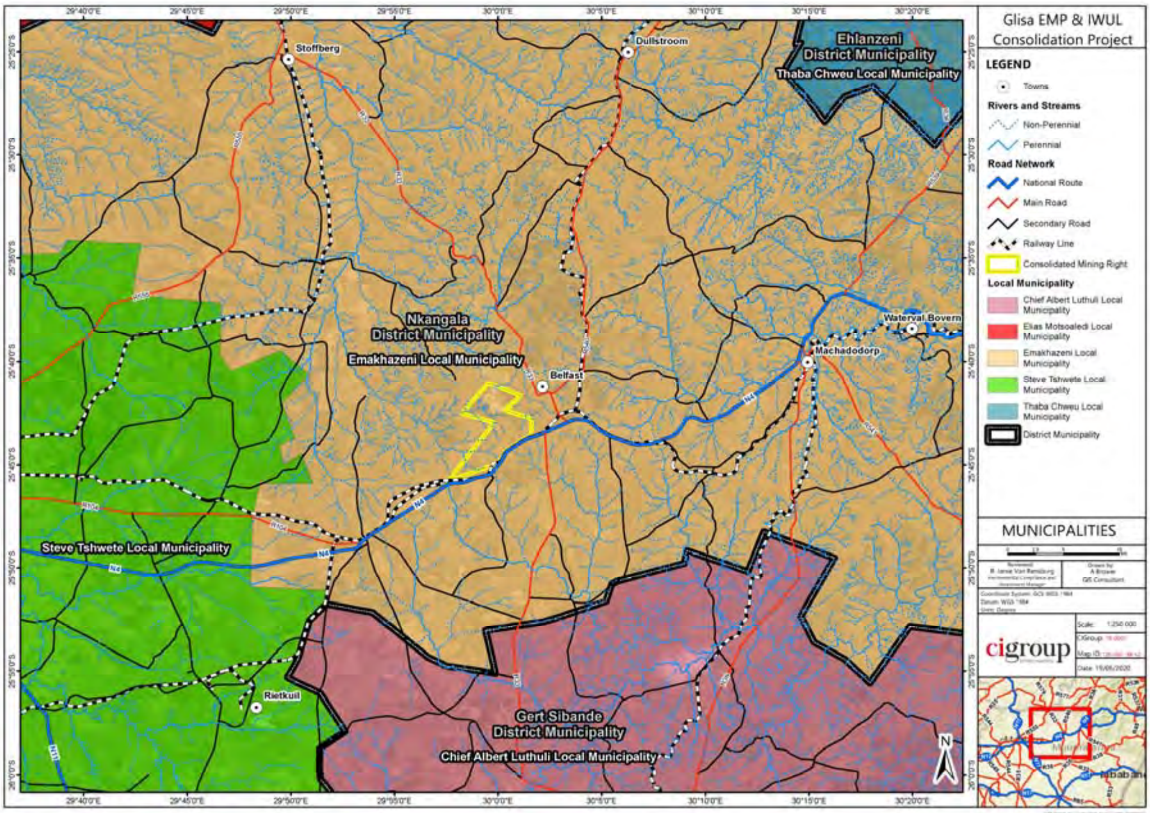

Figure 3.5: Municipal Location of the Integrated Paardeplaats Section.

4 DESCRIPTION OF THE SCOPE OF THE PROPOSED OVERALL ACTIVITY

4.1 Description of the Activities to be Undertaken

4.1.1 Current Activities

4.1.1.1 Glisa Section

Mining started at the Glisa Section in 1890 using underground mining methods. From 2006 mining was undertaken by opencast mining methods with underground pillars being reclaimed. This opencast mining method is still in force at the Glisa Section. Coal is crushed and screened at stationary plants whilst other coal products are processed at the main Crushing, Screening and Washing Plant (CSWP) located in the Glisa Section. In addition to mining and coal processing, the Glisa Section also consists of infrastructure such as roads, offices, workshops, stockpiles, pipelines, and a Water Treatment Plant (WTP).

NBC has an existing supply agreement with Eskom to supply steady and secure coal for selected Eskom coal fired power stations. The Glisa Section has been the source of this coal for many years; however the Glisa Section Life of Mine (LoM) is nearing its end and a resultant reduction in Run of Mine (RoM) coal is occurring. In order to meet its contractual obligations to Eskom, NBC intend to supply Eskom with coal from the adjoining Paardeplaats Section.

NBC, through the utilisation of the Glisa Section infrastructure, intends to limit the disturbance of additional natural areas in the Paardeplaats Section. In so doing, the utilisation of the existing infrastructure at the Glisa Section is paramount. Existing infrastructure at the Glisa Section is licensed in terms of the MPRDA and the NEMA and all of the existing infrastructure at the Section will continue to be used in support of mining activities in the Integrated Paardeplaats Section. The infrastructure that will continued to be used and which <u>does not</u> require licensing in terms of this application includes, the following (**Figure 4.1**):

- RoM stockpile areas at the crushing and screening plants, e.g. Gijima, and the main CSWP;
- Product stockpiles at the crushing and screening plants and main CSWP;
- Haul roads, including existing river diversions, culverts, and drains;
- Stormwater management infrastructure, including existing dams and channels;
- Magazine and explosives area;
- Workshops, administrative offices, mining contractor offices, and security offices, including ablution facilities, septic tanks, and French drains;
- Fuel bays, above and below ground diesel storage tanks, wash bays, and salvage areas; and

- Waste management areas.

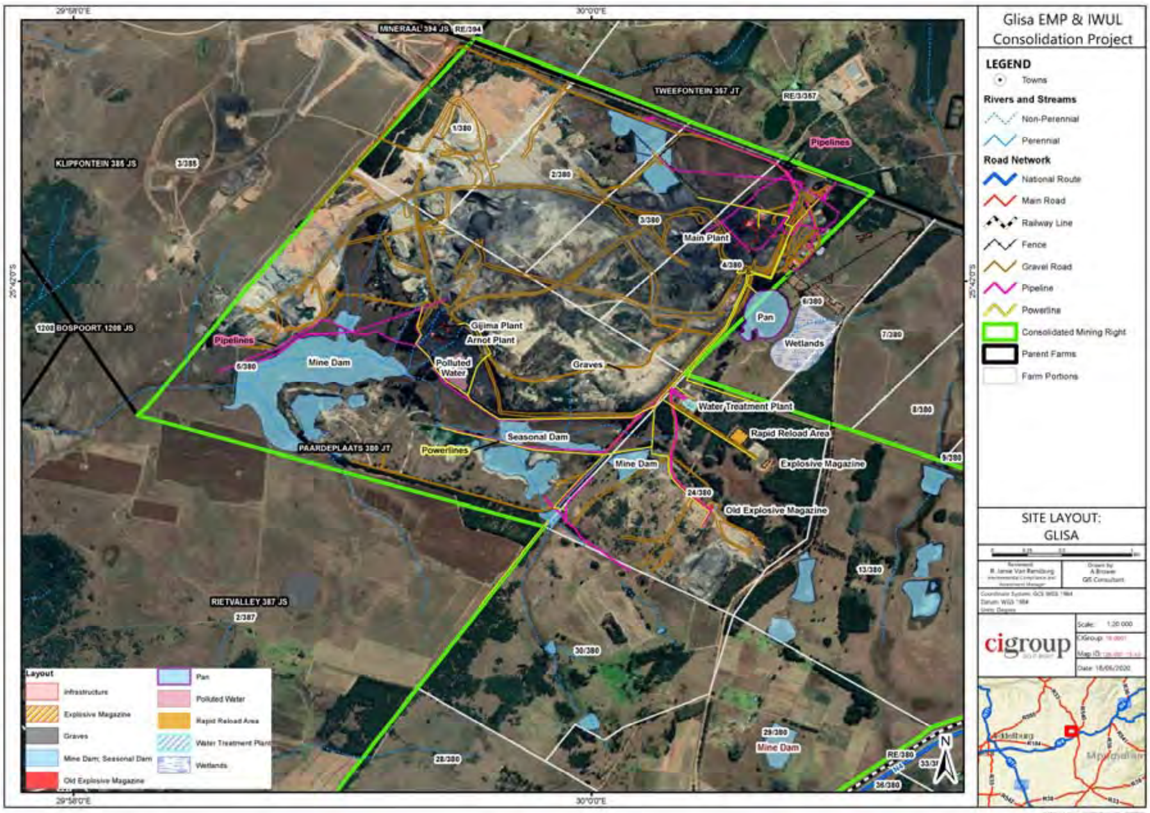

Figure 4.1: Existing Infrastructure Layout at the Glisa Section.

4.1.1.2 Water Treatment Plant

The WTP for the Glisa Section spans an area of approximately 0.67 ha on Portion 24 of Paardeplaats 380JT and is fully operational. The design treatment capacity of the WTP is 1.5 megalitres per day (Ml/d) on average over a 30-day cycle, equating to an average of 62.5 cubic metres per hour (m^3/h). Proxa designed and constructed the WTP on behalf of the previous mine owner, Exxaro, and have been operating the WTP since 2017. The WTP processes (**Figure 4.2**) entail chemical precipitation in combination with Ultrafiltration (UF) and Reverse Osmosis (RO) technologies. Additional brine treatment is designed for to ensure a zero-brine discharge.

RO is a water treatment process whereby dissolved salts, such as sodium, chloride, calcium carbonate, and calcium sulphate may be separated from water by forcing the water through a semi-permeable membrane under high pressure. The water diffuses through the membrane and the dissolved salts remain behind as the liquid by-product. The liquid by-product generated by the WTP process is routed to a filter press which produces *Gypsum by-product* (25% moisture content) which is stored within a concrete based, bunded storage area on site.

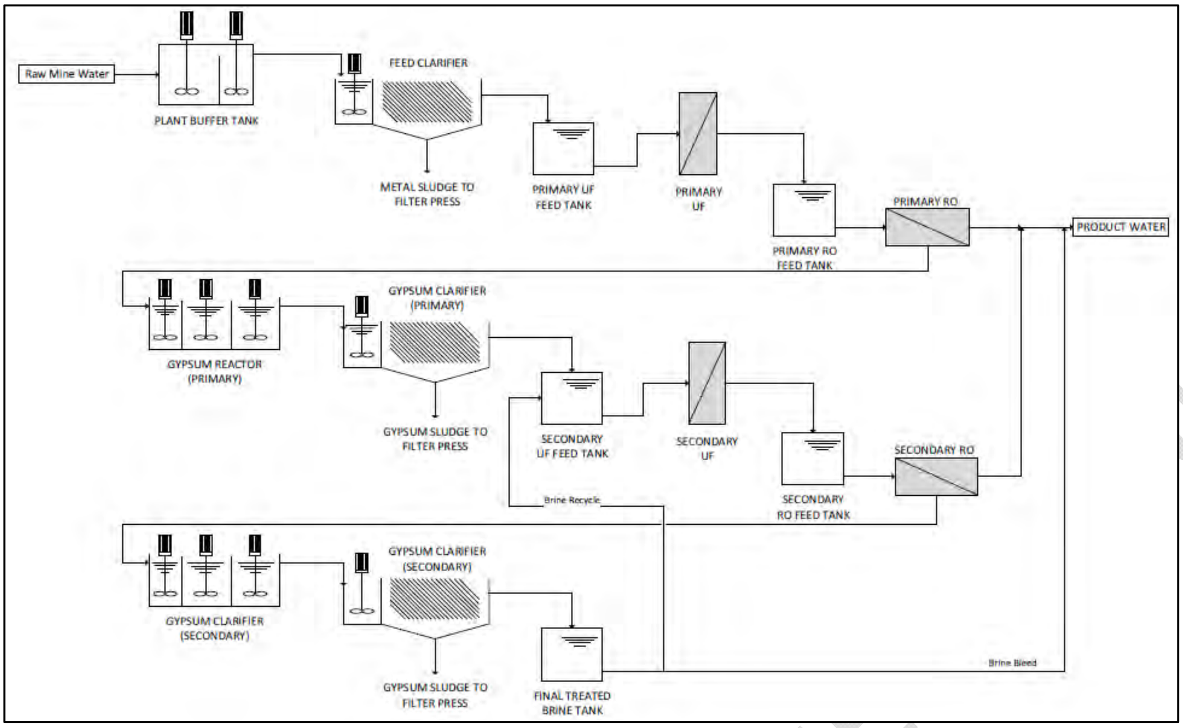

Figure 4.2: Overview of the WTP Process (Proxa, 2013).

The process water pipelines (dirty water collection and product water pipelines) traverse Portions 2, 3, 4, 5 and 24 of Paardeplaats 380JT. The purpose of the WTP is to treat water within the dams and voids at the Glisa and Paardeplaats Sections which have been impacted on by historical and current mining activities. The WTP is supported by a significant pipeline network to transfer feed water from the collection points to the WTP for treatment, as well as the pipeline routes from the plant to the discharge point and clean water storage locations. The location of the WTP and the layout of the associated pipelines are shown in **Figure 4.3**. The collection points, represented by the red dots in **Figure 4.3**, are referred to as:

- Blue Gum Evaporation Dam;
- Block B, Void B1;
- Block C, Void C1; and
- Dirty Water Dam.

The collection points are located within un-rehabilitated voids from historical opencast mining by previous owners of the mine. These voids contain poor quality water mainly from runoff. The voids are licensed in terms of the current Glisa IWUL (License No.: 06/B41A/ABCFGIJ/1002; File No.: 27/2/2/B141/3/9) Water is collected from the collection points by means of sumps within which pumps are located.

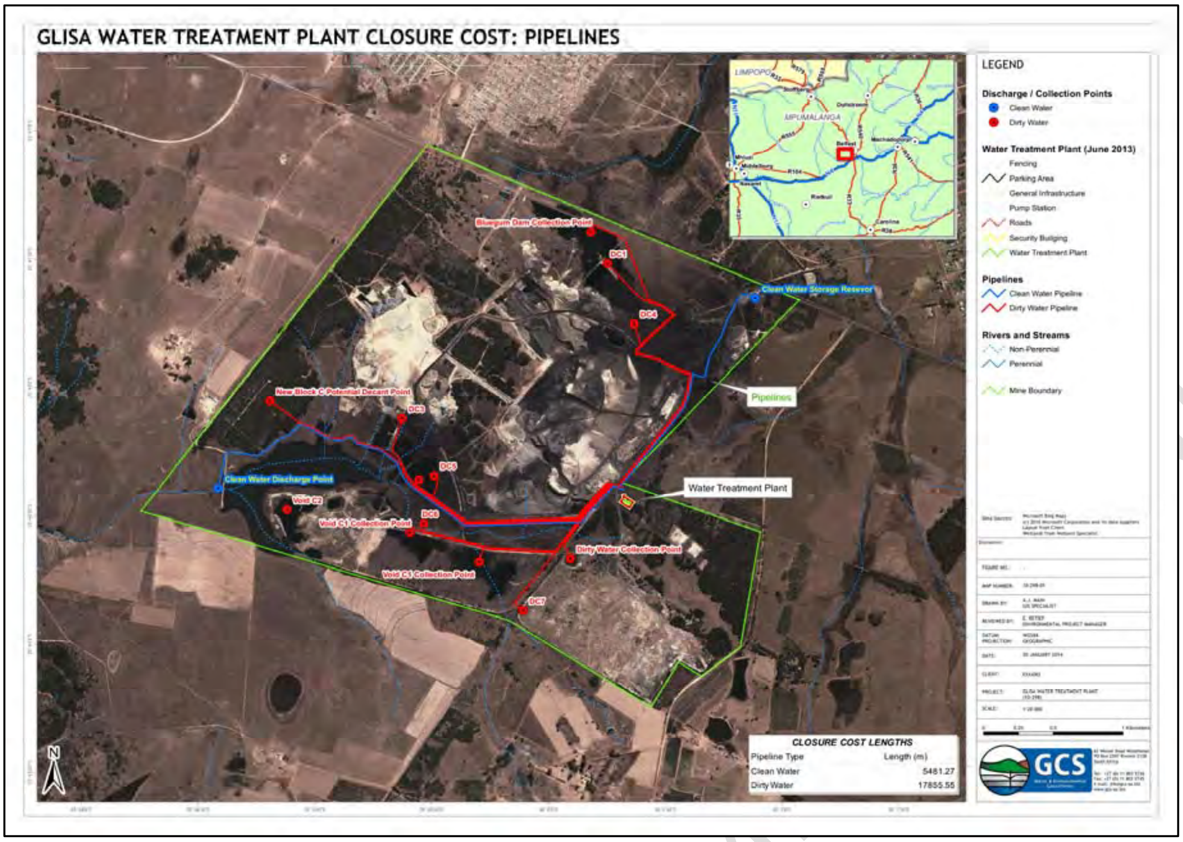

Figure 4.3: WTP and Pipeline Location (GCS, 2014).

Existing infrastructure at the WTP in the Glisa Section is licensed in terms of the MPRDA and the NEMA and all of the existing infrastructure for the WTP will continue to be used in support of the Paardeplaats Section mining activities. The infrastructure that will continued to be used and which <u>does not</u> require licensing in terms of this application includes, the following (**Figure 4.4**):

- WTP and pipeline reticulation system, including discharge pipeline and electrical supply through a 500 Kilovolt Ampere (kVA) mini-substation;
- Gypsum storage areas at the WTP; and
- Waste management areas.

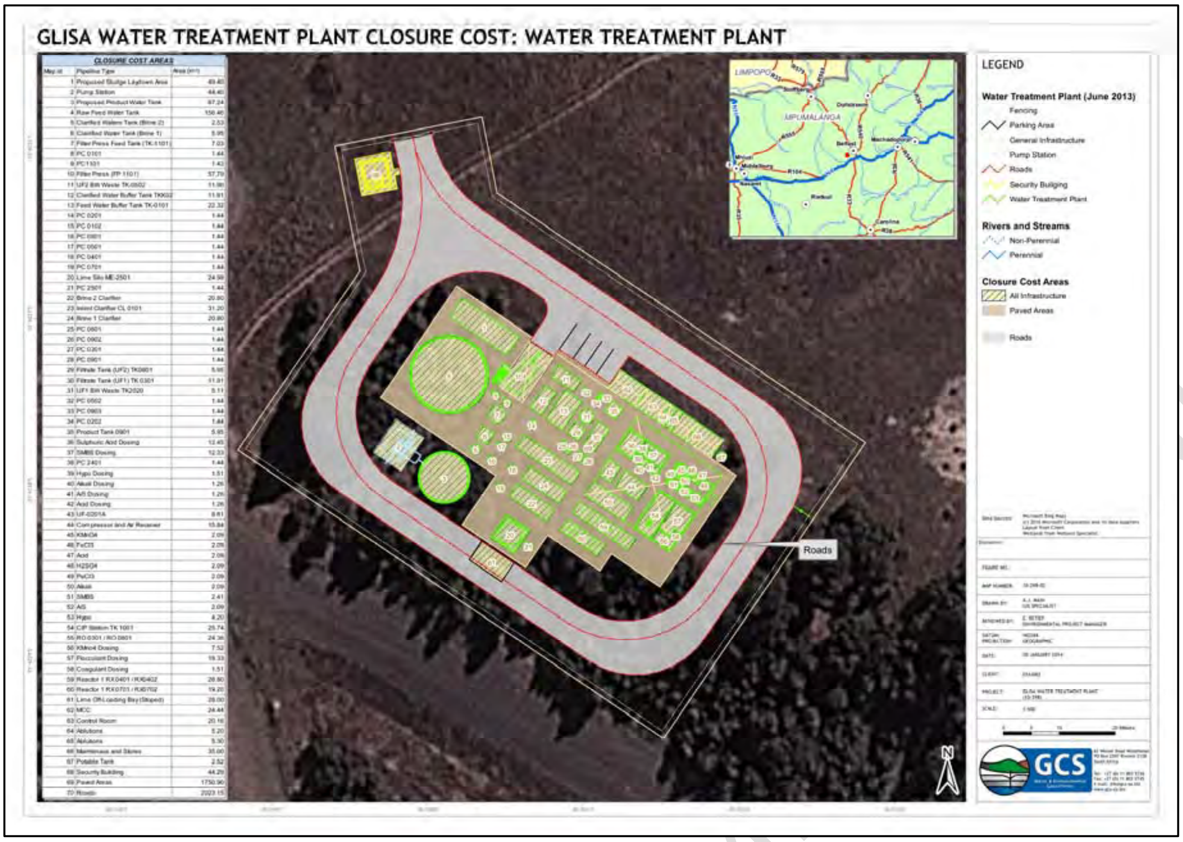

Figure 4.4: Existing Infrastructure Layout for the WTP (GCS, 2014).

4.1.1.3 Paardeplaats Section

The Paardeplaats Section is an operational section which adjoins the Glisa Section. Mining is undertaken by opencast mining methods. Mining at the Paardeplaats Section will focus on Portion 30 of the farm Paardeplaats 380 JT for the first ten (10) years of the MR, before expanding to other farm portions.

As RoM reduces at the Glisa Section, the shortfall will be addressed through coal mined at the Paardeplaats Section. The Paardeplaats Section is an open cast mining operation where bench mining techniques are employed to access the coal seams. The 2 Seam Burden is removed with Dozers doing roll-over of the 2 seam burden into the previous 2 seam voids, and the upper burden seams are removed with the truck and shove mining method. Coal seams 4, 3 and 2 will be mined for processing. Seam 1 appears in certain areas only and is highly weathered and contaminated with inseam shales and is not suitable to mined and will be left in situ in the pit. The Paardeplaats Section has an estimated RoM supply rate of 4.2 – 4.4 mtpa which relate to 2.4 – 2.6 mtpa of product, supplying Eskom's Komati and Arnot power stations, as well as an estimated RoM supply rate of 1.7 mtpa of export coal which equates to 1.0 mtpa of export product.

4.1.1.3.1 Resource Details

The Integrated Paardeplaats Section falls within the Witbank Coal Field which is close to the north-eastern edge of the Karoo Basin. The Karoo sequence is represented by the Dwyka Formation consisting of diamictite and the overlaying Ecca Group. The coal seams of the Witbank Coal Field are found at the base of the Vryheid Formation of the Ecca Group and the strata in which coal seams occur consist predominantly of fine, medium and course grained sandstone with subordinate mudstone, shale, siltstone, and carbonaceous shale.

All five coal seams of the Witbank Coal Field occur within the Integrated Paardeplaats Section. The number 2 and 4 seams are more extensively developed than seams 1, 3 and 5. In the far north–east portion of the Paardeplaats Section a dolerite sill, likely a post depositional feature related to the Lesotho Basalts, is believed to have completely displaced coal seams (EIMS, 2014). The coal seams are relatively flat-lying, and the average seam thickness is as follows:

- The Number (No.) 1 seam has an average thickness of 0.34 metres (m);
- The No. 2 seam has an average thickness of 5.37 m;
- The No. 3 seam has an average of 0.78 m;
- The No. 4 seam has an average thickness of 3.04 m; and
- The No. 5 seam has an average thickness of 0.62 m.

The No. 1, 2, 4 and 5 seams can be mined whilst the No. 3 seam, although persistent across the entire coal filed, has been determined to be too thin to be considered an economically viable resource.

4.1.1.3.2 Mining Method

Mining at the Paardeplaats Section entails opencast mining. The open cast mining method was selected due to the shallowness of the target coal seams present within the MR area. The open cast mining will be undertaken as a hybrid of roll-over and bench/box cut mining techniques. The use of the two respective techniques is dependent on the number of seams present as well as the overburden thickness. The roll-over technique will be utilised where only a single seam is present and where the overburden has a corresponding thickness of less than 20 m. The bench/box-cut technique will be utilised where two or more seams are present, and the overburden has a thickness of greater than 20 m.

The creation of the opencast was initiated through a stripping operation which removes topsoil and exposes the overburden of the first proposed cut. Initial topsoil was hauled to a designated area and stored for use in rehabilitation. When steady state is reached, topsoil will be replaced in a continuous operation. The overburden is then drilled and blasted. The removal of overburden is undertaken in two phases namely, the top portion will be loaded and hauled, and the lower portion dozed. This will ensure that backfilling is adequately addressed, and that concurrent rehabilitation may take place.

Once the overburden has been removed and dozed, the coal seams are drilled and blasted and then transferred to the Glisa Section for mineral processing by means of standard load and hauls operations. It is anticipated that after the first four (4) cuts, a steady state will be reached. The schematics presented in **Figure 4.5** to **Figure 4.8** describes the mining method in more detail, with the mining direction being from left to right, and depicts the following:

1. A section through the general stratigraphic sequence;
2. The box cut is excavated after removal of the topsoil and subsoil;
3. Coal is removed from the box cut, subsoil from cut 2 and topsoil from cut 3;
4. The overburden from cut 2 is drilled and blasted;
5. The topmost part of the overburden is loaded and hauled to a stockpile due to insufficient pit room availability;
6. The bottom part is dozed over;
7. Coal is removed from cut 2 and subsoil from cut 3;
8. Cut 3 overburden is blasted;
9. The top part of the blasted overburden is hauled and placed at the beginning of the low wall;
10. The bottom part of cut 3 is dozed over and the cleaned coal face;
11. Coal is removed from cut 3 and subsoil from cut 4; and
12. Overburden from cut 4 is blasted.

At this point the pit is now in a ready state and no more material is stockpiled as it can now be accommodated in the pit. Concurrent rehabilitation can now logically follow as soon as the subsoil gets stripped in the front and replaced in the back. The same is true for the topsoil which gets placed over the subsoil in a continuous process.

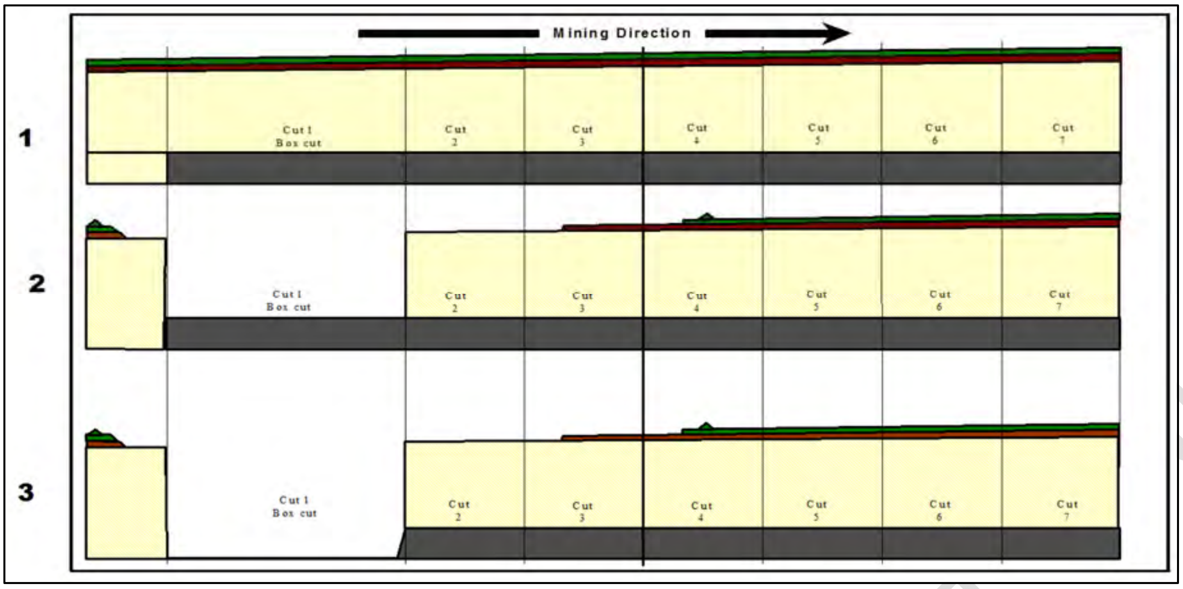

Figure 4.5: Mining Method steps 1-3.

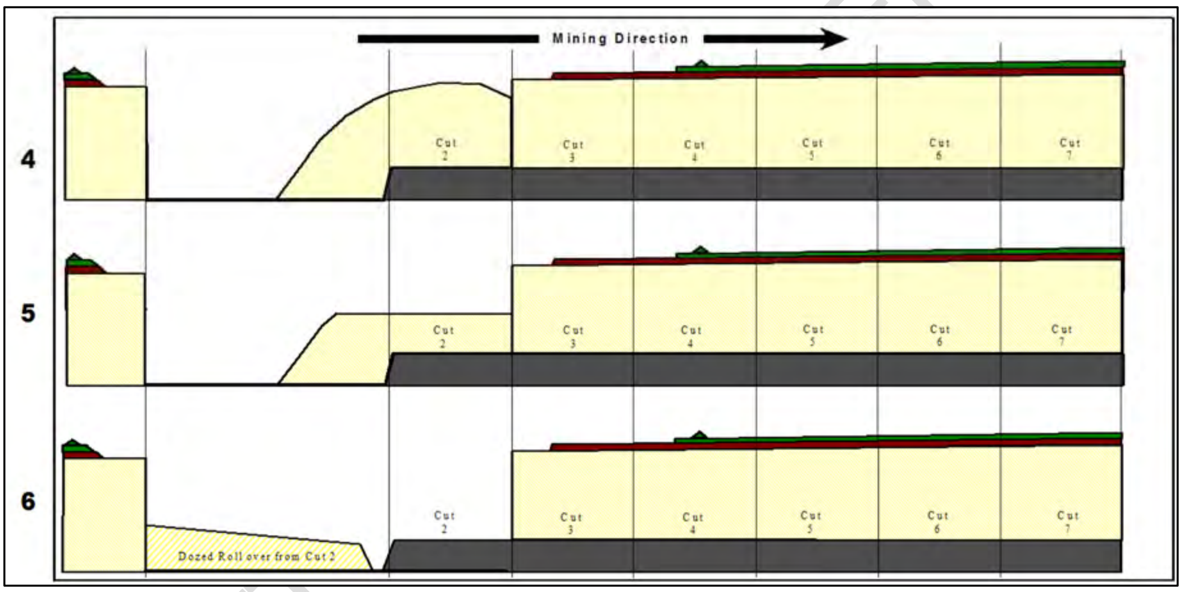

Figure 4.6: Mining Method steps 4-6.

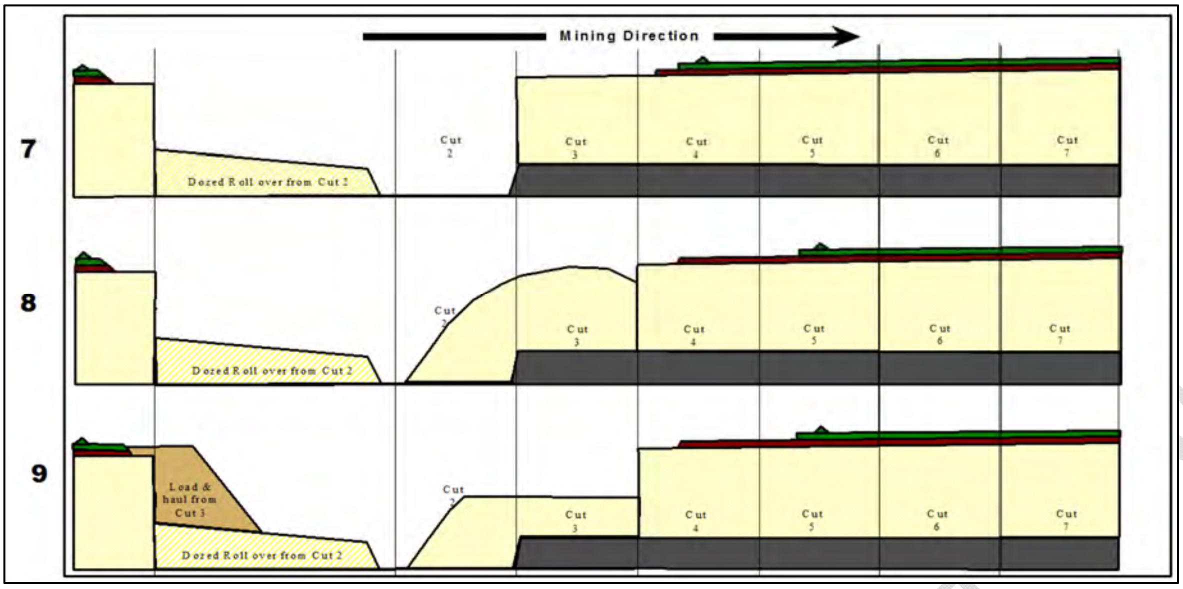

Figure 4.7: Mining Method steps 7-9.

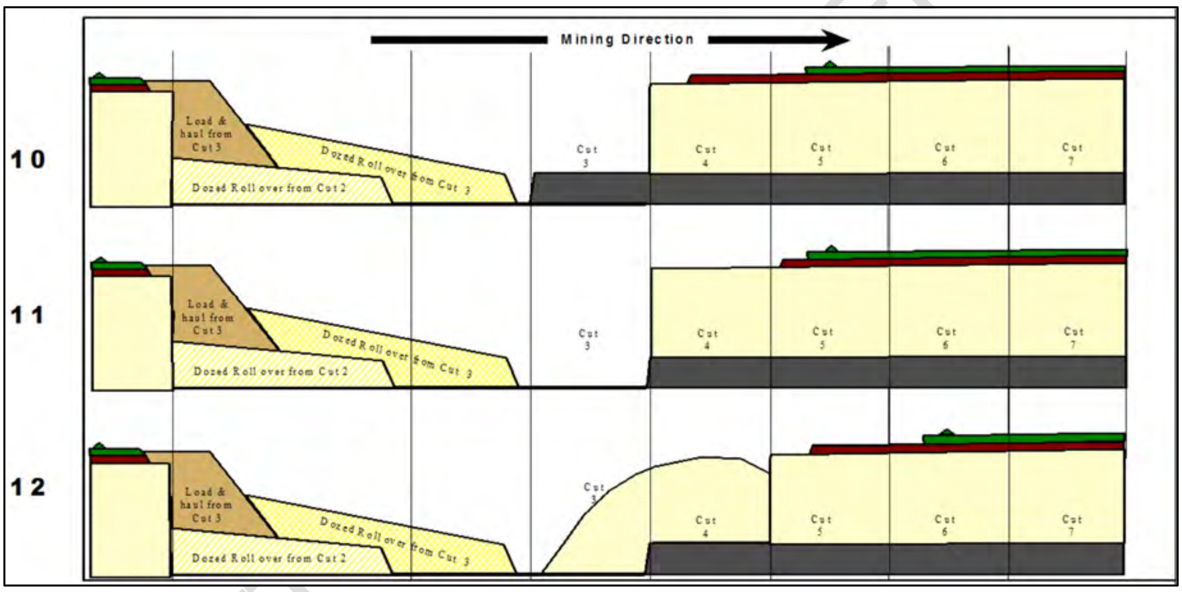

Figure 4.8: Mining Method steps 10-12.

Due to the proximity of the Glisa and Paardeplaats Sections, all mineral processing and waste disposal for the Paardeplaats Section is being undertake at the Glisa Section. For this reason NBC require the consolidation of the Sections into the Integrated Paardeplaats Section to align with the Paardeplaats Section LoM which currently extends until 25 September 2038. Coal will be crushed at stationary plants prior to processing being undertaken at the main CSWP located in the Glisa Section. Water treatment will also be undertaken at the WTP in the Glisa Section. The 2020 LoM plan is presented in **Figure 4.9**.

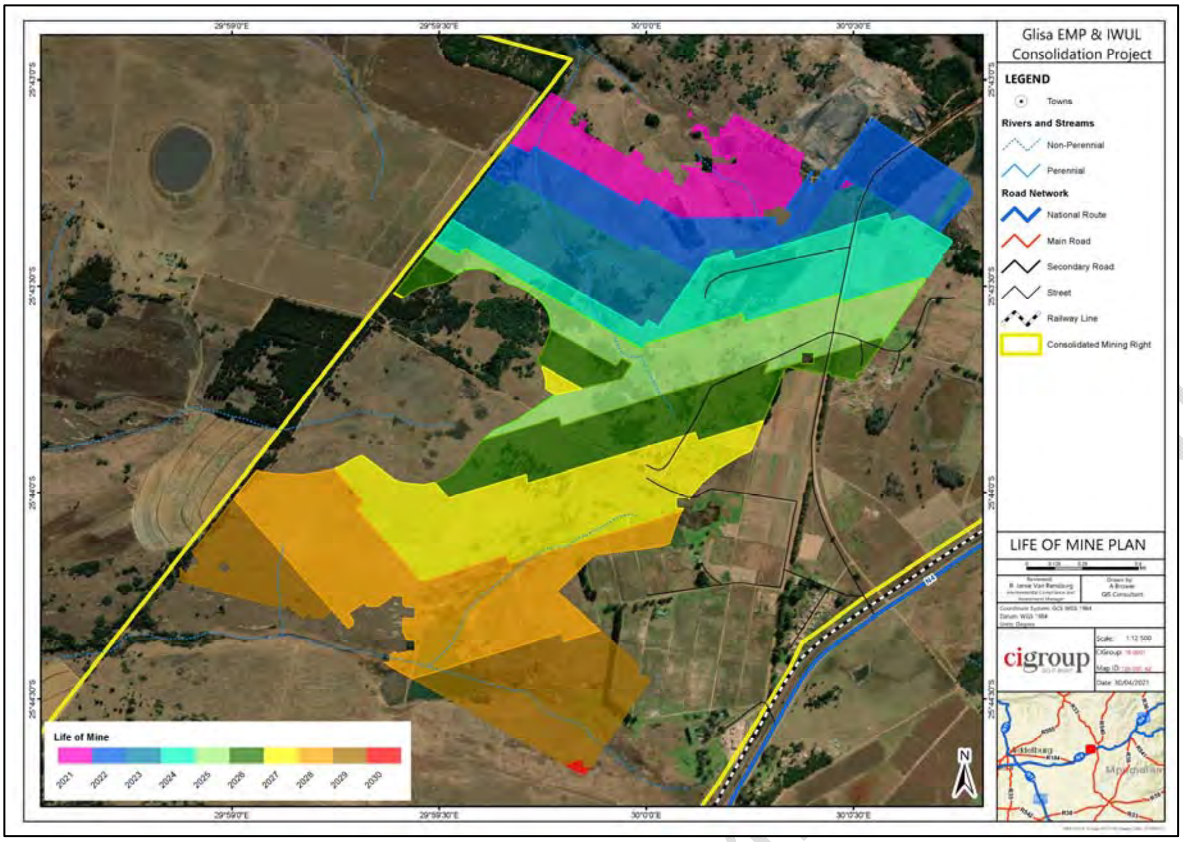

Figure 4.9: 2020 LoM Plan.

4.1.2 Proposed Activities

4.1.2.1 Existing Infrastructure Changes

NBC require the following changes to existing infrastructure:

- Expansion of the CSWP on Portion 3 and 4 of the farm Paardeplaats 380 JT;
- Expansion of the existing WTP pipeline network on all farm portions associated with the Integrated Paardeplaats Section; and
- Widening of haul roads between the mining sections and processing plants.

4.1.2.2 New Infrastructure Required

In order to ensure the continuation of mineral processing and water treatment activities for the Integrated Paardeplaats Section in support of the mining activities taking place, NBC require new infrastructure within the Integrated Paardeplaats Section in support operation activities in the Section. This new infrastructure includes the following:

- A RoM pad on Portion 3 and 4 of the farm Paardeplaats 380 JT;
- A PCD at the CSWP on Portion 3 and 4 of the farm Paardeplaats 380 JT;

- Additional stormwater management infrastructure including diversion channels around the CSWP, and diversion channels around the administrative, contractor, workshop, and security offices on Portion 3 and 4 of the farm Paardeplaats 380 JT;
- Rerouting of a powerline at the CSWP on Portion 3 and 4 of the farm Paardeplaats 380 JT to ensure a clear footprint area for the PCD;
- A RoM pad on Portion 24 of the farm Paardeplaats 380 JT;
- An additional crushing and screening plant on Portion 24 of the farm Paardeplaats 380 JT;
- A mining contractors office, workshop, and conservancy tank on Portion 24 of the farm Paardeplaats 380 JT;
- A PCD on Portion 24 of the farm Paardeplaats 380 JT;
- Stormwater management infrastructure, including diversion channels, for the above-mentioned infrastructure on Portion 24 of the farm Paardeplaats 380 JT;
- A powerline extension from the existing network to supply power to the infrastructure on Portion 24 of the farm Paardeplaats 380 JT;
- Pipelines between the PCD, Plant and the WTP on Portion 24 of the farm Paardeplaats 380 JT;
- A conveyor between the RoM Pad on Portion 24 of the farm Paardeplaats 380 JT and the CSWP on Portion 3 and 4 of the farm Paardeplaats 380 JT;
- An emulsion silo adjacent to the magazine yard on Portion 24 of the farm Paardeplaats 380 JT;
-
- Haul roads and a dewatering pipeline within the active mining area on Portion 30 of the farm Paardeplaats 380 JT and planned mining areas on Potion 13, 28, 29 and 40 of the the farm Paardeplaats 380 JT and Portion 2 and Remaining Extent of the farm Paardeplaats 425 JS;
- Backfill areas on Portion 1, 3, 4 and 5 of the farm Paardeplaats 380 JT; and
- Discard Management Facility (DMF) on Portion 24 of the farm Paardeplaats 380 JT.

Figure 4.10 presents the expansion, upgrade and new infrastructure that are required in and around the CSWP located in the Glisa Section. **Figure 4.11** presents the expansion and new infrastructure that are required on Portion 24. **Figure 4.12** presents the backfill areas in the Glisa Section and the proposed DMF on Portion 24. Finally, **Figure 4.13** presents the gravel roads and dewatering pipeline in the active mining area (Portion 30) and planned mining areas (Potion 13, 28, 29 & 40 of the the farm Paardeplaats 380 JT and Portion 2 & RE of the farm Paardeplaats 425 JS).

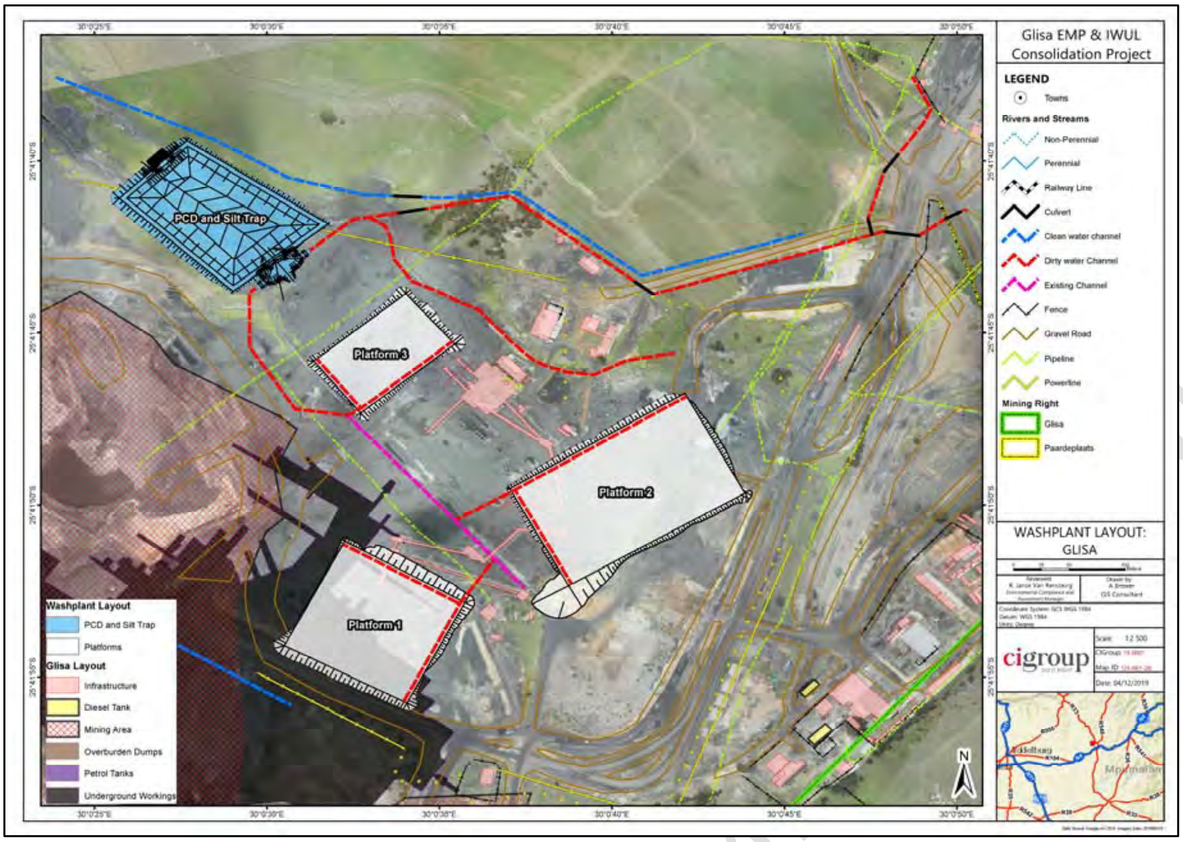

Figure 4.10: Proposed Site Layout around the Glisa Section CSWP.

Figure 4.11: Proposed Site Layout on Portion 24.

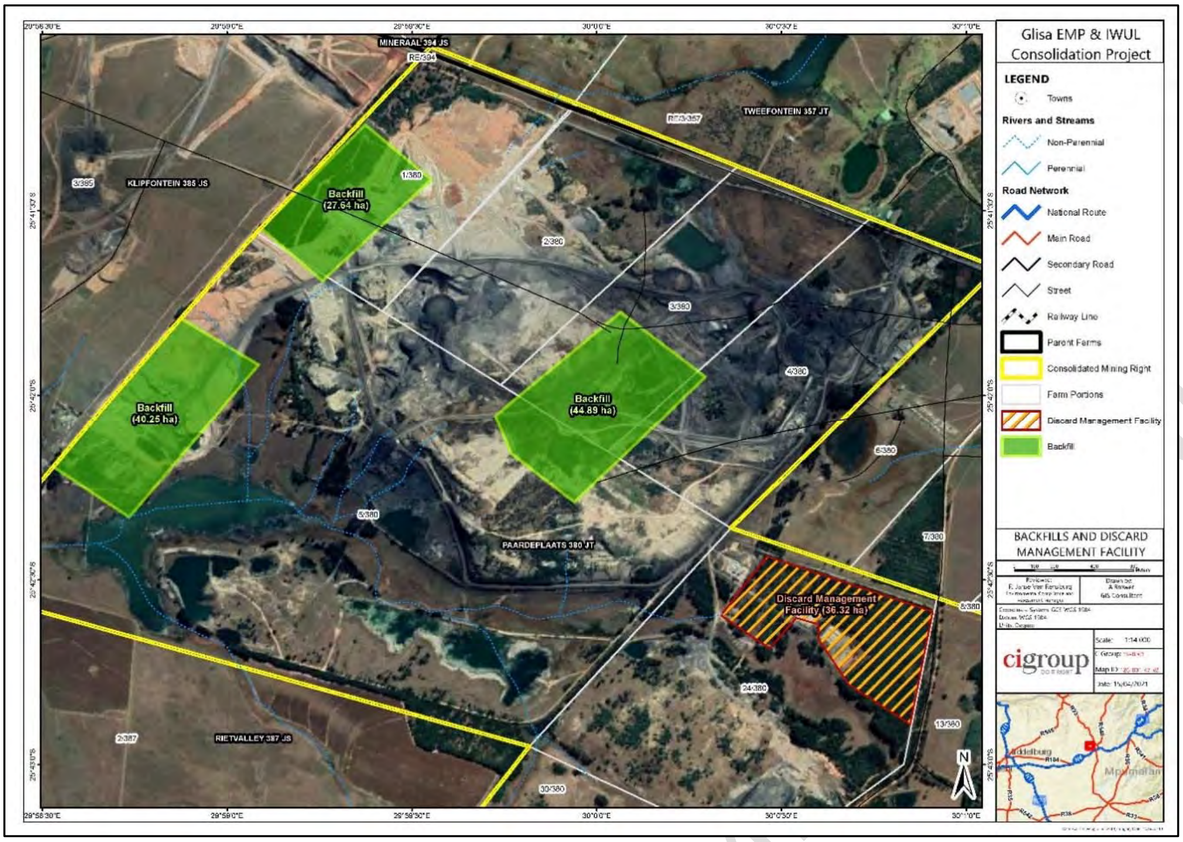

Figure 4.12: Proposed Backfill Areas in the Glisa Section and DMF on Portion 24.

Figure 4.13: Proposed Gravel Roads and Dewatering Pipeline in the Active and Planned Mining Areas.

4.2 Listed Activities

The Department of Environment, Fisheries and Forestry (DEFF) has, in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), developed a list of activities which are likely to have an impact on the environment. The Environmental Impact Assessment (EIA) Regulations, 2014 (GN R982), together with Listing Notice 1 (GN R983), Listing Notice 2 (GN R984) and Listing Notice 3 (GN R985) were published in 2014, and amended in 2017. Any activity which is listed under these notices requires an environmental assessment to be conducted and approved before the activity can proceed. Activities falling under Listing Notice 1 (GN R983) or Listing Notice 3 (GN R985) require a Basic Assessment (BA) to be conducted while any activity falling under Listing Notice 2 (GN R984) requires a full Scoping and Environmental Impact Reporting (S&EIR) process to be conducted.

The National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM:WA) provides for a licensing regime specific to waste management activities. It replaces the historical system of permits issued in terms of the repealed Section 20 of the Environmental Conservation Act, 1989 (Act No. 73 of 1989) (ECA). Transitional arrangements allow existing permits granted in terms of ECA to be regarded as licences in terms of the NEM:WA until the Minister requires a licence application as per the NEM:WA category of the waste management activity (i.e. category A or B). The NEM:WA waste management categories determine the environmental assessment procedure (which is the equivalent of the NEMA EIA regulations' requirements) required to obtain a licence. Category A activities require a BA process to be undertaken, whilst Category B activities require a S&EIR process to be undertaken.

The List Of Waste Management Activities That Have, Or Are Likely To Have, A Detrimental Effect On The Environment (GN R921), published in terms of the NEM:WA in 2013, as amended, provides details on Category A and B activities that require a Waste Management License (WML) in terms of the NEM:WA. Since the authorisation process is equivalent to the NEMA process, NBC include these activities herewith as an integrated application.

The Glisa Section has an approved MPRDA EMP for the Glisa Section and the WTP, approved by the DMRE on 06/12/2011 and 14/09/2016 respectively. The Glisa Section and the WTP are operated in terms of the approved EMPs. In addition, the Glisa Section has three (3) approved EAs, all issued by the Mpumalanga Department of Economic Development, Environment and Tourism (MDEDET), now the Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (MDARDLEA), all of which are still in force. The EAs and associated activities are noted as follows:

1. Glisa Section Section 24 G (17/2/3/G NK 13), issued on 03/09/2012 for Activity 7 of the NEMA EIA Regulations, 2006, Listing Notice (LN) Government Notice Regulation (GNR) 386;
2. Glisa Section Expansion (17/2/3N-4), issued on 04/07/2013, for Activities 22, 28, 39, and 47 of the NEMA EIA Regulations, 2010, LN 1 (GNR 544); and
3. Glisa WTP (17/2/3N-235), issued on 03/10/2014, for Activities 9, 11, 12, 13, 22, 23, 24, 28, 37, 39, and 49 of the NEMA EIA Regulations, 2010, LN 1 (GNR 544); and Activities 3, 5, and 19 of the NEMA EIA Regulations, 2010, LN 2 (GNR 545).

The Paardeplaats Section has an approved MPRDA EMP, approved by the DMRE on 18/12/2018, and the Section is operated in terms of that EMP. The approved MPRDA EMP includes the following listed activities:

1. Activities 9, 11, 12, 13, 22, 26, and 47 of the NEMA EIA Regulations, 2010, LN 1 (GNR 544);
2. Activities 5, 15, 19, and 20 the NEMA EIA Regulations, 2010, LN 2 (GNR 545); and
3. Activities 12, 14, and 16 of the NEMA EIA Regulations, 2010, LN 2 (GNR 546).

Identification of the Listed Activities (LAs) that are applicable to this application was determined after assessing the required developments for the Integrated Paardeplaats Section and then comparing these to the listed activities in the NEMA Listing Notices, GNR 983 (LN 1), GNR 984 (LN 2), and GNR 985 (LN 3), as amended, as well as GNR 921 of the NEM:WA, as amended. The LAs associated with the Integrated Paardeplaats Section are provided in **Table 4.1** and **Figure 4.14**.

In summary, the following LAs apply to this application:

6. GNR 983, LN 1: Activity 10, 12, 14, 19, 24, 45, 46, 48 and 56;
7. GNR 984, LN 2: Activity 6, 15, 17 and 19;
8. GNR 985, LN 3: Activity 10, 14 and 18;
9. GNR 921, Category B: Activity 1, 10 and 11; and
10. GNR 921, Category C: Activity 1.

Table 4.1: Listed Activities Being Applied For in terms of the NEMA and NEM:WA.

REGULATION & ACTIVITY NO.	LISTED ACTIVITY DESCRIPTION	DESCRIPTION	COMMENT	AUTHORISATION
GNR 983, LN 1 Activity 9	The development of infrastructure exceeding 1,000 metres in length for the bulk transportation of water or storm water- (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more; excluding where- (a) such infrastructure is for bulk transportation of water or storm water or storm water drainage inside a road reserve or railway line reserve; or (b) ~~where such development will occur within an urban area.~~	Trapezoidal and V-drain earth-lined channels with concrete pipe culverts required for the separation of clean water around the CSWP (Ptn 3 & 4 of 380 JT).	The culverts have an internal diameter of between 0.45 – 0.75 metres (m) and the channels a peak throughput of 380 – 1,374 litres per second (l/s), however the infrastructure itself is only ±700 m in length, so the LA is not triggered.	Not required
		High Density Poly-ethylene (HDPE) pipe required for the provision of potable water from the WTP to the new workshop, offices, and ablution facilities (Ptn 24 of 380 JT).	The pipeline is 1,245 m in length; however the pipe only has an internal diameter of 0.02 m, a peak throughput of 1.2 l/s, and is within a road reserve so the LA is not triggered.	Not required
		HDPE pipe required for the dewatering of the active mining area (Ptn 30 of 380 JT) and planned mining areas (Ptn 13, 28, 29 & 40 of 380 JT and Ptn RE & 2 of 425 JS).	The pipeline will be between 200 – 3,500 m in length depending on the opencast pit location; however the pipe only has an internal diameter of 0.2 m, a peak throughput of 60 l/s, and will	Not required

REGULATION & ACTIVITY NO.	LISTED ACTIVITY DESCRIPTION	DESCRIPTION	COMMENT	AUTHORISATION
			be within the road reserve of the haul roads so the LA is not triggered.	
GNR 983, LN 1 Activity 10	The development and related operation of infrastructure exceeding 1,000 metres 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 metres or more; or (ii) with a peak throughput of 120 litres per second or more; excluding where- (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 ~~(b) where such development will occur within an urban area.~~	Trapezoidal and V-drain concrete-lined channels with concrete pipe culverts required for the capture of dirty water within the CSWP (Ptn 3 & 4 of 380 JT).	The culverts have an internal diameter of between 0.45 – 0.75 m and the channels a peak throughput of 90 – 2,243 l/s, and the infrastructure itself is ±1,620 m in length, so the LA is triggered.	Required
		Trapezoidal and V-drain concrete-lined channels with concrete pipe culverts required for the capture of dirty water within the new plant, ROM pad, and workshop area (Ptn 24 of 380 JT).	The culverts have an internal diameter of between 0.3 – 1.05 m and the channels a peak throughput of 145 – 3,251 l/s, and the infrastructure itself is ±3,175 m in length, so the LA is triggered.	Required
		HDPE pipe required for the routing of dirty water from the PCD to the WTP (Ptn 24 of 380 JT).	The pipeline has an internal diameter of 0.18 m, a peak throughput of 19.0 l/s, is within a road reserve, and the infrastructure itself is	Not required

REGULATION & ACTIVITY NO.	LISTED ACTIVITY DESCRIPTION	DESCRIPTION	COMMENT	AUTHORISATION
			±290 m in length, so the LA is not triggered.	
GNR 983, LN 1 Activity 11	The development of facilities or infrastructure for the transmission and distribution of electricity- (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts; or ~~(ii) inside urban areas or industrial complexes with a capacity of 275 kilovolts or more;~~ ~~excluding the development of bypass infrastructure for the transmission and distribution of electricity where such bypass infrastructure is-~~ ~~(a) temporarily required to allow for maintenance of existing infrastructure;~~ ~~(b) 2 kilometres or shorter in length;~~ ~~(c) within an existing transmission line servitude; and~~	Overhead transmission power line re-routing to ensure that the footprint of the PCD at the CSWP is clear (Ptn 3 & 4 of 380 JT).	The overhead transmission power line is ±430 m in length, occurs outside an urban area, and has a capacity of 11 kilovolts (kV), so the LA is not triggered.	Not required
		Overhead transmission power line required to provide power to the workshop and plant (Ptn 24 of 380 JT).	The overhead transmission power line is ±735 m in length, occurs outside an urban area, and has a capacity of 11 kV, so the LA is not triggered.	Not required

REGULATION & ACTIVITY NO.	LISTED ACTIVITY DESCRIPTION	DESCRIPTION	COMMENT	AUTHORISATION
	(d) ~~will be removed within 18 months of the commencement of development.~~			
GNR 983, LN 1 Activity 12	The development of- (i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or (ii) infrastructure or structures with a physical footprint of 100 square metres or more;	PCD and ROM pads at the CSWP (Ptn 3 & 4 of 380 JT).	The PCD and ROM pads all exceed 100 square metres (m^2), however they do not occur within a water course, in front of a development setback, or within 32 m of a water course measured from the edge of a watercourse, so the LA is not triggered.	Not required
	where such development occurs- (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;- ~~excluding-~~	New ROM pad and workshop area (Ptn 24 of 380 JT).	The new ROM pad and workshop area exceed 100 m^2, however they do not occur within a water course, in front of a development setback, or within 32 m of a water course measured from the edge of a watercourse, so the LA is not triggered.	Not required
	~~(aa) the development of infrastructure or structures within existing ports or harbours that will not increase the~~	New plant, PCD and Discard Management Facility (DMF) areas (Ptn 24 of 380 JT).	The new plant, PCD, and DMF areas exceed 100 m^2, and they occur within 32 m of a water course measured	Required

REGULATION & ACTIVITY NO.	LISTED ACTIVITY DESCRIPTION	DESCRIPTION	COMMENT	AUTHORISATION
	~~development footprint of the port or harbour;~~		from the edge of a watercourse, so the LA is triggered.	
	~~(bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies;~~ ~~(cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14~~	New HDPE pipes required for the routing of dirty water from the PCD to the WTP (Ptn 24 of 380 JT).	The new pipelines will exceed 100 m², and they occur within 32 m of a water course measured from the edge of a watercourse, so the LA is triggered.	Required
	~~in Listing Notice 3 of 2014, in which case that activity applies;~~ ~~(dd) where such development occurs within an urban area;~~ ~~(ee) where such development occurs within existing roads, road reserves or~~	New conveyor belt (Ptn 4 & 5 of 380 JT) between the active mining area (Ptn 30 of 380 JT) and the CSWP (Ptn 3 & 4 of 380 JT).	The new conveyor belt exceeds 100 m² and occurs within 32 m of a water course measured from the edge of a watercourse, so the LA is triggered.	Required
	~~railway line reserves; or~~ ~~(ff) the development of temporary infrastructure or structures where such infrastructure or structures will be removed within 6 weeks of the commencement of development and where indigenous vegetation will not be cleared.~~	Haul roads and road realignment within the active mining area (Ptn 30 of 380 JT), infrastructure area (Ptn 24 of 380 JT), and planned mining areas (Ptn 13, 28, 29 & 40 of 380 JT and Ptn RE & 2 of 425 JS).	The haul roads and road realignment exceed 100 m² and occur both within a water course and within 32 m of a water course measured from the edge of a watercourse, so the LA is triggered.	Required

REGULATION & ACTIVITY NO.	LISTED ACTIVITY DESCRIPTION	DESCRIPTION	COMMENT	AUTHORISATION
GNR 983, LN 1 Activity 13	The development of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50 000 cubic metres or more, unless such storage falls within the ambit of activity 16 in Listing Notice 2 of 2014.	The new PCD at the CSWP (Ptn 3 & 4 of 380 JT) and the new PCD (Ptn 24 of 380 JT).	The combined capacity of the new PCDs is 48,000 m^3, so the LA is not triggered.	Not required
GNR 983, LN 1 Activity 14	The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres.	The new emulsion silo, plant, and workshop areas (Ptn 24 of 380 JT).	The new emulsion silo, plant, and workshop area have a combined capacity of 80 m^3 or more but do not exceed 500 m^3, so the LA is triggered.	Required
GNR 983, LN 1 Activity 19	The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles, or rock of more than 10 cubic metres from a watercourse; ~~but excluding where such infilling, depositing, dredging, excavation, removal or moving~~ ~~(a) will occur behind a development setback;~~	Haul roads and road realignment within the active mining area (Ptn 30 of 380 JT), infrastructure area (Ptn 24 of 380 JT), and planned mining areas (Ptn 13, 28, 29 & 40 of 380 JT and Ptn RE & 2 of 425 JS).	The haul roads and road realignment will result in the removal or moving of soil or rock of more than 10 m^3 from a watercourse, so the LA is triggered.	Required

REGULATION & ACTIVITY NO.	LISTED ACTIVITY DESCRIPTION	DESCRIPTION	COMMENT	AUTHORISATION
	~~(b) is for maintenance purposes undertaken in accordance with a maintenance management plan;~~ ~~(c) falls within the ambit of activity 21 in this Notice, in which case that activity applies;~~ ~~(d) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or~~ (e) ~~where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies.~~			
GNR 983, LN 1 Activity 24	The development of a road- ~~(i) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or~~ (ii) with a reserve wider than 13,5 meters, or where no reserve	Haul roads and road realignment within the active mining area (Ptn 30 of 380 JT), infrastructure area (Ptn 24 of 380 JT), and planned mining areas (Ptn 13, 28, 29 & 40 of 380 JT and Ptn RE & 2 of 425 JS).	The haul roads and road realignment that will be developed will be wider than 8 m and jointly longer than 1 km, so the LA is triggered.	Required

REGULATION & ACTIVITY NO.	LISTED ACTIVITY DESCRIPTION	DESCRIPTION	COMMENT	AUTHORISATION
	exists where the road is wider than 8 metres; but excluding a road- ~~(a) which is identified and included in activity 27 in Listing Notice 2 of 2014;~~ ~~(b) where the entire road falls within an urban area; or~~ (c) which is 1 kilometre or shorter.			
GNR 983, LN 1 Activity 30	Any process or activity identified in terms of section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).	Mining activities and infrastructure on all portions (Ptn 13, 24, 28, 29 & 40 of 380 JT and Ptn RE & 2 of 425 JS) within an identified threatened ecosystem (i.e. the Eastern Highveld Grassland) as published in terms of section 52(1)(a) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA).	No threatening activities in terms of section 53(1) of the NEM:BA have been published in relation to the Eastern Highveld Grassland, so the LA is not triggered.	Not required
GNR 983, LN 1 Activity 45	The expansion of infrastructure for the bulk transportation of water or storm water where the existing infrastructure-	Future earth-lined channels with concrete pipe culverts required for the separation	It is likely that expansions within the next five (5) years will meet the criteria of this	Required

REGULATION & ACTIVITY NO.	LISTED ACTIVITY DESCRIPTION	DESCRIPTION	COMMENT	AUTHORISATION
	(i) has an internal diameter of 0,36 metres or more; or (ii) has a peak throughput of 120 litres per second or more; and (a) where the facility or infrastructure is expanded by more than 1 000 metres in length; or ~~(b) where the throughput capacity of the facility or infrastructure will be increased by 10% or more;~~ ~~excluding where such expansion-~~ ~~(aa) relates to transportation of water or storm water within a road reserve or railway line reserve; or~~ ~~(bb) will occur within an urban area.~~	of clean water around the active mining area (Ptn 30 of 380 JT), the infrastructure area (Ptn 24 of 380 JT), and planned mining areas (Ptn 13, 28, 29 & 40 of 380 JT and Ptn RE & 2 of 425 JS), as well as HDPE pipes required for the provision of potable water from the WTP to future office/workshop facilities on the same portions.	LA, therefore the LA is triggered.	
GNR 983, LN 1 Activity 46	The expansion and related operation of infrastructure for the bulk transportation of sewage, effluent, process water, wastewater, return water, industrial discharge, or slimes where the existing infrastructure- (i) has an internal diameter of 0,36 metres or more; or (ii) has a peak throughput of 120 litres per second or more;	Future concrete-lined channels with concrete pipe culverts required for the capture of dirty water the active mining area (Ptn 30 of 380 JT), the infrastructure area (Ptn 24 of 380 JT), and planned mining areas (Ptn 13, 28, 29 & 40 of 380 JT and Ptn RE & 2 of 425 JS),	It is likely that expansions within the next five (5) years will meet the criteria of this LA, therefore the LA is triggered.	Required

REGULATION & ACTIVITY NO.	LISTED ACTIVITY DESCRIPTION	DESCRIPTION	COMMENT	AUTHORISATION
	and (a) where the facility or infrastructure is expanded by more than 1 000 metres in length; or ~~(b) where the throughput capacity of the facility or infrastructure will be increased by 10% or more;~~ ~~excluding where such expansion-~~ ~~(aa) relates to the bulk transportation of sewage, effluent, process water, wastewater, return water, industrial discharge or slimes within a road reserve or railway line reserve; or~~ ~~(bb) will occur within an urban area.~~	as well as HDPE pipes required for the routing of dirty water from the active mining area (Ptn 30 of 380 JT) area (Ptn 30 of 380 JT) and planned mining areas (Ptn 13, 28, 29 & 40 of 380 JT and Ptn RE & 2 of 425 JS) to the WTP.		
GNR 983, LN 1 Activity 48	The expansion of- (i) infrastructure or structures where the physical footprint is expanded by 100 square metres or more; or (ii) dams or weirs, where the dam or weir, including infrastructure and water surface area, is expanded by 100 square metres or more; where such expansion occurs-	Pipeline expansion throughout the active mining area (Ptn 30 of 380 JT) area (Ptn 30 of 380 JT) and planned mining areas (Ptn 13, 28, 29 & 40 of 380 JT and Ptn RE & 2 of 425 JS).	It is likely that expansions within the next five (5) years will meet the criteria of this LA, therefore the LA is triggered.	Required

REGULATION & ACTIVITY NO.	LISTED ACTIVITY DESCRIPTION	DESCRIPTION	COMMENT	AUTHORISATION
	(a) within a watercourse; (b) in front of a development setback; or (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; ~~excluding-~~ ~~(aa) the expansion of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour;~~ ~~(bb) where such expansion activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies;~~ ~~(cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 23 in Listing Notice 3 of 2014, in which case that activity applies;~~ ~~(dd) where such expansion occurs within an urban area; or~~			

REGULATION & ACTIVITY NO.	LISTED ACTIVITY DESCRIPTION	DESCRIPTION	COMMENT	AUTHORISATION
	~~(ee) where such expansion occurs within existing roads, road reserves or railway line reserves.~~			
GNR 983, LN 1 Activity 56	The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre- (i) where the existing reserve is wider than 13,5 meters; or (ii) where no reserve exists, where the existing road is wider than 8 metres; ~~excluding where widening or lengthening occur inside urban areas.~~	The widening and lengthening of existing haul roads between the infrastructure area (Ptn 24 of 380 JT) and the CSWP (Ptn 3 & 4 of 380 JT).	Existing haul roads which have a reserve of wider than 13.5 m or, where no reserve exists, are wider than 8 m, will be widened by more than 6 m or lengthened by more than 1 km, so the LA is triggered	Required
GNR 984, LN 2 Activity 6	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, excluding- ~~(i) activities which are identified and included in Listing Notice 1 of 2014;~~ ~~(ii) activities which are included in the list of waste management~~	Integrated Water Use License (IWUL) application for anticipated future amendments or new IWUL applications relating to the Glisa Section (Ptn 1, 2, 3, 4 & 5 of 380 JT), the active mining area (Ptn 30 of 380 JT), the infrastructure area (Ptn 24 of 380 JT), and planned mining areas (Ptn	It is likely that amendments and/or new applications within the next five (5) years will meet the criteria of this LA, therefore the LA is triggered.	Required

REGULATION & ACTIVITY NO.	LISTED ACTIVITY DESCRIPTION	DESCRIPTION	COMMENT	AUTHORISATION
	~~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;~~ ~~(iii) the development of facilities or infrastructure for the treatment of effluent, polluted water, wastewater, or sewage where such facilities have a daily throughput capacity of 2 000 cubic metres or less; or~~ ~~(iv) where the development is directly related to aquaculture facilities or infrastructure where the wastewater discharge capacity will not exceed 50 cubic metres per day.~~	13, 28, 29 & 40 of 380 JT and Ptn RE & 2 of 425 JS).		
GNR 984, LN 2 Activity 15	The clearance of an area of 20 hectares or more of indigenous vegetation, excluding	Vegetation clearance within the active mining area (Ptn 30 of 380 JT), the	An area of 20 ha or more of indigenous vegetation will be cleared to establish	Required

REGULATION & ACTIVITY NO.	LISTED ACTIVITY DESCRIPTION	DESCRIPTION	COMMENT	AUTHORISATION
	where such clearance of indigenous vegetation is required for- (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.	infrastructure area (Ptn 24 of 380 JT), and planned mining areas (Ptn 13, 28, 29 & 40 of 380 JT and Ptn RE & 2 of 425 JS).	infrastructure and mine the various portions, so the LA is triggered.	
GNR 984, LN 2 Activity 17	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- (a) associated infrastructure, structures, and earthworks, directly related to the extraction of a mineral resource; or (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,	Consolidation of the Glisa Section and Paardeplaats Section MRs as well as the inclusion of Ptn 24 of 380 JT into the consolidated MR.	A Section 102 application for the consolidation of the Glisa MR into the Paardeplaats MR for the farm Paardeplaats 380JT, Ptn 1, 2, 3, 4, 5, 13, 24, 28, 29, 30 & 40; and the farm Paardeplaats 425JS, Ptn 2 & RE, requiring the issuance of the Integrated Paardeplaats Section MR (MP 30/5/1/2/2/10090 MR), so the LA is triggered.	Required

REGULATION & ACTIVITY NO.	LISTED ACTIVITY DESCRIPTION	DESCRIPTION	COMMENT	AUTHORISATION
	calcining, or gasification of the mineral resource in which case activity 6 in this Notice applies.			
GNR 984, LN 2 Activity 19	The removal and disposal of minerals contemplated in terms of section 20 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including- (a) associated infrastructure, structures, and earthworks, directly related to prospecting of a mineral resource; or (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 current (Ptn 30 of 380 JT) and planned (Ptn 13, 28, 29 & 40 of 380 JT and Ptn RE & 2 of 425 JS) opencast mining activities, the placement of discard material from the CSWP into existing opencast pits as backfill (Ptn 1, 3, 4 & 5 of 380 JT), as well as the placement of discard at the DMF (Ptn 24 of 380 JT).	The active and planned opencast mining and the discard material from the CSWP are to be used for backfill in opencast pits as well as disposed of in an above-surface DMF on Portion 24, so the LA is triggered.	Required
GNR 985, LN 3 Activity 10	The development and related operation of facilities or infrastructure for the storage,	The infrastructure area on Ptn 24 of 380 JT.	The Integrated Paardeplaats Section is located in a	Required

REGULATION & ACTIVITY NO.	LISTED ACTIVITY DESCRIPTION	DESCRIPTION	COMMENT	AUTHORISATION
	or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres. f. Mpumalanga i. Outside urban areas: ~~(aa) A protected area identified in terms of NEMPAA, excluding conservancies;~~ ~~(bb) National Protected Area Expansion Strategy Focus areas;~~ (cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; ~~(dd) Sites or areas identified in terms of an international convention;~~ (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; ~~(ff) Core areas in biosphere reserves;~~ ~~(gg) Areas within 10 kilometres from national parks or world heritage sites~~		Critical Biodiversity Area (CBA), so the LA is not triggered.	

REGULATION & ACTIVITY NO.	LISTED ACTIVITY DESCRIPTION	DESCRIPTION	COMMENT	AUTHORISATION
	~~or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, where such areas comprise indigenous vegetation; or~~ (hh) Areas within a watercourse or wetland, or within 100 metres of a watercourse or wetland; ~~or~~ ~~ii. Inside urban areas:~~ ~~(aa) Areas zoned for use as public open space; or~~ ~~(bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority or zoned for a conservation purpose.~~			
GNR 985, LN 3 Activity 14	The development of- (i) dams or weirs, where the dam or weir, including infrastructure and water surface area exceeds 10 square metres; or (ii) infrastructure or structures with a physical footprint of 10 square metres or more;	The PCD and ROM pads at the CSWP (Ptn 3 & 4 of 380 JT), the new infrastructure area and DMF (Ptn 24 of 380 JT), new HDPE pipes required for the routing of dirty water from the PCD to the WTP (Ptn 24 of 380 JT), new conveyor	No EMF has been adopted for the Mpumalanga Province and the plant is not located in a CBA, however the active and future mining areas fall within CBAs, so the LA is triggered.	Required

REGULATION & ACTIVITY NO.	LISTED ACTIVITY DESCRIPTION	DESCRIPTION	COMMENT	AUTHORISATION
	where such development occurs- (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse; excluding the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour. f. Mpumalanga i. Outside urban areas: ~~(aa) A protected area identified in terms of NEMPAA, excluding conservancies;~~ ~~(bb) National Protected Area Expansion Strategy Focus areas;~~ ~~(cc) World Heritage Sites;~~ (dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter	belt between the active mining area (Ptn 30 of 380 JT) and the CSWP (Ptn 4 & 5 of 380 JT), and haul roads within the active (Ptn 30 of 380 JT) and planned (Ptn 13, 28, 29 & 40 of 380 JT and Ptn RE & 2 of 425 JS) mining areas.		

REGULATION & ACTIVITY NO.	LISTED ACTIVITY DESCRIPTION	DESCRIPTION	COMMENT	AUTHORISATION
	5 of the Act and as adopted by the competent authority; ~~(ee) Sites or areas identified in terms of an international convention;~~ (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; ~~(gg) Core areas in biosphere reserves; or~~ ~~(hh) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve, where such areas comprise indigenous vegetation; or~~ ~~ii. Inside urban areas:~~ ~~(aa) Areas zoned for use as public open space; or~~ ~~(bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the~~			

REGULATION & ACTIVITY NO.	LISTED ACTIVITY DESCRIPTION	DESCRIPTION	COMMENT	AUTHORISATION
	~~competent authority, zoned for a conservation purpose.~~			
GNR 985, LN 3 Activity 18	The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre. f. Mpumalanga i. Outside urban areas: ~~(aa) A protected area identified in terms of NEMPAA, excluding conservancies;~~ ~~(bb) National Protected Area Expansion Strategy Focus areas;~~ (cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; ~~(dd) Sites or areas identified in terms of an international convention;~~ (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; ~~(ff) Core areas in biosphere reserves; or~~	Haul roads and road realignment within the active mining area (Ptn 30 of 380 JT), the infrastructure area (Ptn 24 of 380 JT), and the planned mining area (Ptn 13, 28, 29 & 40 of 380 JT and Ptn RE & 2 of 425 JS).	No EMF has been adopted for the Mpumalanga Province and the plant is not located in a CBA, however the haul roads and road realignment fall within CBAs, so the LA is triggered.	Required

REGULATION & ACTIVITY NO.	LISTED ACTIVITY DESCRIPTION	DESCRIPTION	COMMENT	AUTHORISATION
	~~(gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve, where such areas comprise indigenous vegetation; or~~ ~~ii. Inside urban areas:~~ ~~(aa) Areas zoned for use as public open space; or~~ ~~(bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority or zoned for a conservation purpose.~~			
GNR 921, Category B Activity 1	Storage of hazardous waste (1) The storage of hazardous waste in lagoons excluding storage of effluent, wastewater, or sewage.	PCD at the CSWP (Ptn 3 & 4 of 380 JT) and the PCD on Ptn 24 of 380 JT.	PCDs are considered by the DMRE to trigger this activity, so the LA is triggered.	Required
GNR 921, Category B Activity 10	Construction of facilities and associated structures and infrastructure (10) The construction of a facility for a waste management activity listed in Category B of this Schedule (not in isolation to	ROM pads (Ptn 4 & 24 of 380 JT) and the DMF (Ptn 24 of 380 JT).	The ROM pads will contain stockpiles which is a listed activity in Category B, as is the construction of the DMF, so the LA is triggered.	Required

REGULATION & ACTIVITY NO.	LISTED ACTIVITY DESCRIPTION	DESCRIPTION	COMMENT	AUTHORISATION
	associated waste management activity).			
GNR 921, Category B Activity 11	Residue stockpiles or residue deposits (11) 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 Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).	The DMF on Ptn 24 of 380 JT.	The DMF is resultant from activities which require a mining right, so the LA is triggered.	Required
GNR 921, Category C Activity 1	Storage of waste (1) The storage of general waste at a facility that has the capacity to store in excess of 100 m³ of general waste at any one time, excluding the storage of waste in lagoons or temporary storage of such waste. (2) The storage of hazardous waste at a facility that has the capacity to store in excess of 80 m³ of hazardous waste at	General and hazardous waste storage at the plant and workshop on Ptn 24 of 380 JT.	Waste storage areas have the capacity to store in excess of 100 m^3 of general waste or 80 m^3 of hazardous waste at any one time, so the LA is triggered, and the relevant Norms and Standards apply.	Required

REGULATION & ACTIVITY NO.	LISTED ACTIVITY DESCRIPTION	DESCRIPTION	COMMENT	AUTHORISATION
	any one time, excluding the storage of hazardous waste in lagoons or temporary storage of such waste.			

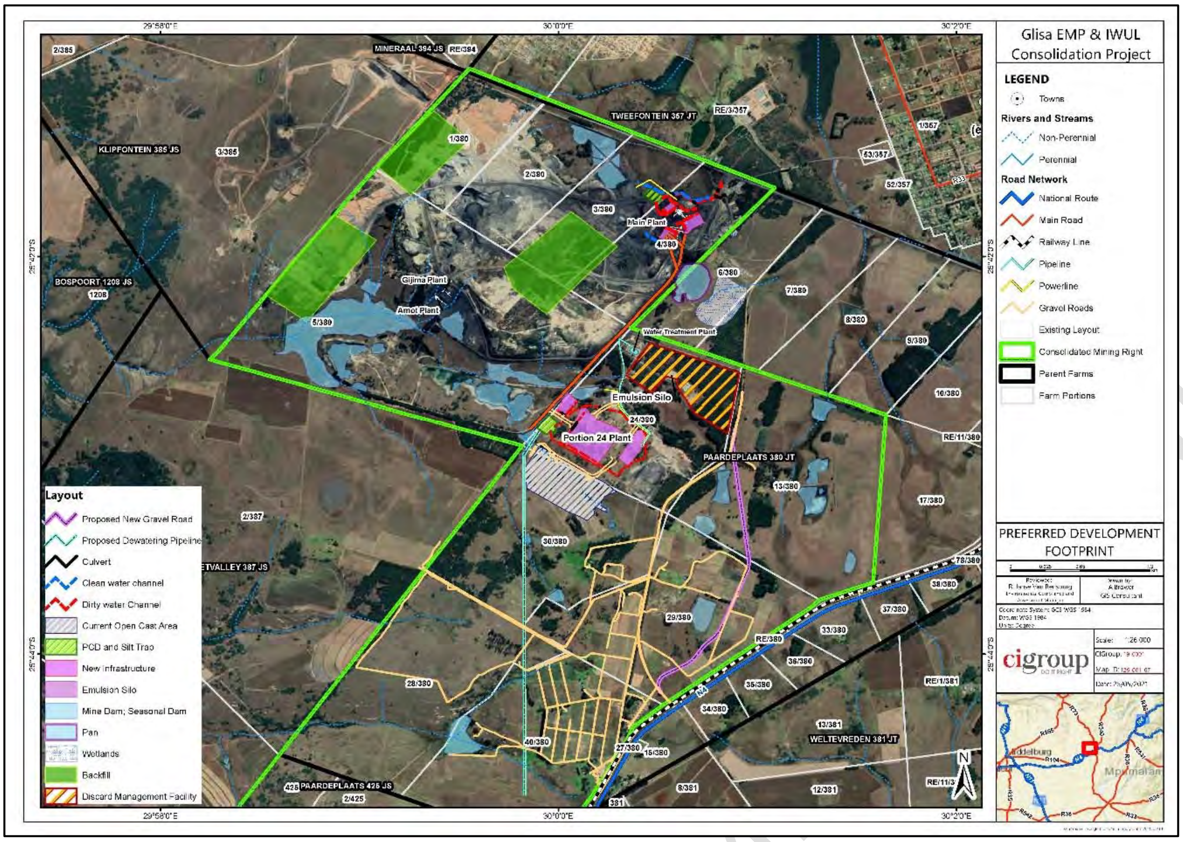

Figure 4.14: Location of Listed Activities.

5 POLICY AND LEGISLATIVE CONTEXT

The Glisa and Paardeplaats Sections Consolidation Project triggers requirements under the various Acts, Regulations, and guidelines. In summary, the legislation and guidelines presented in **Table 5.1** were used or considered to compile this report.

Table 5.1: Legislation and Guidelines Used to Compile Report.

LEGISLATION AND/OR GUIDELINES USED	REFERENCE WHERE APPLIED
Constitution of South Africa, 1996	Throughout document. Open and participatory consultation followed.
Mineral and Petroleum Resources Development Act, 2002	Throughout document. Informed by findings of specialist assessments. This application process.
National Water Act, 1998 • Regulations on Use of Water for Mining and Related Activities Aimed at The Protection of Water Resources, 1999	Throughout document. Informed by findings of specialist assessments. Separate application process undertaken.

LEGISLATION AND/OR GUIDELINES USED	REFERENCE WHERE APPLIED
Environmental Conservation Act, 1989	Throughout document. Informed by findings of specialist assessments.
National Environmental Management Act, 1998 • EIA Regulations, 2014 (as amended) • Financial Provisioning Regulations, 2015 (as amended)	Throughout document. Informed by findings of specialist assessments. This application process.
National Environmental Management: Waste Act, 2008 • List of Waste Management Activities That Have, or are Likely to Have, A Detrimental Effect on the Environment, 2013 (as amended) • Waste Classification and Management Regulations, 2013 • National Norms and Standards for the Assessment of Waste for Landfill Disposal, 2013 • National Norms and Standards for Disposal of Waste to Landfill, 2013	Throughout document. Informed by findings of specialist assessments. This application process.
National Environmental Management: Biodiversity Act, 2004 • Threatened or Protected Species Regulations, 2007 (as amended) • Alien and Invasive Species Regulations, 2020 (as amended) • Alien and Invasive Species Lists, 2020	Throughout document. Informed by findings of specialist assessments. Separate application process may be required.
National Environmental Management: Air Quality Act, 2004 • National Dust Control Regulations, 2013	Throughout document. Informed by findings of specialist assessments. No application process required.
National Heritage Resources Act, 1999	Throughout document. Informed by findings of specialist assessments. Separate application process may be required.
Mpumalanga Nature Conservation Act, 1998	Throughout document. Informed by findings of specialist assessments. Separate application process may be required.

The legislative context for the environmental licensing process is provided herewith.

5.1 Constitution of South Africa, 1996 (Act No. 108 of 1996)

The Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996) is the supreme act to which all other acts must speak to. The Constitution sets out the rights for every citizen of South

Africa and aims to address past social injustices. With respect to the environment, Section 24 of the constitution states that:

> *"Everyone has the right:*
>
> *a) To an environment that is not harmful to their health or well-being; and*
>
> *b) To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:*
>
> *i. Prevent pollution and ecological degradation;*
>
> *ii. Promote conservation; and*
>
> *iii. Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development".*

All companies are thus duty-bound to constitutional, legislative, and other measures to prevent pollution and ecological degradation, promote conservation and to develop in a sustainable manner. The constitutional environmental right elevates the importance of environmental protection and conservation and emphasises the significance that South Africans attach to a sound and healthy environment. The constitution also establishes the idea of the Polluter Pays Principal and is simply that the party responsible for pollution of the environment remains responsible for financial reparations of the impacts from their activities.

5.2 Mineral And Petroleum Resources Development Act (Act No. 28 of 2002)

An application in terms of Section 102 of the MPRDA is required in order to formally include Portion 24 of the farm Paardeplaats 380 JT into the Integrated Paardeplaats Section MR, as well as to consolidate the Glisa and Paardeplaats Sections MRs and EMPs. Section 102 of the MPRDA pertains to the amendment of rights, permits, programmes and plans, and states that a reconnaissance permission, prospecting right, mining right, mining permit, retention permit, technical corporation permit, reconnaissance permit, exploration right, production right, prospecting work programme, exploration work programme, production work programme, mining work programme, environmental management programme or an environmental authorisation issued in terms of the NEMA, as the case may be, may not be amended or varied (including by extension of the area covered by it or by the additional of minerals or a shares or seams, mineralised bodies or strata, which are not at the time the subject thereof) without the written consent of the Minister.

The IEA application for EA and WML will result in the development of a legally binding Environmental Management Plan (EMP) for the Integrated Paardeplaats Section. This EMP and supporting documents will be used in support of the Section 102 application. The Competent Authority for this Application is the DMRE, eMalahleni Office.

5.3 National Water Act (Act No. 36 of 1998)

One of the main and ever-continuing concerns in South Africa is the sustainability of water management, and the costs associated with the prevention and remediation of pollution in a country with an average rainfall far below international standard. The National Water Act, 1998 (Act No. 36 of 1998) (NWA) is one of the government's answers to some of these challenges and functions as sectoral legislation within the framework of the NEMA.

The NWA aims to ensure the protection and sustainable use of South Africa's water resources. The three main pillars of the NWA are sustainability, equity, and efficiency. The NWA provides for a Section 21 Water Use License (WUL) which a company will have to apply for, before commencing with any water use related activities. Various conditions may be attached to these licenses and a breach thereof will result in criminal and civil liability. The conditions attached to water use authorisations will function alongside the additional protective measures, duty of care and statutory liability provisions provided by the NWA and other legislation to regulate a whole array of water issues.

Section 19 of the NWA mirrors the provision of Section 28 of NEMA and addresses the prevention and remediation of the effects of pollution through the Polluter Pays Principle. The NWA provides a wide duty of care in that:

> *"(1) an owner of land, a person in control of land or a person who occupies or uses the land on which:*
>
> *a) any activity or process is or was performed or undertaken; or*
>
> *b) any other situation exists, which causes, has caused or is likely to cause pollution of a water resource must take all reasonable measures to prevent any such pollution from occurring, continuing, or recurring."*

According to NWA, water may not be used without prior authorisation from the leading authority, in this case the DHSWS. Due to the requirements of the NWA, an IWUL and IWWMP needs to be compiled and submitted to the DHSWS for authorisation to ensure the legality of the proposed water uses.

Sections 40 and 42 of NWA provides for the responsible authority to request public participation and an assessment of the likely effect of the proposed licence the protection, use, development, conservation, management, and control of the water resource. The NWA defines 11 consumptive and non-consumptive water uses in terms of Section 21 of the NWA:

- Section 21(a): Taking water from a water resource;
- Section 21(b): Storing water;

- Section 21(c): Impeding or diverting the flow of water in a watercourse;
- Section 21(d): Engaging in a stream flow reduction activity;
- Section 21(e): Engaging in a controlled activity: irrigation of any land with waste or water containing waste;
- Section 21(f): Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, or other conduit;
- Section 21(g): Disposing of waste in a manner which may detrimentally impact on a water resource;
- Section 21(h): Disposing in any manner of water which contains waste from, or which has been heated in any industrial or power generation process;
- Section 21(i): Altering the bed, banks, course, or characteristics of a watercourse;
- Section 21(j): Removing, discharging, or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people;
- Section 21(k): Using water for recreational purposes.

Water uses that are not permissible in terms of Schedule 1 of the NWA need to be authorised under a tiered authorisation system as a General Authorisation in terms of the General Authorisations as published under Section 39 of the NWA or as a water use licence, as provided for in terms of section 21 of the NWA. The authorisation system allows for the "Reserve" and provides for public consultation processes in the establishment of strategies and decision making and guarantees the right to appeal against such decision.

NBC holds two (2) Integrated Water Use Licenses (IWULs) in terms of the NWA, one for each of the Sections. The Paardeplaats Section IWUL is valid for a period of twenty (20) years until 21 February 2039, and the Glisa Section IWUL is valid for a period of twenty (20) years until 4 October 2040. NBC are authorised by the DHSWS to undertake the following NWA Section 21 water uses:

- **Glisa Section (License No.: 06/B41A/ABCFGIJ/1002; File No.: 27/2/2/B141/3/9)**
  - Section 21(a): taking water from a water resource;
  - Section 21(b): storing water;
  - Section 21(c) & 21(i): impeding or diverting the flow of water in a watercourse and altering the bed, banks, course, or characteristics of a watercourse;
  - Section 21(f): discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
  - Section 21(g): disposing of waste in a manner which may detrimentally impact on a water resource; and
  - Section 21(j): removing, discharging, or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.

- **Paardeplaats Section (06/B41A/CGIJ/8880)**
  - Section 21(c) & (i): impeding or diverting the flow of water in a watercourse and altering the bed, banks, course or characteristics of a watercourse;
  - Section 21(g): disposing of waste in a manner which may detrimentally impact on a water resource; and
  - Section 21(j): removing of water found underground for the efficient continuation of an activity or for the safety of people.

5.3.1 Regulations on Use of Water for Mining and Related Activities Aimed at The Protection of Water Resources

The Regulations on Use of Water for Mining and Related Activities Aimed at The Protection of Water Resources (GN 704) was published in 1999. The Notice was published in terms of Section 26 (1), (b), (g) and (i) of the NWA (DWAF, 1999). Regulation 3 of GNR 704 states that "*The Minister may in writing authorise an exemption from the requirements of regulations 4, 5, 6, 7, 8, 10 or 11 on his or her own initiative or on application, subject to such conditions as the Minister may determine.*" The Glisa Section was previously granted with exemption from GN 704 Regulation 4(a) and 4(c) for the areas presented in **Table 5.2**.

Table 5.2: GNR 704 Exemptions Granted for the Glisa Section.

AREA	DESCRIPTION OF GNR 704 Regulation
Mahim Dam	4(a): Locate or place any residue deposit, dam, reservoir, together with any associated structure within 1:100 year flood-line or within a horizontal distance of 100 m of a watercourse or borehole, excluding boreholes drilled specifically to monitor the pollution of groundwater, or on ground likely to become water-logged, undermined, unstable or cracked.
Blue Gum Dam	
Blesbok Pit	4(c): place or dispose of any residue or substance which causes or is likely to cause pollution of a water resource, in the workings of any underground or opencast mine excavation, prospecting diggings, pit or any other excavation.

5.4 Environment Conservation Act (Act No. 73 of 1989)

The Environment Conservation Act, 1989 (Act No. 73 of 1989) (ECA) has now largely been replaced by the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) but certain provisions, general policies, and regulations still remain in force.

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

The NEMA provides the framework environmental legislation and establishes an integrated environmental management system for South Africa. It aims to prevent pollution and degradation of South Africa's natural environments while promoting sustainable economic and social development.

Central to NEMA is the idea of Integrated Environmental Management (IEM). IEM seeks to:

- Promote the integration of the principles of environmental management into the making of all decisions;
- Identify, predict, and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage, the risks and consequences and alternatives and options for mitigation of activities, with a view to minimising negative impacts, maximising benefits, and promoting compliance with Section 2 principles; and
- Ensure that the effects of activities on the environment receive adequate consideration before actions are taken in connection with them.

Any decision taken in respect of an application for environmental authorisation should consider the principles as set out in Section 2 of NEMA. The principles include:

- <u>The Polluter Pays Principle:</u> The Polluter Pays Principle means that "polluters and users of natural resources (should) bear the full environmental and social costs of their activities". The Polluter Pays Principle can also be described as an economic principle that requires the polluter to be held liable to compensate or pay for pollution prevention, minimisation, and remediation. Therefore, the crux of the principle is to impose economic obligations when environmental damage is caused by a polluter and this is achieved by setting minimum rules on liability for environmental damage.
- <u>The Precautionary Principle</u>: The Precautionary Principle provides guidance during development or when anything occurs which might harm the environment and where there is scientific uncertainty. NEMA stipulates and requires "a risk averse and cautious approach" to be applied and that decision-makers should take into account the limits of current knowledge about the consequences of decisions and actions".
- <u>The Preventative Principle:</u> The Preventive Principle is reflected in the concept that the disturbance of ecosystems and loss of biological diversity are to be "…avoided, or…minimised and remedied". Furthermore, the principle prescribes that the disturbance of the landscape and the nation's cultural heritage is to be avoided, and where it cannot be altogether avoided, must be minimised and remedied. The principle aims to minimise environmental damage by requiring that action be taken at an early stage of the process, and if possible, before such damage actually occurs. Broadly stated, it prohibits any activity which causes

or may cause damage to the environment in violation of the duty of care established under environmental law.

- Cradle-to-Grave: A Cradle-to-Grave stewardship perspective indicates the adoption of a comprehensive ecological view of the impacts of a process on the environment, commencing with research, development and design through the extraction and use of raw materials, production and processing, storage, distribution and use, to the final disposal of the product and the waste generated as a by-product. The cradle-to-grave principle advocates liability as a result of, or caused by, policies, programmes, projects, products, processes, services, and activities. Given the general purpose of NEMA, together with the other sustainability principles, this legal liability may include to rectify, remedy, or compensate for environmental damage or degradation.

Chapter 7 of NEMA contains essential provisions dealing with liability for environmental damage in South Africa and two key elements form part thereof; namely: pollution prevention and remediation. A duty of care is contained in Section 28, which encompasses the main liability provision which applies retrospectively and therefore also to historical pollution. Section 28(1) applies to all forms of pollution and is formulated generally by providing a duty of care to avoid, minimise and/or remedy pollution or environmental degradation.

In terms of this subsection, the duty imposes liability on an almost non-exhaustive category of persons, because it refers to "every person". Section 28(2) goes even further and imposes the duty on a range of people including owners or people in control of land or premises and people who have the right to use the land or premises on which, or in which, an activity or process is, or was, performed or undertaken, or any other situation exists which causes, or is likely to cause, significant pollution or degradation to the environment.

The duty of care imposes strict liability since Section 28(1) requires reasonable persons to take reasonable measures. Subsection (3) provides an indicative range of measures that can be considered as “reasonable measures” and these may include measures to investigate, assess and evaluate the impact on the environment; inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed in order to avoid causing significant pollution or degradation, contain or prevent the movement of pollutants or the causing of degradation, eliminate any source of the pollution or degradation and to remedy the effects of the pollution or degradation.

One can identify from the wording an obligation to prevent and minimise pollution or degradation and this indicates that remediation is clearly part of South African law. Where a company fails to take reasonable measures to prevent or minimise pollution, it can be directed to do so by the relevant authority and if it does not comply with the directive, measures will be taken by government on its behalf, but at the company's expense. Under Section 34(7), liability is specifically extended to the director of the company concerned in his or her personal capacity, in other words, the director is personally liable.

Furthermore, Section 43 provides that if directors failed to take all reasonable steps to prevent the offence being committed, and monetary advantage was gained, they may be personally liable for damages or compensation, have to pay a fine, or have to comply with remedial measures determined by the Court, and may even have to pay the State's investigative costs.

5.5.1 Environmental Impact Assessment (EIA) Regulations

A new IEA is required for the Integrated Paardeplaats Section. This application will serve to license new activities in the Integrated Paardeplaats Section, which are required to effectively link the Glisa and Paardeplaats Sections together. The application is being undertaken in terms of the NEMA EIA Regulations, 2014 (as amended) (GNR 982), which regulates the procedure and criteria as contemplated in Chapter 5 of NEMA relating to the preparation, evaluation, submission, processing and consideration of, and decision on, applications for environmental authorisations for the commencement of activities, subjected to environmental impact assessment, in order to avoid or mitigate detrimental impacts on the environment, and to optimise positive environmental impacts, and for matters pertaining thereto.

The EIA Regulations, 2014 (as amended) specify Listed Activities (LAs) that require EA from the applicable Competent Authority, in this case the Department of Mineral Resources and Energy (DMRE), eMalahleni Office. LAs are specified in three Listing Notices (LNs), namely LN 1 (GNR 983), LN 2 (GNR 984), and LN 3 (GNR 985). Activities triggered in LN 1 and LN 3 require a Basic Assessment (BA) process to be followed, whereas as activities triggered in LN 2 require a Scoping and Environmental Impact Report (S&EIR) process to be followed. In instances where LAs in all 3 notices are triggered the S&EIR process is undertaken.

5.5.2 Financial Provisioning Regulations

The purpose of the Financial Provisioning Regulations, 2015 (GNR 1147), as amended, is to regulate the determination and making of financial provision as contemplated in the NEMA 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. GNR 1147 applies to an applicant and a holder of a right or permit as contemplated in the MPRDA.

Section 17B of GNR 1147 states that a holder, or holder of a right or permit, who applied for such right or permit prior to 20 November 2015, regardless when the right or permit was obtained-

a) must by no later than 19 June 2021 comply with these Regulations; and
b) shall, until 19 June 2021, be regarded as having complied with the provisions of these Regulations, if such holder has complied with the provisions and arrangements regarding financial provisioning, approved as part of the right or permit issued in terms of the MPRDA.

5.5.3 Notice of the Requirement to Submit A Report Generated by the National Web Based Environmental Screening Tool

Government Notice 960 (GN 960) gives notice that the submission of a report generated from the National Web-based Environmental Screening Tool, as contemplated in Regulation 16(1)(b)(v) of the EIA Regulations, 2014 (as amended) will be compulsory when submitting an application for environmental authorisation in terms of regulation 19 and regulation 21 of the EIA Regulations, 2014 (as amended).

The National Web-based Environmental Screening Tool is a geographically based web-enabled application which allows a proponent intending to submit an application for environmental authorisation in terms of the EIA Regulations 2014, as amended, to screen their proposed site for any environmental sensitivity. The Screening Tool also provides site specific EIA process and review information, for example, the Screening Tool may identify if an industrial development zone, minimum information requirement, Environmental Management Framework or bio-regional plan applies to a specific area. Further to this, the Screening Tool identifies related exclusions and/ or specific requirements including specialist studies applicable to the proposed site and/or development, based on the national sector classification and the environmental sensitivity of the site. Finally, the Screening Tool allows for the generating of a Screening Report referred to in Regulation 16(1)(v) of the EIA Regulations 2014, as amended, whereby a Screening Report is required to accompany any application for EA and as such the tool has been developed in a manner that is user friendly and no specific software or specialised GIS skills are required to operate this system.

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

The National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM:WA) fundamentally reformed the law regulating waste management, and for the first time provides a coherent and integrated legislative framework addressing all the steps in the waste management hierarchy. The objectives of the NEM:WA are to protect health, well-being, and the environment by providing reasonable measures for, inter alia, remediating land where contamination presents, or may present, a significant risk of harm to health or the environment. The objectives of the NEM:WA are structured around the steps in the waste management hierarchy, which is the overall approach that informs waste management in South Africa. The waste management hierarchy consists of options for waste management during the lifecycle of waste, arranged in descending order of priority; i.e. waste avoidance, reduction, re-use, recycling, recovery, treatment, and safe disposal as a last resort.

NEMA, as previously mentioned, introduced a number of additional guiding principles into South African environmental legislation, including the life-cycle approach to waste management, producer responsibility, the precautionary principle and the polluter pays principle (i.e. the sustainability principles as contained in Section 2 of NEMA). Section 5(2) of the NEM:WA stipulates that the Act should be interpreted and guided in accordance with these sustainability principles. The NEM:WA, furthermore, echoes the duty of care provision, in terms of Section 28 of NEMA, by obliging holders of waste to take reasonable measures to implement the waste management hierarchy. Section 16(1) of the NEM:WA provides that:

"A holder of waste must, within the holder's power, take all reasonable measures to–

a) avoid the generation of waste and where such generation cannot be avoided, to minimise the toxicity and amounts of waste that are generated;
b) reduce, re-use, recycle and recover waste;
c) where waste must be disposed of, ensure that the waste is treated and disposed of in an environmentally sound manner;
d) manage the waste in such a manner that it does not endanger health or the environment or cause a nuisance through noise, odour, or visual impacts;
e) prevent any employee or any person under his or her supervision from contravening this Act; and
f) prevent the waste from being used for an unauthorised purpose."

While the NEM:WA creates a comprehensive legal framework for waste management, its provisions will be meaningless without measures to monitor and, where necessary, enforce compliance. Compliance monitoring is supported by a range of reporting provisions contained in the NEM:WA. In addition to compliance reports for waste management licences and norms and standards, the NEM:WA has provisions for annual performance reports on the implementation of provincial and local Industry Waste Management Plans (IWMPs). IWMPs are subject to review at intervals to be determined by the authority that mandated the plan. Furthermore, Environmental Management Inspectors and Waste Management Officers can request a Waste Impact Report where they suspect a contravention of the Act, licence conditions or exemption conditions.

Waste is regulated under NEM:WA, and is defined in NEM:WA as the following:

a) *any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, or that is intended or required to be discarded or disposed of, by the holder of that substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 to this Act; or*

b) *any other substance, material or object that is not included in Schedule 3 that may be defined as a waste by the Minister by notice in the Gazette,*

but any waste or portion of waste, referred to in paragraphs (a) and (b), ceases to be a waste-

i. *once an application for its re-use, recycling or recovery has been approved or, after such approval, once it is, or has been re-used, recycled, or recovered;*

ii. *where approval is not required, once a waste is, or has been re-used, recycled, or recovered;*

iii. *where the Minister has, in terms of section 74, exempted any waste or a portion of waste generated by a particular process from the definition of waste; or*

iv. *where the Minister has, in the prescribed manner, excluded any waste stream or a portion of a waste stream from the definition of waste."*

5.6.1 List of Waste Management Activities That Have, or are Likely to Have, A Detrimental Effect on the Environment

Based on the definition of waste in the NEM:WA, NBC require authorisation in terms of the NEM:WA, which is being undertaken in conjunction with this IEA application. The required Waste Management License (WML) will be issued in the IEA for the Integrated Paardeplaats Section. This application will serve to license new activities in the Integrated Paardeplaats Section, which are required to effectively link the Glisa and Paardeplaats Sections together. The application is being undertaken in terms of the List of Waste Management Activities That Have, or are Likely to Have, A Detrimental Effect on the Environment, 2013 (as amended) (GN 921), which identifies the activities which require authorisation in terms of the NEM:WA.

A distinction is made in GN 921 between Category A, B and C waste management activities. According to Section 44 of the Act, Category A and B activities require the licensing procedure to be integrated with the applicable NEMA EIA Regulations, 2014 (as amended) process. Therefore, this application will also be undertaken in terms of the NEMA EIA Regulations, 2014 (as amended) (GNR 982), as an integrated application. The Competent Authority for this application is also the DMRE, eMalahleni Office.

5.6.2 Waste Classification and Management Regulations

Three (3) regulations govern waste classification and management in terms of the NEM:WA. The first of these is the Waste Classification and Management Regulations (GNR 634), 2013. The purpose of these Regulations is to-

a) regulate the classification and management of waste in a manner which supports and implements the provisions of the Act;
b) establish a mechanism and procedure for the listing of waste management activities that do not require a Waste Management Licence;
c) prescribe requirements for the disposal of waste to landfill;
d) prescribe requirements and timeframes for the management of certain wastes; and
e) prescribe general duties of waste generators, transporters and managers.

5.6.3 National Norms and Standards for the Assessment of Waste for Landfill Disposal

Waste classification is performed in terms of the National Norms and Standards for the Assessment of Waste for Landfill Disposal (GNR 635). These Norms and Standards prescribe the requirements for the assessment of waste prior to disposal to landfill in terms of Regulation 8(1)(a) of GNR 634.

5.6.4 National Norms and Standards for Disposal of Waste to Landfill

Waste classification guides the applicable waste disposal options as prescribed in the National Norms and Standards for Disposal of Waste to Landfill (GNR 636). These Norms and Standards determine the requirements for the disposal of waste to landfill as contemplated in regulation 8(1)(b) and (c) of GNR 634.

5.7 National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004)

The purpose of the National Environmental Management Biodiversity Act (Act No. 10 of 2004) (NEM:BA) is to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA and the protection of species and ecosystems that warrant national protection. As part of its implementation strategy, the National Spatial Biodiversity Assessment (NSBA) was developed. In terms of the NEM:BA, the developer has a responsibility for:

- The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA Regulations, 2014);

- Application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all developments within the area are in line with ecological sustainable development and protection of biodiversity; and
- Limiting further loss of biodiversity and conserve endangered ecosystems.

5.7.1 Threatened or Protected Species Regulations

NEM:BA restricts activities on protected species via its associated Threatened or Protected Species (TOPS) Regulations, 2007 (GNR 152), as amended, and provides protection for any activity (which must be identified in terms of the NEM:BA which may impact these species. The purpose of these regulations is to -

a) further regulate the permit system set out in Chapter 7 of the Biodiversity Act insofar as that system applies to restricted activities involving specimens of listed threatened or protected species;
b) provide for the registration of captive breeding operations, commercial exhibition facilities, game farms, nurseries, scientific institutions, sanctuaries and rehabilitation facilities and wildlife traders;
c) provide for the regulation of the carrying out of a specific restricted activity, namely hunting;
d) provide for the prohibition of specific restricted activities involving specific listed threatened or protected species;
e) provide for the protection of wild populations of listed threatened species; and
f) provide for the composition and operating procedure of the Scientific Authority.

5.7.2 Alien and Invasive Species Regulations and Species Lists

The Alien and Invasive Species Regulations, 2020 (GNR 1020), as amended identifies categories for invasive species and prescribes how each category must be managed and what activities need to be undertaken to reduce invasive plant communities in an area. The regulations further identify restricted activities and prescribe national framework documents that should be developed.

The Alien and Invasive Species Lists, 2020 (GN 1003), published in terms of Sections 66(1), 67(1), 70(1)(a), 71(3) and 71A of the NEM:BA contains the following notices:

- Notice 1: Notice in respect of Categories 1a, 1b, 2 and 3, Listed Invasive Species, in terms of which certain Restricted Activities are prohibited in terms of section 71A(1); exempted in terms of section 71(3); require a Permit in terms of section 71(1);
- Notice 2: Exempted Alien Species in terms of section 66(1);
- Notice 3: National Lists of Invasive Species in terms section 70(1), including:
    - List 1: National List of Invasive Terrestrial and Fresh-water Plant Species;

- List 2: National List of Invasive Marine Plant Species;
- List 3: National List of Invasive Mammal Species;
- List 4: National List of Invasive Bird Species;
- List 5: National List of Invasive Reptile Species;
- List 6: National List of Invasive Amphibian Species;
- List 7: National List of Invasive Fresh-water Fish Species;
- National List of Invasive Marine Fish Species;
- List 8: National List of Invasive Terrestrial Invertebrate Species;
- List 9: National List of Invasive Fresh-water Invertebrate Species;
- List 10: National List of Invasive Marine Invertebrate Species; and
- List 11: National List of Invasive Microbial Species.

These notices must be read together with the Alien and Invasive Species Regulations.

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

The National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEM:AQA) shifted the approach of air quality management from source-based control to receptor-based control. The NEM:AQA made provision for National ambient air quality standards, however it is generally accepted that more stringent standards can be established at the Provincial and Local levels. Emissions are controlled through the listing of activities that are sources of emission and the issuing of emission licences for these listed activities. Atmospheric emission standards have been established for each of these activities and an Atmospheric Emission Licence (AEL) is now required to operate.

The issuing of AELs is the responsibility of the District or Local Municipalities within which a project is located. Municipalities are required to designate an Air Quality Officer to be responsible for co-ordinating matters pertaining to air quality management in the Municipality. The appointed Air Quality Officer will be responsible for the issuing of AELs or the Air Quality Officer could delegate the responsibility to the Director of Community Environmental Services.

According to the NEM:AQA, the Department of Environmental Affairs, now the Department of Forestry, Fisheries and Environment (DFFE), the provincial environmental departments and local authorities (district and local municipalities) are separately and jointly responsible for the implementation and enforcement of various aspects of the NEM:AQA. Each of these spheres of government is obliged to appoint an Air Quality Officer and to co-operate with each other and co-ordinate their activities through mechanisms provided for in the NEMA.

The objective of the NEM:AQA is:

a) to protect the environment by providing reasonable measures for -
   i. the protection and enhancement of the quality of air in the Republic;
   ii. the prevention of air pollution and ecological degradation; and
   iii. securing ecologically sustainable development while promoting justifiable economic and social development; and

b) generally to give effect to section 24(b) of the Constitution in order to enhance the quality of ambient air for the sake of securing an environment that is not harmful to the health and well-being of people.

5.8.1 National Dust Control Regulations

The National Dust Control Regulations, 2013 (GNR 827), prescribes general measures for the control of dust. According to the regulations, any person conducting any activity in such a way that would give rise to dust in quantities and concentrations that exceeded the dustfall standard set out in the regulation (**Table 5.3**) is impelled to, upon receipt of a notice from an air quality officer, implement a dustfall monitoring programme.

Table 5.3: Acceptable Dustfall Rate.

RESTRICTION AREAS	DUST FALL RATE (D) (mg/m³/day, 30-days average)	PERMITTED FREQUENCY OF EXCEEDING DUST FALL RATE
Residential Areas	D < 600	2 within a year, not sequential months.
Non-Residential Area	600 < D < 1200	2 within a year, not sequential months.

The method to be used for measuring the dustfall rate and the guideline for locating sampling points would be the American Standards for Testing and Materials (ASTM) method, or an equivalent method approved by any internally recognised body. ASTM D1739:2010 is the current ASTM method in use.

The regulation further states that an Air Quality Officer could require any person, through a written notice, to undertake a dustfall monitoring programme if the officer reasonably suspects that the person was contravening the Regulations or that the activity being conducted required a fugitive dust emission management plan. A person required to implement the programme must then, within a specified period, submit a dustfall monitoring report to the Air Quality Officer.

A dustfall monitoring report must provide information on the location of sampling sites, classification of the area where samplers were located, as well as reference to the standard methods used for site selection, sampling and analysis. The report would also be required to provide meteorological data for the sampling area, the dustfall monitoring results, including a comparison of current year and historical results for each site, as well as a tabular summary of compliance with the dustfall standard. Any person that had exceeded the dustfall standard must, within three months after submission of the dustfall monitoring report, develop and submit a dustfall management plan to the Air Quality Officer for approval. This management plan must identify all possible sources of dust within the affected site, detail the best practicable measures to be undertaken to mitigate dust emissions, identify the line management responsible for implementation and incorporate the dust fallout monitoring plan. Such a plan would need to be implemented within a month of the date of approval and an implementation progress report must be submitted to the Air Quality Officer at agreed time intervals.

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

The National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) has applicability, as the study forms part of an overall Heritage Impact Assessment (HIA) in terms of the provisions of Section 34, 35, 36 and 38 of the NHRA and forms part of a study that serves to identify key heritage resources, informants, and issues relating to the palaeontological, archaeological, built environment and cultural landscape, as well as the need to address such issues during the impact assessment phase of the HIA process.

According to Section 34 of the NHRA, no person may alter, damage or destroy any structure that is older than 60 years, and which forms part of the sites built environment, without the necessary permits from the relevant provincial heritage authority.

According to Section 35 (Archaeology, Palaeontology and Meteorites) and Section 38 (Heritage Resources Management) of the NHRA, Palaeontological Impact Assessments (PIAs) and Archaeological Impact Assessments (AIAs) are required by law in the case of developments in areas underlain by potentially fossiliferous (fossil-bearing) rocks, especially where substantial bedrock excavations are envisaged, and where human settlement is known to have occurred during prehistory and the historic period.

A section 36 permit application is made to the South African Heritage Resources Agency (SAHRA) or the competent provincial heritage authority which protects burial grounds and graves that are older than 60 years and must conserve and generally care for burial grounds and graves protected in terms of this section, and it may make such arrangements for their conservation as it sees fit. SAHRA must also identify and record the graves of victims of conflict and any other graves which it deems to be of cultural significance and may erect memorials associated with these graves and must maintain such memorials. A permit is required under the following conditions:

Permit applications for burial grounds and graves older than 60 years should be submitted to the South African Heritage Resources Agency:

a) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of the conflict, or any burial ground or part thereof which contains such graves.
b) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or
c) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation equipment, or any equipment which assists in the detection or recovery of metals.

SAHRA or a provincial heritage resources authority may not issue a permit for the destruction or damage of any burial ground or grave referred to in subsection (3)(a) unless it is satisfied that the applicant has made satisfactory arrangements for the exhumation and re-interment of the contents of such graves, at the cost of the applicant.

A NHRA Section 38 (HIA) application to the Mpumalanga Provincial Heritage Resources Agency (MP-PHRA) is required when the proposed development triggers one or more of the following activities:

a) the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length;
b) the construction of a bridge or similar structure exceeding 50 m in length;
c) any development or other activity which will change the character of a site,
    i. exceeding 5 000 m^2 in extent; or
    ii. involving three or more existing erven or subdivisions thereof;
    iii. involving three or more erven or divisions thereof which have been consolidated within the past five years; or
    iv. the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;
d) the re-zoning of a site exceeding 10 000 m^2 in extent; or
e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority.

Section 38 (3) Impact Assessments are required, in terms of the statutory framework, to conform to basic requirements as laid out in Section 38(3) of the NHRA. These are:

- The identification and mapping of heritage resources in the area affected;
- The assessment of the significance of such resources;
- The assessment of the impact of the development on the heritage resources;

- An evaluation of the impact on the heritage resources relative to sustainable socio/economic benefits;
- Consideration of alternatives if heritage resources are adversely impacted by the proposed development;
- Consideration of alternatives; and
- Plans for mitigation.

5.10 Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998)

The Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998) (MNCA) is responsible for making provisions with respect to nature conservation in the Mpumalanga province. It provides for, among other things, protection of wildlife, hunting fisheries, protection of endangered fauna and flora as listed in the Convention of International Trade in Endangered Species (CITES) of wild flora and fauna, the control of harmful animals, freshwater pollution and enforcement. The objectives of the MNCA are to consolidate the laws relating to nature conservation applicable in the Mpumalanga province and to provide for matters connected therewith. The MNCA focuses on the protection of critically endangered to vulnerable fauna, and flora within the province.

5.11 South African National Standards

5.11.1 Calculating and Predicting Road Traffic Noise (SANS 10210:2004)

The South African Bureau of Standards (SABS) established standard SANS 10103: 2008, as amended, is the standard detailing the calculation and prediction of road traffic noise under typical South African traffic and sound propagation conditions. The procedure relates both to traffic operating on uninterrupted flow road facilities and to stop-start conditions on interrupted flow road facilities.

5.11.2 The Measurement and Rating of Environmental Noise with Respect to Annoyance and to Speech Communication (SANS 10103: 2008)

The SABS established standard SANS 10103: 2008, as amended, is the standard detailing methods and gives guidelines to assess working and living environments with respect to acoustic comfort, excellence, and with respect to possible annoyance by noise (i.e. whether complaints can be expected). It also gives a method to predict speech communication efficiency.

5.11.3 Methods for Environmental Noise Impact Assessments (SANS 10328: 2008)

The SABS established standard SANS 10328: 2008, as amended, is the standard detailing Methods for Environmental Noise Impact Assessments and forms the basis on which noise impact investigations which are prescribed in regulations published under the ECA, the NEMA and the NEM:AQA or any other noise control regulations should be conducted.

5.11.4 Drinking Water (SANS 241-1: 2015)

The SABS established standard SANS 241-1: 2015, as amended, is the standard specifiying the quality of acceptable drinking water, defined in terms of Microbiological, Physical, Aesthetic and Chemical Determinants. Water that complies with Part 1 of SANS 241: 2015 is deemed to present an acceptable health risk for lifetime consumption.

5.11.5 Ambient Air Quality (SANS 1929: 2011)

The SABS, in collaboration with the DFFE, established the Ambient Air Quality Standards (South African National Standard (SANS) 1929: 2011), as amended. This standard gives limit values for common air pollutants to ensure that the negative effects of such pollutants on human health are prevented or reduced. Limit values given in this standard are expressed for common pollutants as are permissible frequencies by which limit values may be exceeded. SANS 1929: 2011 included limits for Particulate Matter 10 (PM_{10}), as presented in XX. The limit values, average periods and number of permissible exceedances for particulate PM_{10}.

Table 5.4: Limits for PM10.

AVERAGE PERIOD	CONCENTRATION (µg/m³)	FREQUENCY OF EXCEEDANCES
Target		
24 h	75	4
1 year	40	0

In addition, SANS 1929: 2011 refers to the four-band scale that shall be used in the evaluation of dust deposition (**Table 5.5**). The reference method for measuring dustfall shall be ASTM D1739, as amended. The target, action and alert thresholds for ambient dust deposition are stipulated in **Table 5.6**.

Table 5.5: Four-band Scale Evaluation Criteria for Dust Deposition.

BAND NUMBER	BAND DESCRIPTION LABEL	DUST FALL RATE (mg/m²/day, 30-day average)	COMMENT
1	Residential	D < 600	Permissible for residential and light commercial.
2	Industrial	D < 1200	Permissible for heavy commercial and industrial.
3	Action	1200 < D < 2400	Requires investigation and remediation if two sequential months lie in this band, or more than three occur in a year.
4	Alert	D > 2400	Immediate action and remediation required following the first incidence of the dustfall rate being exceeded. Incident report to be submitted to the relevant authority.

Table 5.6: Target, Action and Alert Thresholds for Dust Deposition.

LEVEL	DUST FALL RATE (mg/m²/day, 30-day average)	AVERAGE PERIOD	PERMITTED FREQUENCY OF EXCEEDING DUSTFALL RATE
Target	300	Annual	
Action Residential	600	30 days	2 within any year, no 2 sequential months.
Action Industrial	1 200	30 days	2 within any year, not sequential months.
Alert Threshold	2 400	30 days	None. First incidence of dustfall rate being exceeded requires remediation and compulsory report to the relevant authorities.

5.12 International Union for Nature Conservation

The International Union for Nature Conservation (IUCN) Red List of Threatened Species is the world's most comprehensive inventory of the global conservation status of plant and animal species. The IUCN Red List of Threatened Species provides taxonomic, conservation status and distribution information on plants and animals that have been globally evaluated using the IUCN Red List Categories and Criteria. This system is designed to determine the relative risk of extinction, and the main purpose of the IUCN Red List is to catalogue and highlight those plants and animals that are facing a higher risk of global extinction (i.e. those listed as Critically Endangered, Endangered, and Vulnerable). The IUCN Red List also includes information on plants and animals that are categorized as Extinct or Extinct in the Wild; on taxa that cannot be evaluated because of insufficient information (i.e., are Data Deficient); and on plants and animals that are either close to meeting the threatened thresholds or that would be threatened were it not for an ongoing taxon-specific conservation programme (i.e., are Near Threatened). Abbreviations and descriptions of each IUCN category are summarised in Table 2-1. Plants and animals that have been evaluated to have a low risk of extinction are classified as Least Concern.

Table 5.7: Description of IUCN Categories.

IUCN CATEGORY	ABBREVIATION	DESCRIPTION
Extinct	EX	No surviving individuals of the species
Extinct In The Wild	EW	Known only to survive in captivity, or as a naturalized population outside its historic range.
Critically Endangered	CR	At a very high risk of extinction.
Endangered	EN	High risk of extinction in the wild.
Vulnerable	VU	High risk of endangerment in the wild.
Near Threatened	NT	Likely to become endangered in the near future.
Least Concern	LC	Lowest risk. Does not qualify for a more at-risk category
Data Deficient	DD	Not enough data to make an assessment of its risk of extinction.
Not evaluated	NE	Has not yet been evaluated against the criteria.

5.12.1 *The Convention on International Trade in Endangered Species of Wild Fauna and Flora*

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival. CITES works by subjecting international trade in specimens of selected species to certain controls. All import, export, re-export and introduction from the sea of species covered by the Convention has to be authorised through a licensing system. Each Party to the Convention must designate one or more Management Authority in charge of administering that licensing system and one or more Scientific Authorities to advise them on the effects of trade on the status of the species. Specimens are divided into the following appendices according to the restriction on trade:

- Appendices I, II and III:
  - Appendix I includes species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances.
  - Appendix II includes species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilisation incompatible with their survival.
  - Appendix III contains species that are protected in at least one country, which has asked other CITES Parties for assistance in controlling the trade. Changes to

Appendix III follow a distinct procedure from changes to Appendices I and II, as each Party is entitled to make unilateral amendments to it.

5.13 Penalties Owing to Offences and/or Non-Compliance

Penalties owing to offences or non-compliances under the various environmental legislation is summarised in **Table 5.8**. NBC should be aware of the penalties associated with offences and/or non-compliances for the NBC Glisa and Paardeplaats Sections.

Table 5.8: Penalties for Offences and/or Non-compliance.

LEGISLATION	SECTION	FINE
NEMA	Section 24, 31	Fine not exceeding R 5,000,000.00, or imprisonment for a period not exceeding 10 years, or both such fine and such imprisonment.
	Section 28, 30	Fine not exceeding R 1,000,000.00, or imprisonment for a period not exceeding 1 year, or both such a fine and such imprisonment.
	Section 34	Fine not exceeding R 10,000.00, or imprisonment for a period not exceeding 1 year, or both such fine and such imprisonment
NWA	Section 15 and Item 31 of Schedule 4	First Conviction: Fine not exceeding R 100,000.00, or imprisonment for a period not exceeding 5 years, or both such fine and such imprisonment. Second or Subsequent Conviction: Fine not exceeding R 200,000.00, or imprisonment for a period not exceeding 10 years, or both such fine and such imprisonment.
NEM:WA	Section 67 and 68	Liable to a fine up to R 10,000,000.00, or imprisonment up to 10 years, or both, in addition to other penalties that may be imposed in terms of NEMA.

6 NEED AND DESIRABILITY OF THE PROPOSED ACTIVITIES

6.1 Electricity Demand

According to the 2019 Integrated Resource Plan (IRP), South Africa continues to pursue a diversified energy mix that reduces reliance on a single or a few primary energy sources (IRP, 2019). The extent of decommissioning of the existing coal fleet due to end of design life, could provide space for a completely different energy mix relative to the current mix. In the period prior to 2030 however, the system requirements are largely for incremental capacity addition and flexible technology, to complement the existing installed inflexible capacity. Coal will continue to play a significant role in electricity generation in South Africa in the foreseeable future as it is the largest base of the installed generation capacity and it makes up the largest share of energy generated. As a result, coal still plays an integral part in the energy mix of South Africa (IRP, 2019)

The National Development Plan (NDP) 2030 identifies the need for South Africa to invest in a strong network of economic infrastructure designed to support the country's medium and long-term economic and social objectives. Energy infrastructure is a critical component that underpins economic activity and growth across the country and therefore, it needs to be robust and extensive enough to meet industrial, commercial, and household needs. The NDP envisages that, by 2030, South Africa will have an energy sector that provides reliable and efficient energy service at competitive rates, is socially equitable through expanded access to energy at affordable tariffs and environmentally sustainable through reduced pollution.

The NDP 2030 defines a desired destination where inequality and unemployment are reduced, and poverty is eliminated so that all South Africans can attain a decent standard of living. Electricity is identified in the NDP 2030 as one of the core elements of a decent standard of living. Whilst South Africa moves from its reliance on a few primary energy sources, such as coal, the demands for electricity will continue. Coal-powered electricity generation will make up the largest share of such provision to meet this demand. The need for the provision of electricity equitably amongst South Africans is clear and as such the importance of coal mines that provide coal to Eskom is undeniable.

NBC has an existing supply agreement with Eskom to supply steady and secure coal for selected Eskom coal fired power stations. The Integrated Paardeplaats Section will produce enough coal for NBC to meet its contractual obligations to Eskom. The Integrated Paardeplaats Section has an estimated RoM supply rate of 4.2 – 4.4 mtpa which relate to 2.4 – 2.6 mtpa of product. This provision aligns with the requirements of the NDP 2030 and will assist South Africa in meeting its planned development objectives.

6.2 Revenue Generation

South Africa produces an average of 224 million tons of marketable coal annually, making it the fifth largest coal producing country in the world. 25% of our production is exported internationally, making South Africa the third largest coal exporting country. The overwhelming volume of coal exports are to India, with demand from other countries such as Pakistan and Sri Lanka. A further possible coal export market with China has the potential to positively impact the coal export market of South Africa, especially since China is no longer accepting coal from Australia. The NBC Integrated Paardeplaats Section has an estimated RoM supply rate of 1.7 mtpa of export coal which equates to 1.0 mtpa of export product, making it a desirable contributor to the coal export market.

6.3 Local Importance

According to the eMakhazeni LM IDP (2019/2020), the leading sectors in terms of percentage contribution to the eMakhazeni LM economy are mining (27.1%), transport (26%) trade (8.4%) and community services (14.7%). Mining has remained the biggest contributor in Gross Domestic Product (GDP) in the municipality over the past few years. The desirability of continued mining operations, such as the NBC Integrated Paardeplaats Section, is high considering the impact that such an operation will have on the GDP of the eMakhazeni LM, not to mention the National GDP.

Mining further contributes the second highest total number of employment opportunities in the eMakhazeni LM and Nkangala DM, second to agriculture in the LM and trade in the DM respectively (eMakhazeni IDP, 2020). This does not consider secondary employment opportunities generated by mining, such as catering services, transport services, laundry services, and environmental services, to list a few. The need for long-term mining projects is therefore significant in ensuring that both primary and secondary employment opportunities associated with the mine would continue, positively impacting both the local and district municipalities.

6.4 Project Specific Job Creation and Retention

NBC have 37 permanent employees as presented in **Table 6.1**. No new jobs will be created at the Integrated Paardeplaats Section as the same personnel will be utilised. Mining activities will be contracted out with these jobs being created at the companies contracted to undertake the mining activities. It is envisaged that the workforce of the contractor will be made up of 239 workers of which 68 will come from the Emakazeni LM, 129 from the remainder of the Nkangala DM, and 42 from the rest of South Africa (EIMS, 2015). Although mining activities will be contracted out, NBC management will be responsible for support services and line management of the Integrated Paardeplaats Section.

Table 6.1: Permanent Employees at the Glisa Section.

EQUITY/STATUS			GENDER		
TOTAL NUMBER		TOTAL NUMBER		TOTAL NUMBER	
Black	31	Male	18	Female	13
Coloured	1	Male	1	Female	0
Indian	1	Male	1	Female	0
White	4	Male	1	Female	3
Youth/Learners	9	Male	4	Female	5

NBC recruit staff from the local area, as well as support local Small, Medium and Micro Enterprises (SMMEs). Approximately 20 local businesses provide services to NBC, totalling an approximate value of R 5.8 million. These local businesses include:

- Domestic and industrial cleaning services;
- Catering services;
- Road maintenance services (2 providers);
- Civil services (2 providers);
- Medical care;
- Transport – logistics;
- Transport – employees;
- Invader species management services;
- Water laboratory services;
- Coal sampling services;
- Sewer cleaning/maintenance services;
- Coal processing and screening; and
- Laundry services.

7 MOTIVATION FOR PREFERRED DEVELOPMENT FOOTPRINT

This section provides the motivation for the preferred development footprint within the approved site, as presented in **Figure 4.14** and **Appendix C**, including a full description of the process followed to reach the final decision.

7.1 Details of the Development Footprint Alternatives Considered

7.1.1 Property or Location

The proposed infrastructure is limited to the properties within the Integrated Paardeplaats Section, which is constrained by existing infrastructure within the mining area, and the presence of other active and future mining operations, farms, and residential areas outside of the mining areas. The resource location further restricts the infrastructure placement, as does previous opencast mining operations and rehabilitation activities. It is proposed to keep all required infrastructure within the Integrated Paardeplaats Section only, and as such no alternative properties or locations were considered.

7.1.2 Type of Activity

The activities to be undertaken include coal transportation (haul road or conveyor belt), coal processing (CSWP, Gijima Plant, Portion 24 Plant, Portion 24 RoM pad), water management (clean and dirty water separation, PCDs, and channels), waste management (backfilling and DMF), water treatment (pipeline reticulation from voids to WTP) and operational management (contractors camp).

The type of activities required are determined by the operational requirements of a coal mine and as such no alternative activities were considered.

7.1.3 Design or Layout

The mineable portions are limited to the properties within the Integrated Paardeplaats Section and the approved mining rights, which is constrained by the presence of other active and future mining operations, farms, and residential areas outside of the Section. The resource location further restricts the proposed design and layout of planned activities and infrastructure placement. Infrastructure will be limited to selected properties within the Integrated Paardeplaats Section, the placement of which was determined based on existing infrastructure within the Section, the current and future mining areas, previously mined areas, and rehabilitation activities.

The layout of the activities is determined by the operational requirements of the mine and are, essentially, pre-determined. Through the utilisation of the existing CSWP in the northern portions of the Integrated Paardeplaats Section, the old Glisa Section, negates the need for a full new plant and contains the processing activities in an already disturbed area. The decision to utilise Portion 24 of the farm Paardeplaats 380 JT was done bearing environmental considerations in mind, once again confining activities to a previously disturbed area.

The design of the PCDs, Portion 24 plant area, Portion 24 RoM pad and water management infrastructure were designed in terms of best practice guidelines and comply with the requirements of GN 704 and the NEM:WA. The proposed infrastructure area on Portion 24 went through various iterations to reach the final layout. Changes were ultimately made to align the infrastructure with the mining contractors plans, so the ROM pad and contractor's area was adjusted as indicated in **Figure 7.1**.

The location of the DMF also went through various iterations to reach the final layout. Changes were made to address initial concerns about seepage and rehabilitation and final landform design requirements at the Glisa Section, as as indicated in **Figure 7.1**. The DMF will be located on Potion 24 and will be developed in accordance with the requirements of GN 704 and the NEM:WA.

Figure 7.1: Portion 24 Infrastructure Layout Iterations.

Figure 7.2: DMF Layout Iterations.

Based on the most recent (2021) LoM plan (**Figure 4.9**), the D 2809 Provincial Gravel Road falls within the planned mining area. The D 2809 will need to be permanently realigned to avoid the mining area. Various iterations resulted in the proposed final permanent realignment route, as presented in **Figure 7.3**.

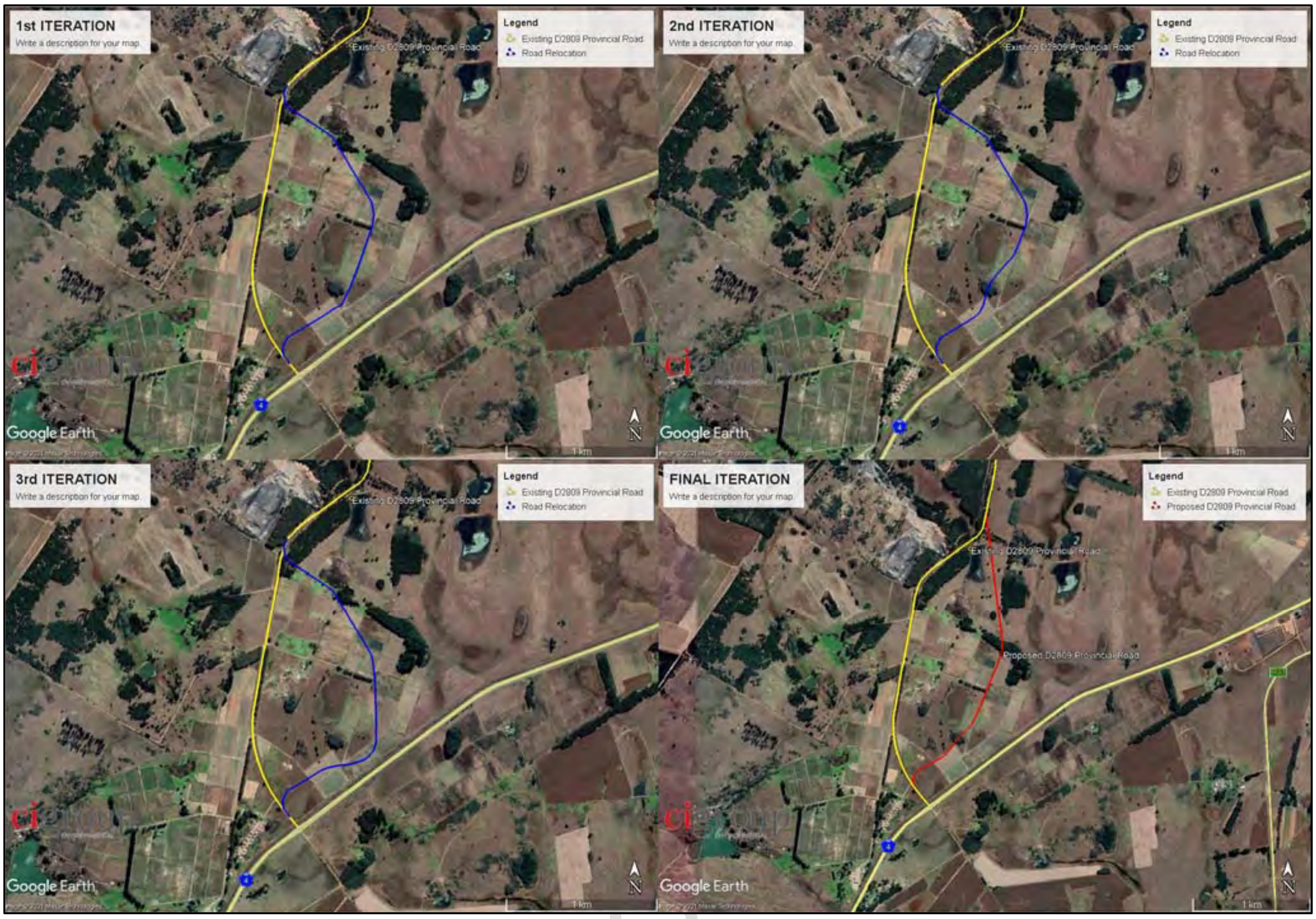

Figure 7.3: D 2809 Provincial Road Permanent Realignment Iterations.

7.1.4 Technology to be Used

No technological alternatives were considered as NBC already operate the Integrated Paardeplaats Section with the most appropriate technology options available. The equipment used in the mining operations includes excavators, dump trucks, and front end loaders, with dozers and graders being utilised as required. Mineral processing involves the crushing of RoM coal at stationary plants before being further beneficiated at the CSWP.

7.1.5 Operational Aspects

Mining in the Integrated Paardeplaats Section entails opencast mining and will be undertaken as a hybrid of roll-over and bench/box cut mining techniques. The use of the two respective techniques is dependent on the number of seams present as well as the overburden thickness within the mining area. The roll-over technique will be utilised where only a single seam is present and where the overburden has a corresponding thickness of less than 20 m. The bench/box-cut technique will be utilised where two or more seams are present, and the overburden has a thickness of greater than 20 m.

All mineral processing for the Integrated Paardeplaats Section is being undertaken at the existing CSWP located in the old Glisa Section. Coal is being crushed at stationary plants prior to being hauled for processing at the CSWP. On approval of the activities applied for herein, coal will be hauled to the plant and ROM pad on Portion 24 for crushing prior to being hauled or conveyed to the CSWP.

Water treatment will be undertaken at the WTP on Portion 24. And mining waste disposal will be undertaken at the DMF on Portion 24.

No further operational aspects were considered.

7.1.6 Option of Not Implementing the Activity

The option of not implementing the activities required at the Integrated Paardeplaats Section was considered by NBC, however, was precluded based on the extensive environmental impacts that would be resultant from not implementing the activities in the areas proposed. The activities have been identified and considered to specifically minimise the environmental footprint of the mine and to enhance environmental management and monitoring for the duration of the mine.

The option of not approving the activities applied for would result in the confirmed mineable coal resource not being available for extraction, lessening the supply of coal to Eskom for power generation and negatively impacting Eskom's ability to provide power to South Africa. The loss of revenue generated by the mine to the national Gross Domestic Product (GDP) and the eMakhazeni LM would be a resultant knock-on effect.

According to the eMakhazeni LM IDP (2019/2020), the leading sectors in terms of percentage contribution to the eMakhazeni LM economy are mining (27.1%), transport (26%) trade (8.4%) and community services (14.7%). Mining has remained the biggest contributor in Gross Domestic Product (GDP) in the municipality over the past few years. The option of not approving the activities applied for, and the subsequent implementation thereof, would result in a loss of revenue generated by the mine to not only the GDP of the eMakhazeni LM, but also the National GDP.

Mining contributes the second highest total number of employment opportunities in the eMakhazeni LM and Nkangala DM, second to agriculture in the LM and trade in the DM respectively (eMakhazeni IDP, 2020). This does not consider secondary employment opportunities generated by mining, such as catering services, transport services, laundry services, and environmental services, to list a few. The option of not implementing the activities applied for would minimise both primary and secondary employment opportunities associated with the mine and would negatively impact on both the local and district municipalities.

A further consideration of not implementing the activities applied for would be that the unmined areas of the Integrated Paardeplaats Section would remain in their current state and would continue to lend themselves to activities such as farming and cattle grazing. Natural areas such as wetlands and rivers/streams would also not be directly impacted upon. However, this assumes that other planned mining developments abutting the Integrated Paardeplaats Section are also not implemented, that rural residential areas are not expanded, and that intensive cattle-grazing or agriculture are undertaken in sensitive areas.

8 DETAILS OF THE PUBLIC PARTICIPATION PROCESS FOLLOWED

Public consultation is an essential part of environmental and water authorisation processes. This legal requirement exists with the aim to ensure that all relevant Interested and Affected Parties (I&APs) are meaningfully notified and consulted, to ensure their opinions are considered during the authorisation process. The process aims to ensure that all stakeholders are provided an opportunity to participate as part of a transparent process which allows for a robust and comprehensive environmental study. The Stakeholder Engagement Process (SEP) needs to be managed sensitively and according to best practises in order to ensure and promote:

- Compliance with international best practise options;
- Compliance with national legislation;
- Establish and manage relationships with key stakeholder groups; and
- Encourage involvement and participation in the environmental study and authorisation/approval process.

The SEP must comply with the legislative requirements of the NWA, MPRDA, NEMA and NEM:WA, as well as in line with the principles of Integrated Environmental Management (IEM), which require public participation as part of environmental licensing application processes. Adherence to the requirements of these Acts will allow for an Integrated SEP to be conducted, and in so doing, satisfy the requirement for public participation referenced in the Acts. The details of the Integrated SEP followed are provided in the sections that follow.

An Integrated SEP Report containing all the detail in the sections that follow is provided in **Appendix D**.

8.1 Purpose of the SEP

The SEP ensures that all I&APs have an opportunity to raise their comments as part of an open and transparent process, which in turn ensures an inclusive report and process. The aim of the SEP is to:

- Introduce the Glisa and Paardeplaats Sections Consolidation Project;
- Explain the various environmental licensing requirements for the Integrated Paardeplaats Section;
- Inform I&APs of their opportunity to participate in the various processes and to garner input from I&APs to inform the various reports that will be developed;
- Gather input on the local area and concerns of local residents;
- Record all issues, concerns, objections, and opinions received for submission to the relevant authority for consideration in their decision-making process;
- Establish lines of communication between I&APs and the project team;
- Identify all the significant issues related to the project; and
- Identify possible mitigation measures or environmental management plans to minimise and/or prevent environmental impacts, associated with the project.

This section of the report documents the process that has been followed to date with respect to consultation of I&APs, stakeholders, and the Government Authorities.

8.2 Identification of Stakeholders and I&APs

Stakeholders and I&APs were identified by making use of existing I&AP databases developed for previous licensing processes applicable to the Glisa and Paardeplaats Sections. The database is continually being updated as I&APs register for the project, request to be removed from the database, or as contact information changes. In addition, the placement of site notices around the Integrated Paardeplaats Section and an advert in a local newspaper was also used to encourage new potential I&APs to make contact and register as part of the processes. The project database is provided in **Appendix D**.

8.3 Notification of Stakeholders and I&APs

Stakeholders and I&APs on the project database were contacted via email and/or Short Message Service (SMS) on 21 November 2019 and 22 November 2019, respectively when the project announcement was released. A project announcement advertisement in English and Afrikaans was placed in the Middleburg Observer on 22 November 2019. A further project announcement in English was placed in the Provincial Government Gazette (GG), GG3108, dated 29 November 2019.

I&APs were notified of the S 102 and IEA application vie email and/or SMS on 5 November 2020. A project announcement advertisement in English was placed in the Middleburg Observer on 6 November 2020. The project notifications are provided in **Appendix D**.

8.4 Site Notices

Six (6) site notices (3 in English and 3 in Afrikaans) were placed around the Integrated Paardeplaats Section as well as at prominent locations in the town of eMakhazeni on 22 November 2019. An additional four (4) site notices (in English) were placed around the Integrated Paardeplaats Section as well as at prominent locations in the town of eMakhazeni when the Draft IWUL & IWWMP Report was released for public review.

Four (4) site notices (in English) were placed around the Integrated Paardeplaats Section as well as at prominent locations in the town of eMakhazeni on 5 November 2020. The site notice and placement locations are provided in **Appendix D**.

8.5 Background Information Documents

Background Information Documents (BIDs) were released to registered and potential I&APs via email on 4 December 2019. An updated BID was released to I&APs via email on 5 November 2020. The updated BID is provided in **Appendix D**.

8.6 Document Review

The Draft Environmental Scoping Report (ESR) was subjected to a minimum 30-day public review period from 5 November 2020 – 6 December 2020. The Draft ESR was made available for review via download from https://cigroup.za.com/public-documents/ and emailed directly to I&APs that requested a copy. All comments received from Stakeholders, I&APs and Registered I&APs were addressed where possible in the Final ESR.

This report serves as the Draft Environmental Impact Assessment Report (EIAR) and is subjected to a minimum 30-day public review period from 28 May 2021 – 27 June 2021. The Draft EIAR was made available for review via download from https://cigroup.za.com/public-documents/ and emailed directly to I&APs that requested a copy. All comments received from Stakeholders, I&APs and Registered I&APs will be addressed where appropriate in the Final EIAR, and all comments will be included in the Comments and Response Report (CRR) which will be submitted with the Final EIAR.

8.7 Authority Consultation Meetings

The S 102 and IEA application processes and the requisite consultation and report review requirements are currently governed by the Directions Regarding Measures to Address, Prevent and Combat the Spread of Covid-19 Relating to National Environmental Management Permits and Licences (GNR 650), as amended, promulgated under the Disaster Management Act, 2002 (Act No. 57 of 2002) (DMA). Annexure 3 of GNR 650 specifies the services to be provided or obtained by proponents, applicants, Environmental Assessment Practitioners (EAPs), specialists, and professionals undertaking actions as part of the environmental authorisation process and organs of state as commenting authorities required in terms of the NEMA, the NEM:WA and the EIA Regulations 2014.

Due to the limitations imposed by the Directions (GNR 650), no consultation meetings were held during the Scoping Phase. An authority meeting will be undertaken with the DMRE during the EIA phase to present the project and garner input from the DMRE and all commenting authorities. Proof of consultation with authorities will only be appended to the Final EIAR.

8.8 Public Consultation Meetings

Due to the limitations imposed by the Directions (GNR 650), no consultation meetings were held during the Scoping Phase. If possible, a public meeting will be undertaken with stakeholders and I&APs during the EIA phase to present the project and garner further feedback on the consolidation project. Stakeholders and I&APs will be notified of the meeting via email and/or SMS. Should a public meeting not be possible, the EAP will undertake individual or group meetings via virtual platforms with Stakeholders and I&APs that request such meetings. Proof of consultation with the public will only be appended to the Final EIAR.

8.9 Summary of issues raised by I&APs

The issues and comments raised to date in I&AP Registration and Comment Forms, emails, letters, during the IWUL public meeting, and during the Scoping Phase are summarised in **Table 8.1**.

Table 8.1: Summary of Issues and Comments Raised to Date.

ISSUES AND COMMENTS	
Safety/integrity of Sasol pipeline	Safety/integrity of Afgri silos
Social impacts	Lack of consultation between NBC and I&APs
Accessing private property without consent	Striking employees casing damage to property
Resettlement of communities due to mining activities	Rezoning of land

ISSUES AND COMMENTS	
Air, soil, and water pollution	Noise and dust impacts
Impact on Important Bird and Biodiversity Areas (IBAs), CBAs and wetlands	Water quality deterioration (surface and groundwater)
Decanting water quality and impacts	Water quality of wastewater discharge from the WTP
Groundwater drawdown	Impact on aquifer
Impact on fountain on Portion 13	Blasting and vibration impacts (i.e. cracking)
Cumulative impacts	Wetland and biodiversity offset requirements
Insufficient grazing land	Post-mining land capability
Paardeplaats Section (i.e. validity of EA, request for EIA & EMP, process queries, IWUL & MR authorisations)	Rehabilitation, offset, and financial provisioning
Job creation and job retention	Water treatment plant ability to handle additional water from Paardeplaats Section.
Requirement for a Strategic Environmental Assessment (SEA)	Social and Labour Plan
Renewable versus non-renewable energy projects	Supply agreements for coal provision to Eskom
Security	Road infrastructure

The detailed disclosure of all issues and comments raised to date is provided in **Table 8.2** overleaf.

Table 8.2: Detailed Disclosure of Issues and Comments Raised to Date.

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
Stakeholders/I&APs			
Christopher Foster	25/11/2019	-	-
Johan Botha	25/11/2019	Sasol/Rompco has natural gas pipelines in the area. Need confirmation of the consolidation area to ascertain whether servitudes are affected or whether blasting/mining activities could impact pipeline.	CIGroup sent a plan showing the consolidation area. No further feedback received.
Andiswa Matikinca	26/11/2019	As project manager for #MineAlert, the digital tool that tracks and shares mining licence applications and license approvals in South Africa, my interest in this particular project is following the project, including it in our #MineAlert database and adding it onto our mapped digital platform.	Information forwarded to NBC for action.
Carol de Bruin	27/11/2019	Strikes and damage to property/roads. Damage to landscape, air, soil and water pollution.	Water management addressed in IWUL Application. Addressed in the approved EMPs for both Sections. Additional measures regarding air and soil will be included in updated EMPs (upcoming NEMA, NEM:WA and MPRDA processes).
Pieter Schoeman	18/12/2019	Cumulative impacts on freshwater catchment areas. Cumulative wetland impacts. Social impacts associated with impact on roads, air	Water management addressed in IWUL Application. Addressed in the approved EMPs for both Sections. Additional measures regarding air and soil will be

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
		quality and sense of place. Low of important wetlands in Mpumalanga.	included in updated EMPs (upcoming NEMA, NEM:WA and MPRDA processes).
Susan Sabbagha Constantine Sabbagha	01/12/2019	Mining impacts including ground and surface water loss and pollution, and long-term land capability and land-use after closure. The project impacts directly on the I&AP property in terms of noise, blasting, dust and the diagram attached to the letter includes a part of portion 13 within the demarcated area of the project. The present Glisa operation impacts directly with our property, the Paardeplaats mine is also going to impact our property directly. I&AP communication has ceased completely. We are at the point of approaching mine management and if no response Department of Minerals Resources to reinstate communication channels.	Water management addressed in IWUL Application. Addressed in the approved EMPs for both Sections. Additional measures regarding air and soil will be included in updated EMPs (upcoming NEMA, NEM:WA and MPRDA processes). CIGroup has suggested that NBC reinstate meetings with neighbouring landowners.
Neville Wilkie	07/01/2020	Impact on water fountains on Portion 13. Dust, noise and water pollution. Blasting impacts.	Water management addressed in IWUL Application. Addressed in the approved EMPs for both Sections. Additional measures regarding air and soil will be included in updated EMPs (upcoming NEMA, NEM:WA and MPRDA processes).
Nadia Hertzel & Johan Smuts	23/01/2020	Afgri owns silos in the area and wants confirmation that they will not be affected by the consolidation.	Afgri sent CIGroup a list of silos in Mpumalanga which CIGroup plotted in

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
			relation to the consolidation project. The Afgri silos fall outside the consolidation area and are not expected to be affected.
Bafana Mnisi	06/02/2020	-	-
Mbongeni Ndlovu	10/02/2020	Damage to graves, property and wetlands. Effects of blasting/mining already noted by cracking houses and this is likely to worsen. Pollution of drinking water and insufficient grazing land.	Water management addressed in IWUL Application. Addressed in the approved EMPs for both Sections. Additional measures regarding air and soil will be included in updated EMPs (upcoming NEMA, NEM:WA and MPRDA processes).
Hiral Naik	02/03/2020	The proposed mining area falls directly within the Steenkampsberg Important Bird and Biodiversity Area (IBA), Critical Biodiversity Areas (CBAs) and in an area that will have a significant negative impact on the threatened birds and Biodiversity in the area. The Steenkampsberg Important Bird and Biodiversity Area (IBA) and the Dullstroom Plateau Grasslands Threatened Ecosystem provides breeding and feeding habitat to a significant number of threatened waterbird species. The Steenkampsberg IBA is a globally recognised IBA as it provides critical habitat for a number of globally threated bird species. BirdLife	The Paardeplaats Section was granted the right to mine within the IBA and CBA mentioned. The operation is legal. Water management addressed in IWUL Application. Addressed in the approved EMPs for both Sections. Additional measures regarding air and soil will be included in updated EMPs (upcoming NEMA, NEM:WA and MPRDA processes).

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
		South Africa cannot support developments on this site that may have negative environmental impacts on the IBA and the priority wetland system. further, the negative impacts of coal mining on groundwater are well documented and many of the threatened species in the area are highly reliant on the numerous dams, streams and wetlands in the region, BirdLife South Africa is concerned about the impacts of mining on water quality and flow in the region.	
Annatjie Burke	08/12/2019	Cumulative impacts will be unacceptable. Historical non-compliance of Glisa Mine. Rezoning problematic.	Cumulative impacts addressed in the approved EMPs for both Sections. Water management addressed in IWUL Application. Addressed in the approved EMPs for both Sections. Additional measures regarding air and soil will be included in updated EMPs (upcoming NEMA, NEM:WA and MPRDA processes). Rezoning process finalized. Non-compliances referred to have all been addressed.
	20/12/2019	Legitimacy of the Paardeplaats Section. Sensitivity approach versus full mining area approach.	The Paardeplaats has a MR for the full mining area.

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
	13/02/2020	Wetland offset requirements.	Wetland offset is required, and NBC will commission an assessment in this regard once clarity is obtained on neighbouring MR applications.
Annatjie Burke	13/02/2020	In the light of the information contained in the Environmental Authorization document please note the following additional comments. The EA is a pivotal document and was used in the rezoning (farming to mining and quarrying) application of Paardeplaats 380JT Portion 30 in December 2019. The value of this document is intrinsic to the application for the Consolidation of the Paardeplaats and Glisa (NBC) sections. NB: Several key conditions in this EA were apparently not met – thus jeopardizing the whole process and nullifying the EA. Alternative 3 (Sensitivity Planning Approach – "Portion 30 only impact") was to be followed. Alternative 3 Sensitivity Planning Approach is the preferred development alternative, and this is supported by reconditions from the EAP and several other specialist consultants" (Quoted from page 23 Synchronicity Development Planning Rezoning Portion 30 of the farm Paardeplaats 380 JT).	The NEMA EA lapsed Exxaro, the original applicant, was in the process of attending to the appeal and landowner aspects that the DMRE required conclusion on. CIGroup went on to state that the documents developed and submitted as part of the NEMA process were also used in the MPRDA process, and that this included the EIA and the EMP, with the same management and mitigation measures proposed. CIGroup commented that with the approval of the MPRDA EMP (the same EMP as submitted for the NEMA process), the management and mitigation measures proposed therein were approved and had to be complied with. CIGroup acknowledged the comment made by AB in which she cited the lapsed EA referring to the mining of Portion 30 only. CIGroup stated that the

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
		Established land uses such as Hadeco Flower Bulb farm had to be allowed to continue. Meanwhile the farm was stripped and all activity ceased. Hadeco (Pty) Ltd appealed against the original Record of Decision. Approximately 200 jobs (including indirect jobs at Hadeco's head office) were lost in the process. The proposed new mine will create less jobs, thus there is a nett loss of jobs. 39 families were affected. In the light of the aforementioned condition, does the mining company not have a liability to continue with the farming operations at Hadeco Flower bulb farm even though Hadeco apparently does not farm there anymore? The mining areas as per the locality map clearly outlines the mining activity planned on Paardeplaats 380JT Portion 28. This is in contradiction to the Sensitivity "Portion 30 only" Planning Approach. "It is also extremely worrying that both the Mining Right (MR) and the Water Use License (WUL) allow mining on all the portions – Paardeplaats380 JT portion 13, 28, 29, 30 and 40 and portion 2 of the farm Paardeplaats 425 JS as opposed to "Portion 30 only" Sensitivity Planning Approach."	MR issued was for the full MR application area, and not just Portion 30. This meant that all the conditions of the EMP had to be complied with including, for example, the wetland offset requirement contained in the EMP. CIGroup stated that the non-compliance referred to were historical and had all been addressed by the previous owner, Exxaro, and were being reassessed for non-compliances by NBC during the IWUL and EA processes.

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
		In your email sent to me on 21 January 2020 you referred to Hadeco Flower Farm operating on Portions 29 and 40. This is in contradiction to information given by Synchronocity which states that Hadeco operated on 28 and 40. Please clarify. Alleged historical non-compliances of the Glisa mine • " Exxaro declined to make information available for Glisa Colliery" (p129 Umsimbithi eMhakazeni Project-Groundwater Assessment). This refusal resulted in Kongiwe Environmental not being able to assess the cumulative impacts of several mines in the Belfast/Emakhazeni area. • Dr Koos Pretorius from the Federation for a Sustainable Environment laid complaints against Exxaro for allegedly mining without a Water Use License and the proper Environmental Authorisations. The Dube family laid charges against Exxaro for allegedly damaging graves. • "Glisa coal mine in Mpumalanga has been criminally charged by the Department of Water Affairs for allegedly contravening	

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
		the National Water Act. According to Nigel Adams, the head of the Blue Scorpions, the company has been operating without a water license and had not been treating polluted water properly" ("Coal mine in hot water" Katherine Child, Times Live 11 September 2012) Wetland offset • EA Paardeplaats par 3:17 - "Identified areas for biodiversity offsetting must be declared a non-mineable area (i.e. an offset protected area to protect the sensitive biodiversity and such declaration must be legally binding to everyone affected." (Emphasis added). • The Alternative 3 Sensitivity Approach prescribed a 231.95ha conservation area as offset for the 46ha wetlands that will be mined out. Please advise if the abovementioned Protected Area (PA) was proclaimed and if so, on which Paardeplaats portions? • EA Paardeplaats par 3:20 - "Paardeplaats Coal Mine must form a Management Committee with relevant stakeholders	

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
		(DMR, DWA, MTP, Mapumalanga Wetland Forum, etc.) with regard to the establishment of the best possible method for the proposed offsetting programme for the identified pan to be managed and protected." (Emphasis added). Please advise if the abovementioned process was followed, and if so, please provide details. EA Paardeplaats par 3:70 - "Non-compliance with a condition of this authorization may result in criminal prosecution or other actions provided for in the National Management Act, 1998 and the regulations." The EA lapsed • The authorization was issued in 2013 and therefore lapsed in 2016. In the light of all the new mines in the direct vicinity and mines that have been under application since 2013*, a new Environmental Impact Assessment (EIA) must be undertaken. Only after the new EIA has been approved an application for a new EA can be submitted. A Public Participation Process for a new EA is imperative to determine the:	

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
		• cumulative impacts re noise-, dust- and water pollution and water extraction • effects of blasting • Social impacts. • Several new mines opened or are under application eg. eMhakazeni/ Umsimbithi (initial footprint 2600ha), Xivono/ Weltevreden (initial footprint 800ha) and Paardeplaats Portion 251. DAFF did not support the rezoning (farming to mining) of Portion 30 –(1 July 2015).	
Annatjie Burke	20/02/2020	A question was raised during the presentation regarding the consolidated Water Balance (WB) developed. She understood the WB to represent a post-mining scenario and queried what the operational scenario would be.	CIGroup replied that the WB presented was an operational scenario considering the ramping down of mining activities at the Glisa Section, and the operational mining activities at the Paardeplaats Section.
Annatjie Burke	20/02/2020	Another question is raised during the presentation regarding the contaminant transport model pot-closure Sulphate (SO_4^{2-}) contaminant plumes. She queried whether the SO_4^{2-} contaminant plume would be under the backfilled areas.	CIGroup replied that the model specifically related to groundwater, so the SO_4^{2-} contaminant plume was below the surface. CIGroup noted that the groundwater would be recharged through water falling on surface and seeping through backfilled areas into the

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
			groundwater resource. CIGroup also commented that recharge would take place over time until such time that the groundwater level reached the surface, at which time decant would be experienced.
Annatjie Burke	20/02/2020	AB raised her concern with regards to the National Environmental Management Act (NEMA) Environmental Impact Assessment (EIA) undertaken and the Environmental Authorisation (EA) granted for the Paardeplaats Section. She stated that the EA was issued in 2013 and had lapsed in 2016. AB went on to state that a number of applications had been done after 2016 on the basis of the lapsed EA, for instance, the rezoning application for Portion 30 which was concluded in 2019. AB stated that she believed the whole process to be fatally flawed due to the fact that the EA, a critical document, lapsed in 2016.	CIGroup acknowledge that the NEMA EA lapsed in 2016 and went on to explain that the Mineral and Petroleum Resources Development Act (MPRDA) Mining Right (MR) application was still in the process of being assessed. CIGroup stated that taking consideration of the 2014 NEMA EIA Regulations, as amended in 2017, that the MPRDA process falls within the transitional arrangements of these Regulations, and that the issuing of the MR and approval of the MPRDA Environmental Management Plan (EMP) by Department of Mineral Resources and Energy (DMRE) is deemed to fulfil the requirements of the NEMA and can be seen as the EA for the Paardeplaats Section.

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
Annatjie Burke	20/02/2020	AB requested to know when the MR was granted.	CIGroup replied that the MR was granted in 2018. CIGroup further explained that there was an appeal process that had to be concluded as well as some issues with landowners that needed to be resolved before the MR could be issued. These processes ran from 2013 – 2018 and once concluded, the MR was granted.
Annatjie Burke	20/02/2020	AB requested that the NEMA EIA Regulations be made available to her as well as an explanation as to why the lapsed EA could still be used by NBC.	CIGroup replied that the NEMA EIA Regulations would be provided to AB. CIGroup stated that the lapsed EA was not in use. CIGroup explained that two (2) separate processes had been undertaken, one for EA in terms of the NEMA and one for a MR in terms of the MPRDA. These processes were separate processes at the time of application and that the NEMA process related to listed activities of which mining related activities were not included. CIGroup continued stating that mining related activities were only recognised as listed activities in the 2014 NEMA EIA Regulations. CIGroup again

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
			acknowledged that the EA had been granted for all NEMA listed activities applied for.
Annatjie Burke	20/02/2020	AB interjected stating that the EA referred to mining as an activity.	CIGroup replied noting that the EA made mention of mining and mining-related activities but that it did not authorise mining as it was not a listed activity at the time. CIGroup went on to note that the NEMA application had been done in terms of the previous NEMA EIA Regulations (2010), which did not contain mining as a listed activity. CIGroup went on to explain that when the NEMA EA lapsed Exxaro, the original applicant, was in the process of attending to the appeal and landowner aspects that the DMRE required conclusion on. CIGroup went on to state that the documents developed and submitted as part of the NEMA process were also used in the MPRDA process, and that this included the EIA and the EMP, with the same management and mitigation measures proposed. CIGroup commented that with the approval of the

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
			MPRDA EMP (the same EMP as submitted for the NEMA process), the management and mitigation measures proposed therein were approved and had to be complied with. CIGroup acknowledged the comment made by AB in which she cited the lapsed EA referring to the mining of Portion 30 only and stated that the MR issued was for the full MR application area, and not just Portion 30. This meant that all the conditions of the EMP had to be complied with including, for example, the wetland offset requirement contained in the EMP.
Annatjie Burke	20/02/2020	AB noted a concern that some of the specialist findings presented graphically in the presentation showed mining activities extending beyond Portion 30. She referred again to the EA that specifically stated that mining only be undertaken on Portion 30.	CIGroup replied that the MPRDA EMP referred to the full MR application area as the coal reserve had been quantified for the full MR application area. CIGroup acknowledged that the lapsed EA adopted the sensitivity approach (i.e. mining of Portion 30 only), but reiterated that with the lapsing of the EA, the approved MPRDA EMP applied and that this addressed the full MR application area. CIGroup noted that

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
			the main focus of the mining at the Paardeplaats Section would initially be on Portion 30, after which it would continue onto other farm portions within the MR application area. CIGroup explained that, in order to ensure that the specialists assess the Glisa and Paardeplaats Sections fully, the extended mining plan on portions other than Portion 30 had to be utilised. CIGroup stated that the bigger picture had to be considered as this would present the worst-case scenario.
Annatjie Burke	20/02/2020	AB, stating that since the lapsed EA was still applicable, the condition stating that a protected area had to be declared within six (6) months of the granting of the EA should then still be applicable. She stated that, based on the Paardeplaats Section layout, this protected area should have been declared on Portion 29, but according to the information presented in the presentation that mining was now planned on Portion 29.	CIGroup noted that the requirement for an offset area (biodiversity/wetland) was specified in the EMP and would still be applicable. CIGroup commented, that the conditions in the EA, which was granted in 2013 had lapsed, one of these being a protected area. CIGroup acknowledged that NBC were aware of the offset requirement and were assessing such options but noted that these had not proceeded very far as NBC was awaiting the outcome of the

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
			Umsimbithi Mining (Pty) Ltd (Umsimbithi) MR application. Once an outcome has been made public, NBC will focus on the required offset area, potentially in consultation with Umsimbithi. CIGroup stated that it would serve no purpose for NBC to identify an offset area that may fall within another MR area as this would negate everything.
Annatjie Burke	20/02/2020	AB interjected wanting to know where the Umsimbithi MR area was.	CIGroup replied that it was adjacent to the Paardeplaats Section on the western side running all the way to the N4.
Annatjie Burke	20/02/2020	AB then commented that she did not understand RJvRs explanation regarding the offset area. She stated that if Portion 29 was within NBCs MR area no one else could mine there, so why couldn't the offset area be placed there.	CIGroup replied that there were many factors to consider in selecting offset areas, including consideration of the overall impact that mining in the area would have on such an area. CIGroup stated that due to the size of the offset area required, Portion 29 may not be sufficiently sized to accommodate the offset. CIGroup also noted that long-term, placement of an offset area on Portion 29 would not be viable due to the

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
			proposed mine development plans which include Portion 29 for mining activities.
Annatjie Burke	20/02/2020	AB queried whether it would be legal for NBC to start mining if the required offset area was not in place.	CIGroup stated that it would be legal for them to start mining without the offset in place.
Annatjie Burke	20/02/2020	AB was concerned about the commitment of NBC to honour the offset requirement.	CIGroup responded that the requirement for the offset was contained in the approved MPRDA EMP and would have to be complied with. CIGroup noted that NBC were committed to the offset, in line with the EMP requirements, but that this process had to be assessed in more detail prior to an area being selected.
Annatjie Burke	20/02/2020	AB raised a concern that the offset process could be postponed indefinitely.	CIGroup responded that she did not believe this would be the case as NBC had already begun engaging with specialists regarding the offset area requirements. CIGroup noted that selection of the correct offset area was imperative and that this had to be done taking the mining plan and adjacent mining operations into account. CIGroup also noted that offset areas do

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
			not have to be within a MR area or within properties owned by NBC. On the contrary offset areas could be located a distance from the area where the impact is occurring because that may be where an existing wetland, for example, may require input to improve its functionality. CIGroup went on to explain that biodiversity offset guidelines had been around for many years and were still in draft format pending finalisation. CIGroup noted that these guidelines, together with the wetland offset guidelines, would assist NBC in assessing and implementing the offset required.
Annatjie Burke	20/02/2020	AB questioned whether NBC were waiting for these guidelines to be finalised before they began planning the offset.	CIGroup replied that NBC were not waiting on these guidelines to be finalised, however they were waiting to understand what would be taking place in the greater area, notably other MR application outcomes, in order to ensure that the offset area selected would provide the long-term offset as required.

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
Annatjie Burke	20/02/2020	AB commented that the lapsed EA stated that a 5:1 offset ratio is required, equating to an area of approximately 230 hectares (ha). She stated that she spoke to a wetland specialist[1] who indicated that an area of 230 ha was insufficient due to the pristine nature of the wetlands to be impacted by mining.	CIGroup acknowledge that there was wetland offset guidelines in place that would guide NBC on the extent of the offset area required.
Annatjie Burke	20/02/2020	AB referred to a report she had read which stated that with the current rate of MRs being issued, the whole of Mpumalanga will be mined out . She noted that in the area surrounding the Glisa and Paardeplaats Sections that the Umsimbithi MR area has an initial footprint of ±2,600 ha, the Mbuyelo Coal (Pty) Ltd (Mbuyelo) mine has an initial footprint of ±800 ha, and both of these mines are adjacent to the Glisa and/or Paardeplaats Sections. AB, noting that this didn't account for other MRs or mines in the vicinity, then questioned where an appropriate offset area would be found bearing those factors in mind.	CIGroup replied that CIGroup could not comment on the extent of MRs or mines in Mpumalanga but noted that NBCs delay in identifying an offset area was for the exact reasons that AB had just mentioned. CIGroup further noted that the choice of an offset area needed to be made bearing in mind the long-term sustainability of that offset, even if that meant that the offset was in a different catchment or province.

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
Annatjie Burke	20/02/2020	AB then stated that she believed it would be a tragedy if NBC did not place the offset in the Paardeplaats area especially considering that the area was in the headwaters of a river. She noted that the offset would be a good opportunity to preserve these headwaters. AB then commented that if she looks at the mining plans, she can see that there is no indication of NBC doing that. AB then requested to read an excerpt from an email she received from BirdLife South Africa. She said the comments confirm what she had just said because his comments were that much of the proposed mining area intercepts with Critical Biodiversity Areas (CBAs) which should be preserved.	CIGroup requested the name of the Birdlife South Africa representative from whom the comments were received.
Annatjie Burke	20/02/2020	AB continued to read from the comments of Mr Hiral Naik. She recited the following: "We remind you that the mining biodiversity guidelines state that there is a very high likelihood of a fatal flaw for mining projects that impact areas of high biodiversity importance. We also wish to emphasise that irreplaceable CBAs as present on Paardeplaats are not suitable for biodiversity offsets and it is often impossible to offset impacts of optimal CBAs." AB stated that the implication	CIGroup responded that the comments recited were noted and requested AB to send them to the EAP in writing.

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
		of that is that you do not mine optimal CBAs and you cannot offset them. She then went on to recite another point as follows: "Due to the likely impact on CBAs, it is unlikely that this project will comply with the Equator Principles and the International Finance Corporation (IFC) performance standards which they invoke. CBAs would be classified as critical habitats by the IFC performance standard 6 and CBA1 areas would not be suitable for biodiversity offset due to the irreplaceability. In this case it is unlikely that the developer would be able to access financing from banks that are signatories to the Equator Principles for this project."	
Annatjie Burke	20/02/2020	AB agreed to send the comments. AB proceeded to draw the meetings attention to comment 2 from Mr. Hiral Naik, which stated: "The attached river and wetlands map show that the proposed mining area also intersects with National Freshwater Ecosystem Priority Areas, wetlands and rivers, which government has identified as those that should remain healthy in order to support sustainable use of water resources as well as conservation goals. With regards to watercourses, as a minimum GN 704 Section 4 of the National	CIGroup replied, in relation to the comments read out, that the IWUL application serves to address the requirements of the National Water Act (NWA) and GN 704 , and that NBC would apply for the necessary exemptions in terms of GN 704 where necessary. CIGroup stated that it was then up to the Department to decide on the application and issue an IWUL and requested exemptions. CIGroup further

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
		Water Act 1998 Regulations, should be complied with when no person in control of a mine or activity may, except in relation to a matter contemplated in Regulation 10, carry on any underground or opencast mining or prospecting or any other operation or activity under or within the 1:50 year floodline or within a horizontal distance of 100 metres (m) from any watercourse, whichever is greater."	noted that an IWUL and GN 704 exemptions had been granted for the Paardeplaats Section.
Annatjie Burke	20/02/2020	AB then requested clarity on whether the Sensitivity Planning Approach (mining on Portion 30 only) which was advocated by the lapsed EA had been waived.	CIGroup replied that the Paardeplaats MR had been granted for the full application area with the current focus for mining being on Portion 30. CIGroup also referred to the mine plan presented which extended beyond Portion 30 in a southerly direction.
Annatjie Burke	20/02/2020	AB referred to a map in her possession which showed a dewatering dam and Pollution Control Dam (PCD) on Portion 28 and a mine dump area planned on Portion 29. She asked for confirmation that this infrastructure was correct.	CIGroup replied that she was not aware of such infrastructure. CIGroup noted that, in terms of the approved Paardeplaats EMP and IWUL, there is a stockpile area and PCD authorised on Portion 24. CIGroup stated that she would confirm this with NBC.

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
Annatjie Burke	20/02/2020	AB referred to the Glisa Section, noting that there was a new PCD planned in that Section. She queried whether a Reverse Osmosis (RO) plant would be required to treat the water in the PCD.	CIGroup replied that there was already a Water Treatment Plant (WTP) established and operational within the Glisa Section. CIGroup stated that the WTP had been operational since 2017 and was treating water from the voids for re-use on site and for release into the Skilferlaagtespruit in line with the IWUL conditions.
Annatjie Burke	20/02/2020	AB queried whether the WTP was a RO plant. AB then questioned whether the WTP would have sufficient capacity to handle water from the Paardeplaats Section.	CIGroup replied that the WTP had capacity to handle water from the Paardeplaats Section, bearing in mind that water would also be used for dust suppression and in the Crushing, Screening and Washing Plant (CSWP).
Annatjie Burke	20/02/2020	AB requested the technical details for the WTP confirming the handling capacity.	CIGroup replied that she would provide the handling capacity of the WTP.
Annatjie Burke	20/02/2020	AB went on to state that in the approved IWUL there was a table that referred to "water quality limits", wherein the pH range was listed as 5.5 – 9.5. AB noted her concern with this range stating that results from pH testing in the Glisa/Paardeplaats area show pH of being in the neutral range to slightly acidic. She was	CIGroup replied that she would provide the approved discharge standards as contained in the IWUL.

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
		concerned that broadening the pH range as per the range specified in the IWUL would result in heavy metals being dissolved and extremely toxic water as a result. AB requested the discharge (into Skilferlaagtespruit) water quality standards.	
Neville Wilkie (NW)	20/02/2020	Neville Wilkie (NW) of Portion 13 made apologies for Con Sabbagha and Susan Sabbagha. NW noted that RJvR had indicated that the Paardeplaats MR which was issued included Portion 13. He stated that as owners of Portion 13 they have not been provided with confirmation of this and requested proof of this.	CIGroup acknowledge the inclusion of Portion 13 in the MR and agreed to send NW supporting documentation to this regard.
Neville Wilkie (NW)	20/02/2020	NW referred to the Paardeplaats IWUL, noting that it only included water uses for Portion 24 and Portion 30.	CIGroup replied that the Paardeplaats IWUL authorised water uses for a certain amount of time and that the water uses approved were only for Portion 24 and Portion 30.
Neville Wilkie (NW)	20/02/2020	NW referred to the map presented showing the farm portions for the Glisa and Paardeplaats Sections. He stated that the farm boundary for Portion 24 was incorrect. He noted that he had consulted with Exxaro on this matter and they had provided confirmation that a portion of Portion 24 (± 6 ha) actually belonged to Portion 13.	CIGroup then stated that the information utilised by the EAP was obtained directly from the Surveyor General (SG) cadastral dataset, so all farm boundaries were based on that information. CIGroup requested that NW show the information he had in this

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
			regard and the area in dispute to her after the meeting.
Neville Wilkie (NW)	20/02/2020	NW queried who would be responsible for the funding of the WTP at/after mine closure.	CIGroup replied that the WTP was included in the NBC financial provision so the responsibility lay with NBC.
Annatjie Burke	20/02/2020	AB then requested, with reference to the Paardeplaats Section, whether the upfront requirement for financial provision had been paid and whether proof of that could be provided to her.	CIGroup replied that CIGroup did not have access to that information and that AB should consult NBC directly on that matter.
Annatjie Burke	20/02/2020	AB replied that she wanted CIGroup to request feedback from NBC together with proof of the payment if it was made.	CIGroup replied that they would request confirmation from NBC.
Neville Wilkie (NW)	20/02/2020	NW made mention of the fact that Exxaro, the previous owners of the Glisa and Paardeplaats Sections, held quarterly meetings with landowners and surrounding land users. He queried whether NBC would initiate the same as such meetings had not been held since NBC had taken over the Sections.	CIGroup replied that they would request feedback from NBC but was certain that the meeting would be reinstated.
Annatjie Burke	20/02/2020	AB queried what the timeframe for the Glisa rehabilitation was.	CIGroup replied that there was no specific timeframe as NBC were still mining the Glisa Section. CIGroup noted that concurrent rehabilitation was being

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
			undertaken and that once the mining was completed that rehabilitation would be ramped up. CIGroup stated that, on average, rehabilitation takes from 18 months to 3 years, and included backfilling, topsoiling, and vegetation and monitoring of vegetation establishment to ensure it was self-sustainable.
Annatjie Burke	20/02/2020	AB requested a specific timeframe for the rehabilitation and wanted a commitment from NBC in writing. AB said that she understood this but wanted NBC to provide I&APs with a starting date for rehabilitation.	CIGroup responded that she would request NBC to address her request but noted that rehabilitation was dependent on many external factors that could influence the rehabilitation timeframes, such as achieving a self-sustaining vegetation cover which is dependent on a variety of climatic variables. CIGroup responded that she would request NBC to provide this together with an anticipated date for completion of the rehabilitation.
Annatjie Burke	20/02/2020	AB then noted that she had been contacted by several members of the press regarding the ownership of NBC stating that information being	CIGroup replied that according to their knowledge all legal aspects relating to the sale/purchase had been finalised

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
		circulated acknowledges that Exxaro sold the Sections to NBC but that the legal process was not finalised.	and NBC was the legal owner and operator of the Sections.
Annatjie Burke	20/02/2020	AB stated that she had received an email directly from Exxaro the day prior to the public meeting (i.e. 19 February 2020) stating that the legal process had not been concluded yet.	CIGroup said that they would have to consult with NBC and Exxaro on that matter, noting that NBC would not be able to operate nor have been issued a MR for the Paardeplaats Section were all the legal processes not concluded. CIGroup requested that AB provide the name of the Exxaro representative that sent her the email so that the matter could be taken up with them directly.
Annatjie Burke	20/02/2020	AB queried whether the I&AP comments received would be made available to all I&APs and specifically to meeting attendees.	CIGroup replied that draft minutes of the meeting would be sent to meeting attendees for comment, after which the minutes would be finalised for distribution. CIGroup confirmed that all issues raised, or comments made during this meeting would be included in the Stakeholder Engagement Report which must be submitted with the the IWUL & IWWMP Technical Report. CIGroup confirmed that aspects raised that were

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
			not directly related to the IWUL application process would still be disclosed in the final submission documentation. CIGroup also stated that the issued raised or comments made would be carried across into the MPRDA Section 102 and EA process for full disclosure to all Departments.
Mbongeni Ndlovu	20/02/2020	Mbongeni Ndlovu (MN) queried how RJvR would share the information from the meeting with I&APs. MN commented that the attendance register did not provide for meeting attendees to include their email addresses.	CIGroup responded that this was provided for on the attendance register and this was shown to MN.
Annatjie Burke	20/02/2020	AB referred to the lapsed EA where it was stated that communities within the MR area would have to be resettled, noting that she could find no other information regarding the resettlement of these communities, querying the legal position of such communities.	CIGroup replied that a resettlement process was being undertaken by NBC, but that since it did not form part of their appointment, CIGroup could not provide further information thereon besides stating that the communities on Portion 30 were being consulted with as they needed to be relocated/resettled first, considering the mine plan. CIGroup also noted that there were communities on other portions that would require

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
			resettlement as the mine progressed. CIGroup stated that they would request a status update on the resettlement process from NBC.
Annatjie Burke	20/02/2020	AB noted with distress that the relocation of communities on the Hadeco farm Portions, stating that the lapsed EA had been based on the Sensitivity Planning Approach, which required the whole of the Hadeco operations to remain functional, ensuring that the employees would remain in the residences and retain their jobs.	CIGroup replied that the lapsed EA stated that the Sensitivity Planning Approach was preferred because the Hadeco operations could continue, and not that the Hadeco operations had to continue. CIGroup noted further that the MR was not issued until Exxaro had finalised outstanding issues with Hadeco regarding the Portions which they owned.
Neville Wilkie (NW)	20/02/2020	NW requested that the map indicating the wetland delineation be shown again. Commenting on the map, he queried whether NBC would be mining through the wetlands that had been identified and delineated on Portion 30.	CIGroup replied that NBC had been issued an IWUL for the Paardeplaats Section which authorised NBC to mine through those wetlands, noting that this had prompted the need for a biodiversity/wetland offset area.
Annatjie Burke	20/02/2020	AB referred to a comment made by RJvR during the presentation regarding the aquifer. She noted that RJvR referred to the aquifer as being classified as a minor aquifer.	CIGroup replied that the South African Aquifer Database classifies the aquifer as a minor aquifer with moderate vulnerability.

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
Annatjie Burke	20/02/2020	AB stated that her comment on the aquifer was that most of the aquifers in Mpumalanga were classified as minor and that this was where issues arose. She noted that there was generally a lot of surface water, yet not a lot of groundwater, noting further that mining in Mpumalanga was causing havoc to the groundwater, resulting in eco-side, with impacts that cannot be reversed. AB went on to say that all the mining in Mpumalanga was short-sighted and that it should not take place because Mpumalanga was a high-value farming and tourism area, not a water rich area. She concluded saying that mining would sterilise the Mpumalanga Province	CIGroup replied that the comments made by AB were noted.
Annatjie Burke	20/02/2020	AB referred to information from the Umsimbithi MR application process, stating that the EIA report states that the mine would require 3 million litres of water per day, and that the EIA states that this amount of water is unlikely to be sourced from within the MR area itself. She said it goes on further to state that water would be sourced from the eMakhazeni Local Municipality, who she notes is already extremely water stressed.	CIGroup replied that as an EAP they needs to look at the cumulative impacts for the Sections and this requires the Umsimbithi specialist reports which she requested from Umsimbithi but which had not been provided as yet.

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
Annatjie Burke	20/02/2020	AB acknowledge the reply and stated that the information was available in the public domain and that she would provide RJvR with the groundwater report. AB referred to the Mbuyelo mine stating that their documentation should also be reviewed with regards to potential cumulative impacts as they also neighbour the NBC Sections.	CIGroup thanked AB for the information and noted that to use the information in the reports being generated they had to submit a formal request for the information.
Neville Wilkie (NW)	20/02/2020	NW raised a concern regarding the fountain that occurs on Portion 13, close to Portion 24, stating that the fountain is not flowing the way it used.	CIGroup acknowledged the location of the fountain and stated that the hydrocensus undertaken for the IWUL refers to a borehole on Portion 13, but whether this was the fountain or not she could not confirm. CIGroup offered to confirm this with NW after the meeting.
Annatjie Burke	20/02/2020	AB suggested that the fountain be included in the monitoring program for monitoring on a quarterly basis.	CIGroup replied that the current monitoring programs are being revised and that they would assess that in relation to the fountain mentioned.
Annatjie Burke	20/02/2020	AB wanted it known that she had alerted journalists from e-TV and Carte Blanche about the NBC environmental licensing processes and that they were following the case.	CIGroup replied that the journalists were welcome to contact them directly to request information or comment. CIGroup also noted that they had emailed some of the journalists that AB had included in email communication

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
			enquiring whether they wanted to register as I&AP for the processes in question, and that to date none of those journalists had indicated that they wanted to be included in the processes.
Neville Wilkie (NW)	20/02/2020	NW presented RJvR with documentation pertaining to the portion of Portion 24 which he states should be included in Portion 13 and not Portion 24. He also indicated on Google Earth where the portion was as well as where the fountain was that he had mentioned during the meeting.	CIGroup thanked NW for the information and made a copy thereof for reference purposes. CIGroup also captured the area on Google Earth together with the location of the fountain he referred to for further consideration.
Neville Wilkie (NW)	20/02/2020	NW complained to CIGroup that NBC had brought members of the community that were to be relocated/resettled onto his property without his permission and requested that RJvR assist him in notifying NBC that this was unacceptable.	CIGroup committed to notifying NBC.
Mbongeni Ndlovu	20/02/2020	MN approached CIGroup and apologised for the late arrival of himself and Isack Mahlangu (IM), stating that they were told that there was no meeting taking place at the Belfast Golf Club.	CIGroup accepted the apology and thanked them for finding the meeting despite the misinformation provided.
Mbongeni Ndlovu	20/02/2020	MN stated that he an IM were the only representatives for the Paardeplaats community at the meeting and requested, that in future,	CIGroup replied positively, saying that the Hall would be considered for any future meetings that were required.

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
		CIGroup consider scheduling meetings at the Paardeplaats Hall near the Hadeco Village to accommodate more members of the community who would struggle to make a meeting in eMakhazeni town, as was evident in attendance at the meeting. He also stated that the Paardeplaats community were decision makers and had the right to comment on the MR and the consolidation process planned.	CIGroup informed MN that the MR for Paardeplaats had already been issued and confirmed that mining would proceed. CIGroup noted that the Paardeplaats Community could not challenge the MR, however they could provide their input into the management measures that were to be proposed in the EMP consolidation process. This would ensure that their requirements and inputs were incorporated, where possible, in the updated EMP. CIGroup informed MN that they were willing to meet with the community to inform them of the processes and establish open communication lines and queried when best suited them.
Mbongeni Ndlovu	20/02/2020	MN replied that meeting on a weekend would be easier for the community and IM concurred with this statement. MN said they wanted to understand to what extent the crop and grazing land would be diminished as the community have cattle that required grazing areas. He also requested that RJvR provide them with a copy of	CIGroup acknowledged the request on grazing land and said they would revert to NBC for clarity thereon.

NAME	DATE COMMENT RECEIVED	ISSUE AND COMMENT RAISED	EAP RESPONSE
		the Paardeplaats MR, the Social and Labour Plan (SLP) and IWUL.	

9 ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE DEVELOPMENT FOOTPRINT

The baseline environmental description was determined through utilising a combination of previous and current specialist assessments and monitoring reports. The list of specialist assessments consulted are presented in **Table 9.1**.

Table 9.1: Specialist Assessments Utilised.

SPECIALIST ASSESSMENT	COMPANY
Climate and Air Quality	Eco Elementum (Pty) Ltd
Soils	Institute for Soil Climate and Water, Agricultural Research Council
Terrestrial Biodiversity	Digby Wells Environmental (Pty) Ltd
Freshwater Ecosystems	Ecology International (Pty) Ltd
Surface Water	Aqua Earth Consulting (Pty) Ltd
Groundwater	Milnex cc
Heritage	PGS Heritage (Pty) Ltd
Traffic	Arup Transport Planning (Pty) Ltd
Blast and Vibration	Blast Management and Consulting (Pty) Ltd
Noise	Jongens Keet Associates
Visual	Eco Elementum (Pty) Ltd
Socio-Economic	Ptersa Environmental Management Consultants

9.1 Climate

Based on an evaluation of the meteorological data simulations run from the global NOAA Environmental Modelling System (NEMS) weather model at approximately 30 km resolution from 1985 to current of the project area, the following deductions can be made (**Figure 9.1**):

- In the summer months' maximum average daily temperatures are predicted to be 21°C - 24°C on average with a maximum of 30°C possible during hot days, dropping to a predicted 9°C - 13°C on average at night and 3°C minimum on cold nights.
- During winter months the average day time temperature are predicted in the 16°C - 19°C range while cold winter night-time temperatures are predicted to drop to -1°C.

Falling in a summer rainfall area, the Integrated Paardeplaats Section is predicted to receive the most precipitation in the summer months of October - March as can be seen in **Figure 9.1**. November - January are predicted the highest rainfall months with between 140 – 179 mm predicted per month during these months. February, March and October are predicted to receive

79 – 103 mm precipitation. All other months are predicted to receive less than 43 mm precipitation on average during the month.

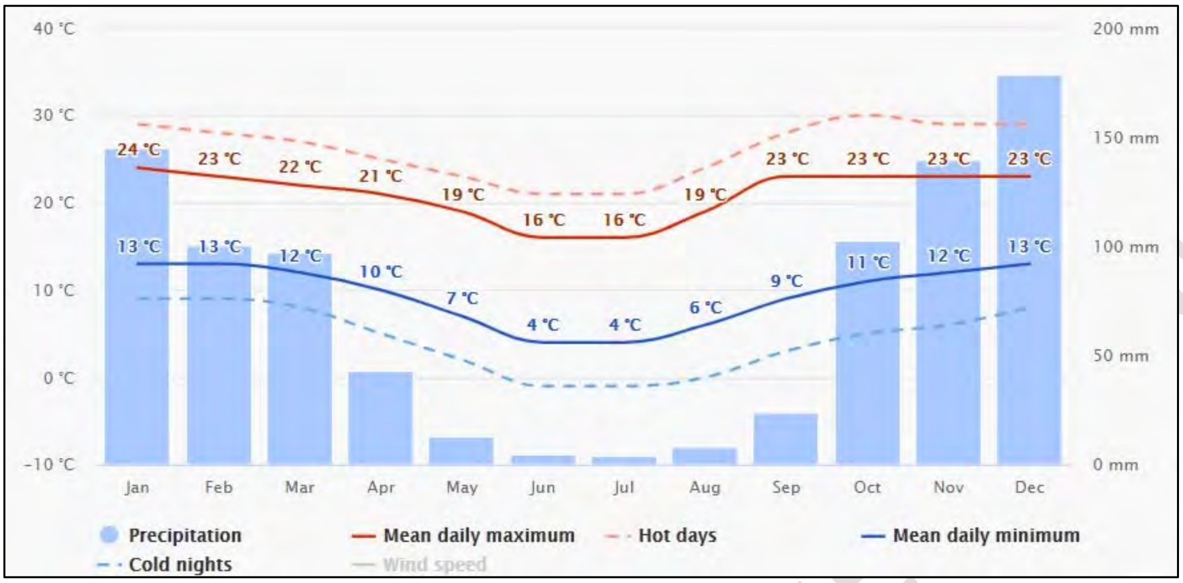

Figure 9.1: Average Temperature and Precipitation for the Integrated Paardeplaats Section.

The total precipitation days predicted at the Integrated Paardeplaats Section are presented in **Figure 9.2**. The highest precipitation days are predicted during the months of October - March. During these months' precipitation is predicted to only occur 16 - 24 days on average. The rest of the year precipitation is predicted to occur less than 9 days per month. Evaporation losses exceed rainfall throughout the year in the Integrated Paardeplaats Section which aligns with the warm and temperate nature of the area. The Mean Annual Evaporation (MAE) (Symons Pan) of the Integrated Paardeplaats Section is 1,500 mm (Bailey & Pitman, 2015).

A period wind rose for the Integrated Paardeplaats Section is presented in **Figure 9.3**. Wind roses comprise of 16 spokes which represents the direction from which winds blew during the period. The colours reflect the different categories of wind speeds. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction categories. Based on an evaluation of the meteorological data simulations run from the global NEMS weather model at approximately 30 km resolution from 1985 to current of the project area, the following deductions can be made:

- The predominant wind direction is predicted to occur mainly from the East-North-East (ENE) 1,073 hours per year.
- A secondary direction is predicted from North-East (NE) 592 hours per year and East (E) 635 hours per year, respectively, with wind speeds higher than 5 kilometres per hour (km/h).

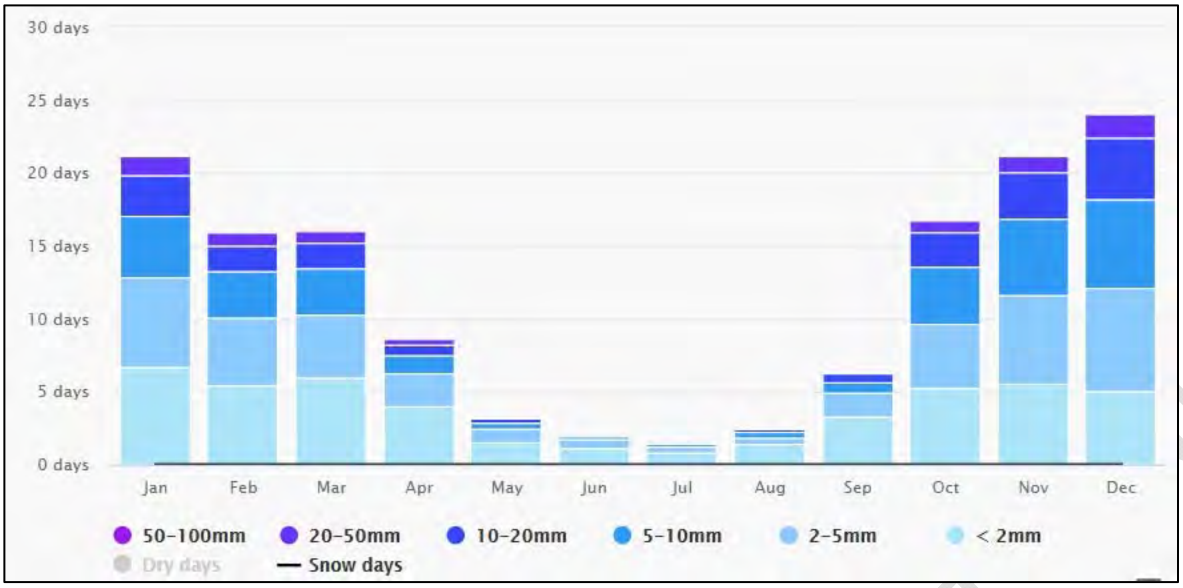

Figure 9.2: Day Count of Total Daily Precipitation per Month for the Integrated Paardeplaats Section (1985 – present).

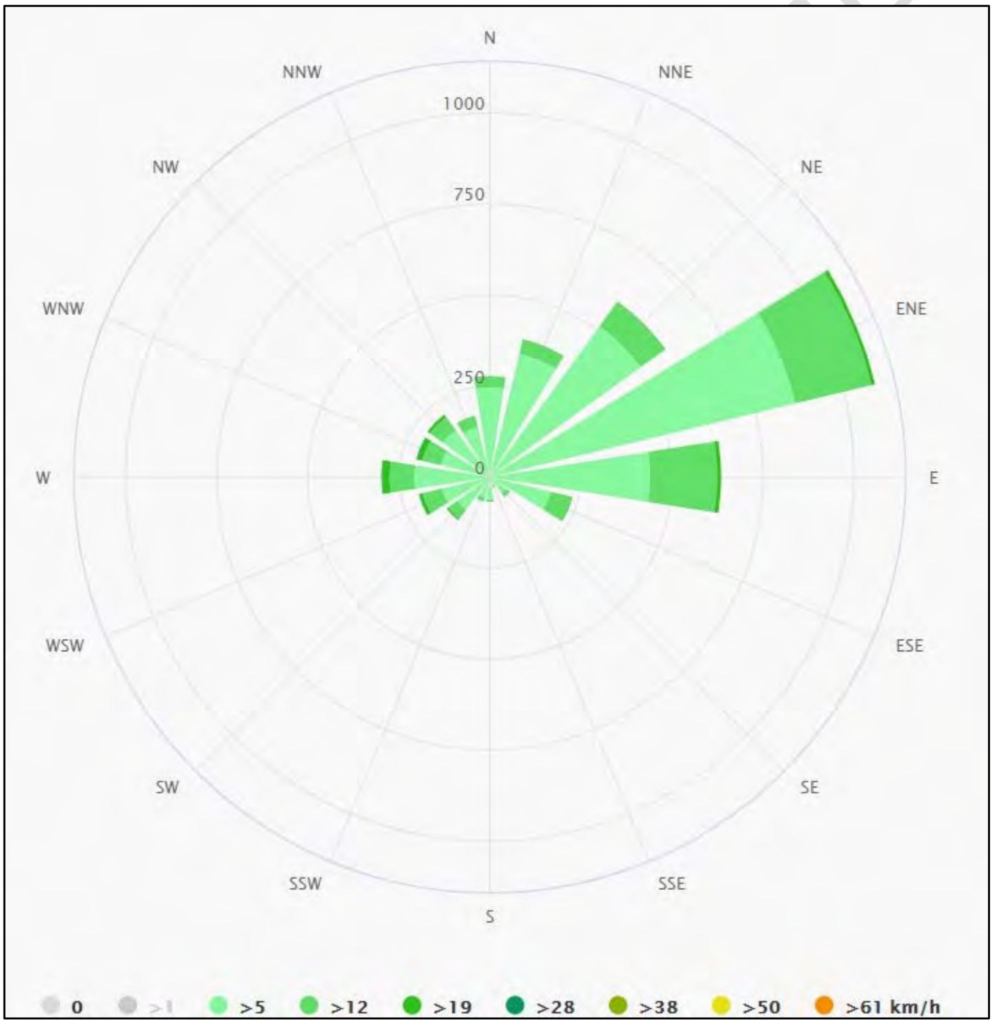

Figure 9.3: Predominant Wind Direction for the Integrated Paardeplaats Section.

It is anticipated that calm conditions with wind speeds of 12 km/h or less for 11 - 18 days per month throughout the year will prevail at the Integrated Paardeplaats Section, whilst 12 - 19 km/h winds are predicted 8-16 days per month through the year (**Figure 9.4**). Wind speeds of more than 19 km/h are predicted to occur 1 - 3 days per year on average.

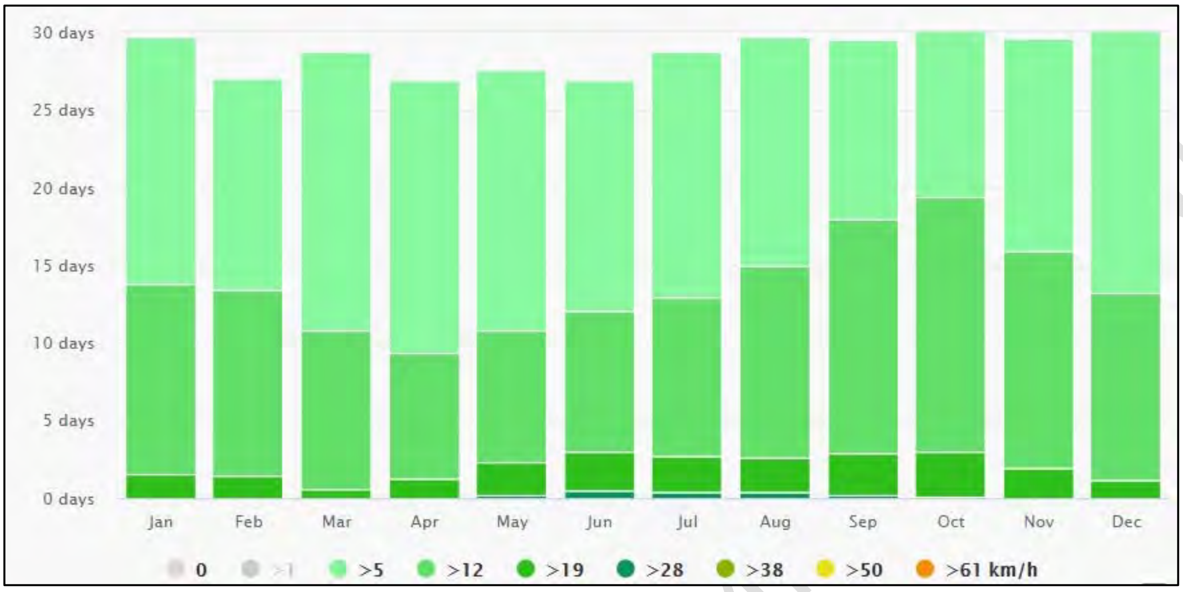

Figure 9.4: Wind Class Frequency Distribution per Month for the Integrated Paardeplaats Section.

9.2 Air Quality

A number of sensitive receptors have been identified in the immediate vicinity of the Integrated Paardeplaats Section (**Figure 9.5**) and include the town of Belfast, the informal settlement of Siysthuthuka, and various homesteads within and around the Section. Various sources of emissions exist, all of which may impact on the identified sensitive receptors, including:

- Vehicle exhaust gases;
- Veld fires;
- Trucks passing on the roads, loading and offloading raw materials;
- Wind erosion as a result of ROM material and topsoil stockpiles;
- Material handling (loading, hauling and tipping); and
- Other mining activities such as wind erosion and vehicle entrained dust.

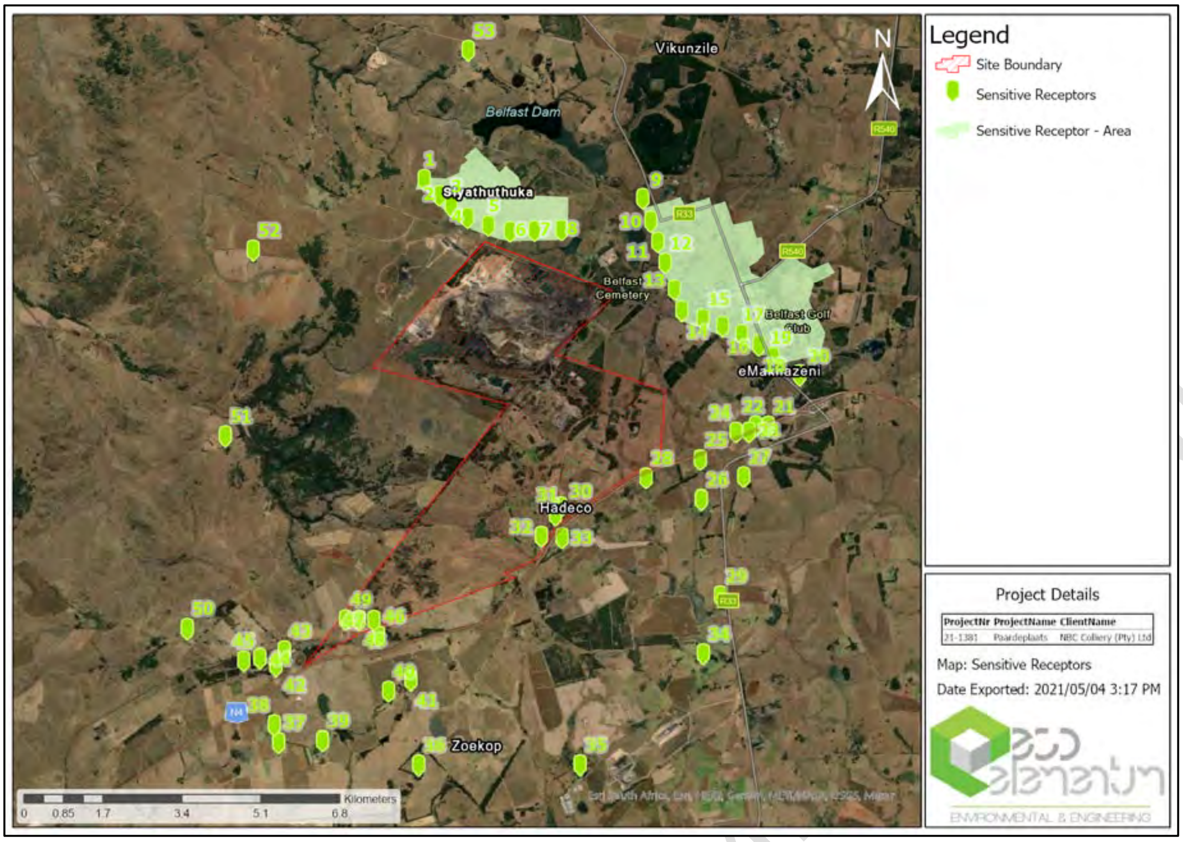

Figure 9.5: Identified Sensitive Receptors in the Immediate Area of the Integrated Paardeplaats Section.

A comprehensive dust monitoring campaign exists for the Integrated Paardeplaats Section and has been in place since 2015. Windblown settleable dust fall-out is monitored based on the ASTM International standard method for collection and analysis of Dustfall (ASTM D1739), with certain modifications. Dust fallout is measured against the National Dust Control Regulations (GNR 827), of the NEM:AQA (**Table 9.2**). In terms of GNR 827, a residential area means any area classified for residential use in terms of local town planning scheme, whereas a non-residential area means any area not classified for residential use as per local town planning scheme.

Table 9.2: National Dust Control Regulations Standards.

RESTRICTION AREAS	30-DAYS AVERAGE DUST FALL RATE (D) ($mg/m^2/day$)	PERMITTED FREQUENCY OF EXCEEDING DUST FALL RATE
Residential area	D < 600	Two within a year, not sequential months
Non-residential area	600 < D < 1200	

The results of the February 2021 monitoring period are presented in **Table 9.3**, and no exceedances in terms of GNR 827 were observed.

Table 9.3: February 2021 Dust Fallout Results.

SITE DESCRIPTION	SITE CLASSIFICATION	NUMBER OF DAYS	DUST FALLOUT ($mg/m^2/day$)
Main Plant	NON-RESIDENTIAL	33	12
Opposite Blue Gum	NON-RESIDENTIAL	33	126
Road to Mahim Dam	NON-RESIDENTIAL	33	27
Mahim Dam	NON-RESIDENTIAL	33	8
Block C	NON-RESIDENTIAL	33	30
Next to Pan	NON-RESIDENTIAL	33	32
Pan	NON-RESIDENTIAL	33	25
PDP 1	NON-RESIDENTIAL	33	17
PDP 2	NON-RESIDENTIAL	33	33
PDP 3	NON-RESIDENTIAL	33	115
PDP 4	NON-RESIDENTIAL	33	16
PDP 5	NON-RESIDENTIAL	33	14

9.3 Topography

The Integrated Paardeplaats Section is located in a hilly area at an altitude of approximately 1,855 - 1,920 metres above mean sea level (mamsl) (**Figure 9.6**). The site area is in the upper catchment region of the Steelpoort River, Grootspruit and Langspruit, and the main water course flowing through the mine area is the Mahim stream. The topography of the Paardeplaats Section slopes in a northerly direction towards a non-perennial tributary of the Grootspruit flowing from south to north approximately 13 km west of the site. The Glisa Section slopes in a westerly direction towards the Grootspruit.

9.4 Geology

According to the 1:250 000 geological maps 2528 Pretoria and 2530 Barberton (Council for Geoscience, 1978 and 1986), the Integrated Paardeplaats Section main reserve area is situated within the Witbank Coal field in the northern part of the main Karoo Basin (Karoo Supergroup). The coal reserves are found in the Vryheid Formation (Ecca Group) and consist predominantly of fine, medium, and coarse-grained sandstone with sub-ordinate mudstone, shale, siltstone, and carbonaceous shale (**Figure 9.7**). The Dwyka Group tillite forms the base of the coal seam deposits. These formations were deposited during the Permian Period of the Paleozoic Era (230 to 280 million years ago) (GCS, 2011).

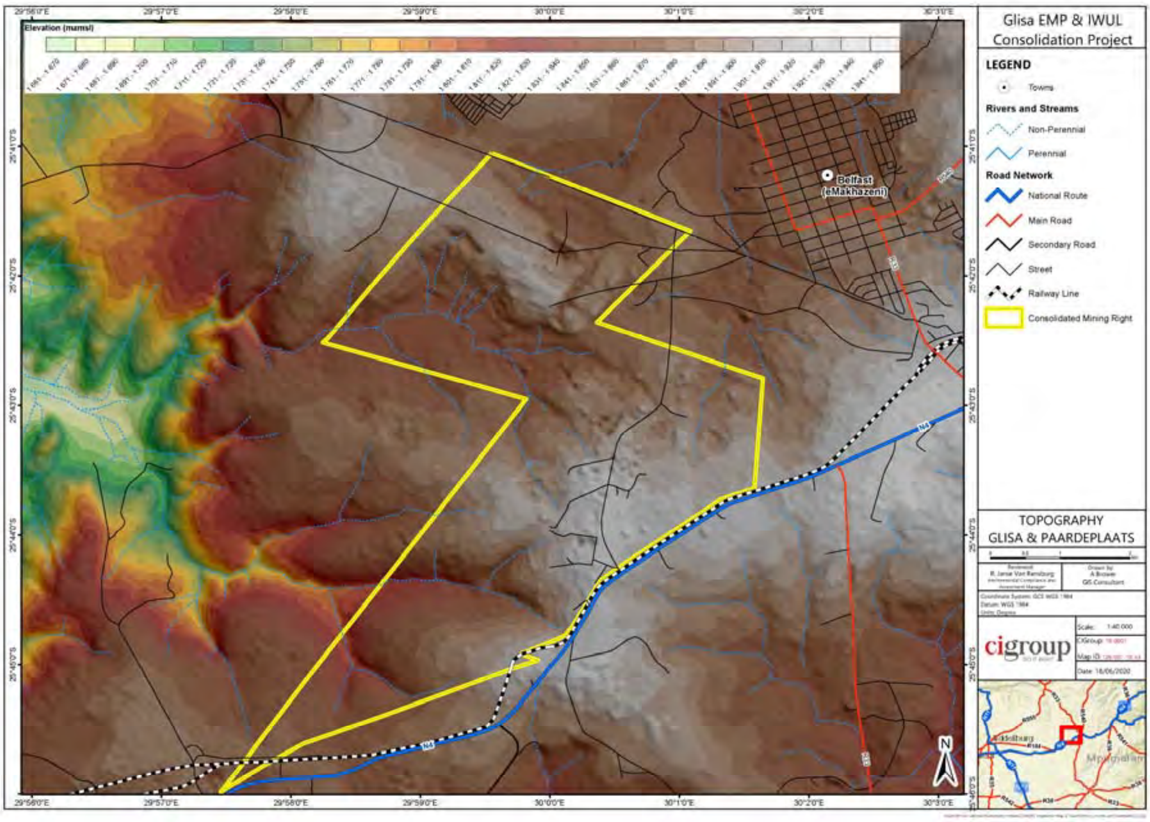

Figure 9.6: Topography of the Integrated Paardeplaats Section.

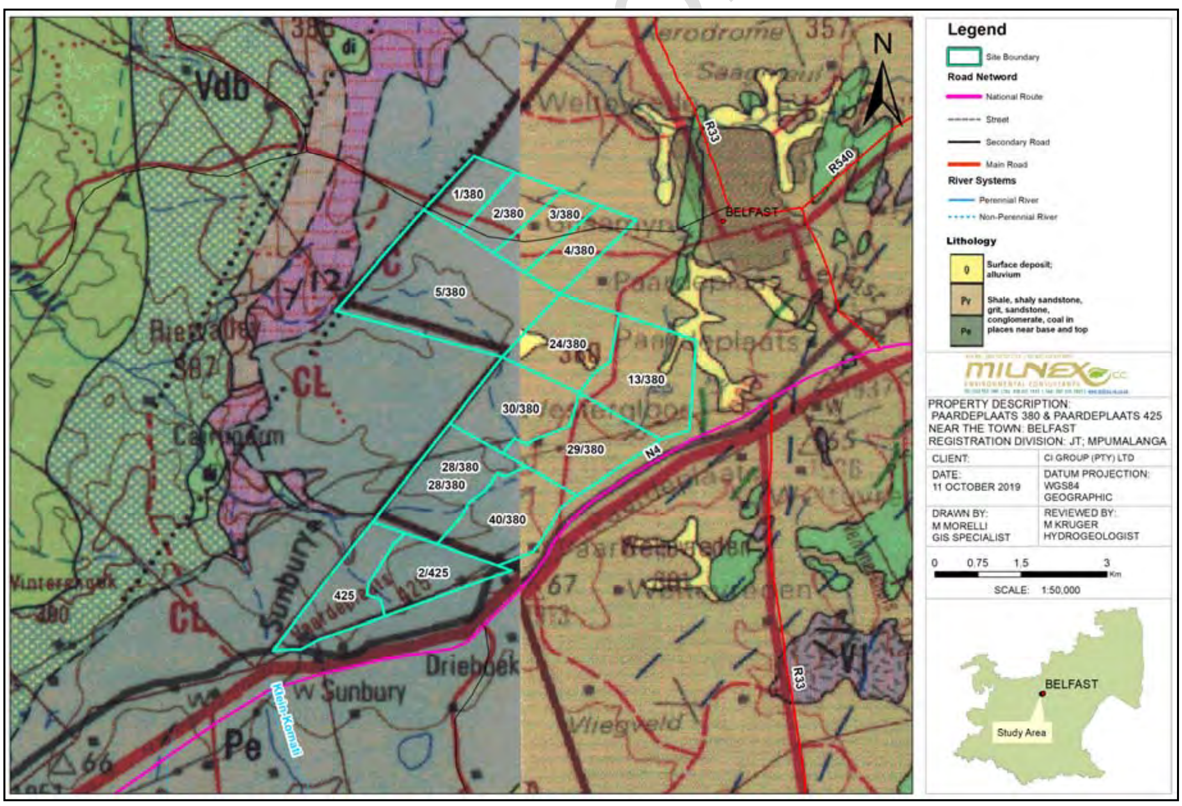

Figure 9.7: Geology Map of the Integrated Paardeplaats Section.

The Vryheid Formation contains up to five (mineable) coal seams. The different lithofacies are mainly arranged in upward coarsening deltaic cycles. The permeabilities of the sandstones are usually very low. The main reason for this is that the sandstones are usually poorly sorted, and that their primary porosities have been lowered considerably by diagenesis. These sedimentary formations have been extensively intruded by dolerite dykes. General directions of the regional structures (dykes and faults) are south-southwest to north-north-east for the dykes and east to west for the faults, with some interconnection between faults as a result of north to south faulting. The slip faults were minor faults that occurred as a result of pressure relief and were mainly perpendicular to the main fault strike direction. The strata and coal seams encountered correlate with the rest of the Witbank coal field, and currently seams 2, 3 and 4 are being mined in the Paardeplaats Section opencast areas.

9.5 Soils

The soils within the Integrated Paardeplaats Section are predominantly of the Red-Yellow Apedal type, considered free draining (**Figure 9.8**). A Miscellaneous classification applies to the south western portion of the Integrated Paardeplaats area. The northern portion of the Integrated Paardeplaats Section, the old Glisa Section, has been extensively mined by opencast methods and the soil profile is considered considerably altered as a result. The majority of the central and southern portions of the Integrated Paardeplaats Section, on the other hand, is considered unaltered.

Several soil map units have been identified in the active (Portion 30 of the farm Paardeplaats 380 JT) and planned (Portion 13, 28, 29 & 40 of the farm Paardeplaats 380 JT and Portion 2 & Remaining Extent of farm Paardeplaats 425 JS) mining areas (**Figure 9.9** and **Table 9.4**).

In general, the greater part of the Integrated Paardeplaats Section contains deep soils intermixed in certain areas with soils of varying depths from shallow to moderate; with predominantly yellow-brown and red (occasionally reddish-brown) colours. The soils are weakly structured to structureless across the entire area, with rock outcrops and surface stones in places. The south western portion of the site is dominated by shallower soils mixed with some moderately deep soils. Wetland areas (including streams and dams) occur in the lower-lying areas in various portions of the Section.

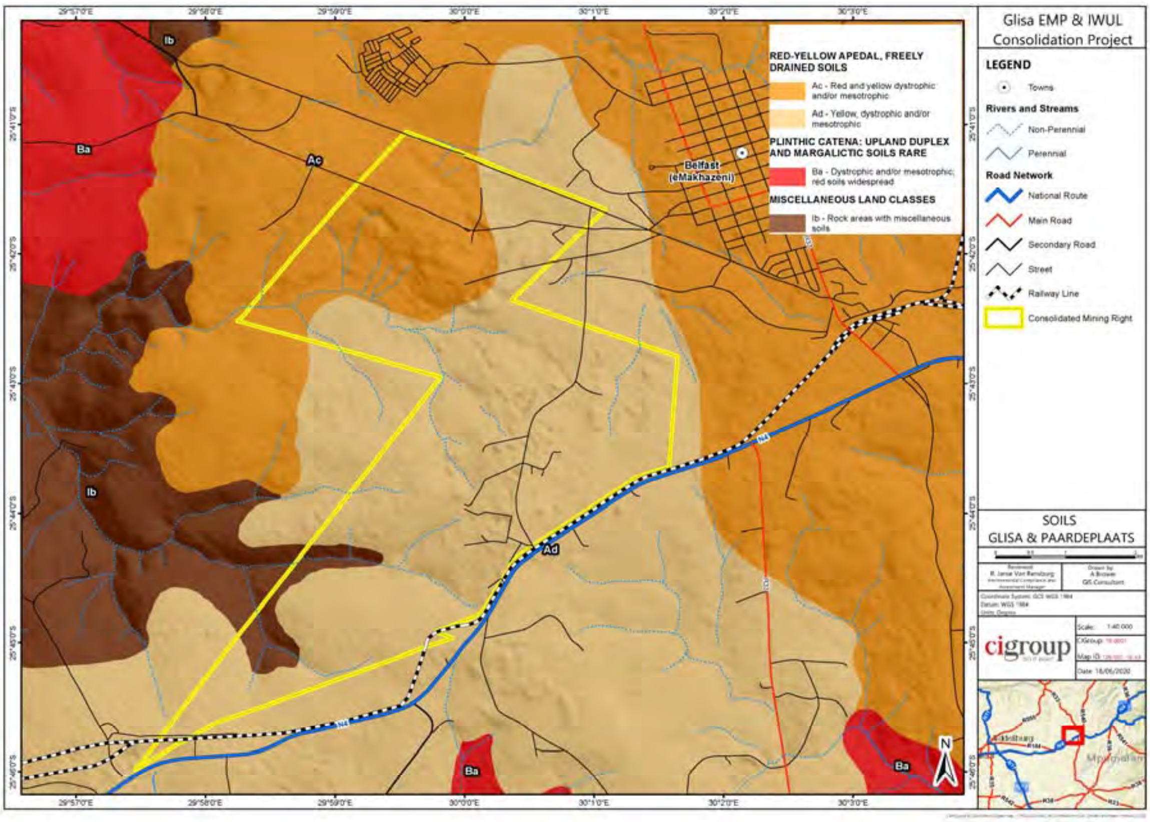

Figure 9.8: Soil Classes in the Integrated Paardeplaats Section.

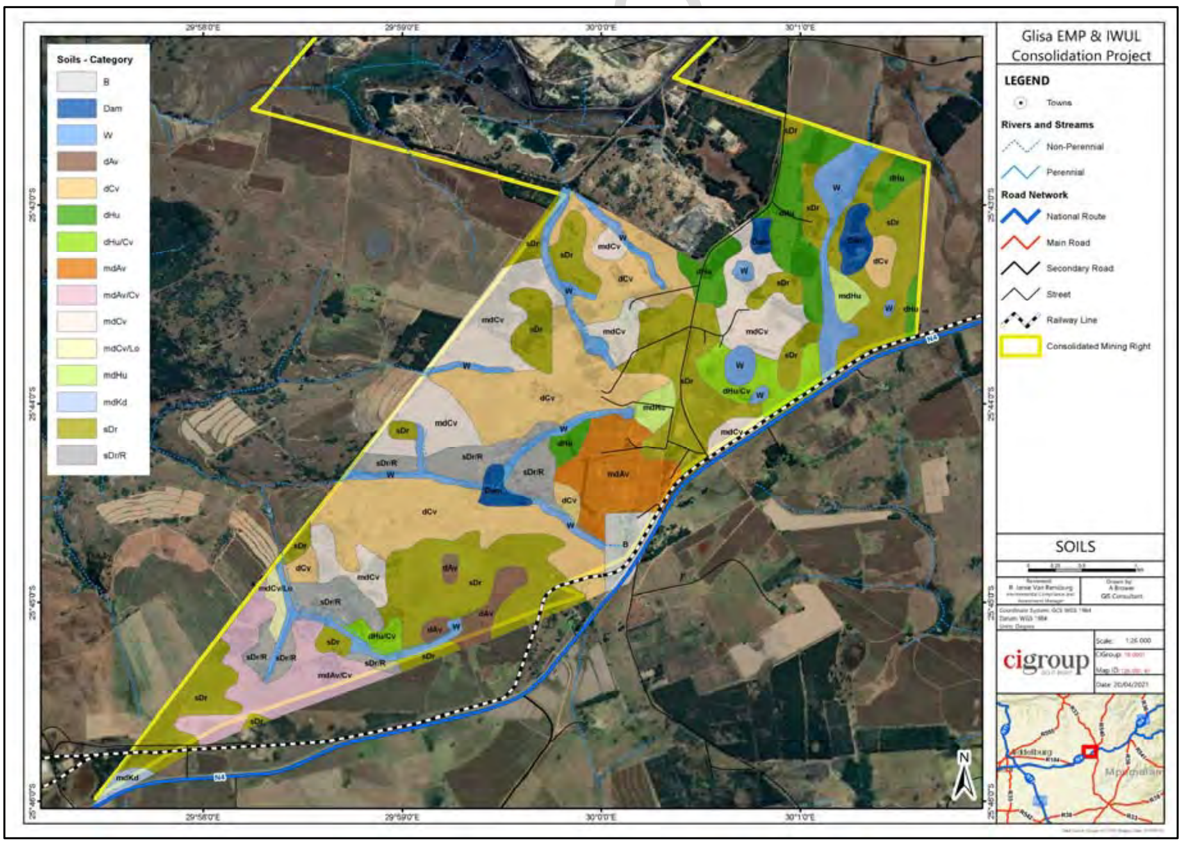

Figure 9.9: Soil Map of the Integrated Paardeplaats Section.

Table 9.4: Soil Maps Units.

MAP UNIT	DEPTH (mm)	DOMINANT SOIL FORM(S)	SUB-DOMINANT SOIL FORM(S)	GENERAL DESCRIPTION OF SOILS OCCURRING	AGRICULTURAL POTENTIAL
DEEP STRUCTURELESS SOILS					
dCv	800-1200	Clovelly 1200	Clovelly 1100 Avalon 1200 Longlands 2000	Brown, apedal, loamy sand to sandy loam topsoil on yellow-brown (occasionally grey), apedal, loamy sand to sandy loam subsoil, occasionally on mottled soft plinthite or weathering rock.	Very high
dHu	800-1200	Hutton 1200	Hutton 1100 Clovelly 1200 Bainsvlei 1200	Reddish-brown, apedal, loamy sand to sandy loam topsoil on red (occasionally yellow-brown), apedal, loamy sand to sandy loam subsoil, occasionally on mottled soft plinthiteor weathering rock.	Very high
dHu/Cv	800-1200	Hutton 1200 Clovelly 1200	Hutton 1100 Clovelly 1100	Brown to reddish-brown, apedal, loamy sand to sandy loam topsoil on yellow-brown to red, apedal, loamy sand to sandy loam subsoil, on weathering rock.	Very high
dAv	800-1200	Avalon 1200	Avalon 1100 Glencoe 1200	Brown, apedal, loamy sand to sandy loam topsoil on yellow-brown, apedal, loamy sand to sandy loam subsoil, on a periodical wetting zone with mottled soil colors, occasionally cemented.	Very high
MODERATELY DEEP STRUCTURELESS SOILS					
mdCv	450-800	Clovelly 1200	Clovelly 1100 Avalon 1200	Reddish-brown, apedal, loamy sand to sandy loam topsoil on red, apedal, loamy sand to sandy loam subsoil (often with concretions) on weathering rock.	Moderate
mdHu	450-800	Hutton 1200	Hutton 1100, Clovelly 1200	Brown, apedal, loamy sand to sandy loam topsoil on yellow-brown, apedal, loamy sand to sandy loam subsoil (often with concretions) on weathering rock.	Moderate

MAP UNIT	DEPTH (mm)	DOMINANT SOIL FORM(S)	SUB-DOMINANT SOIL FORM(S)	GENERAL DESCRIPTION OF SOILS OCCURRING	AGRICULTURAL POTENTIAL
mdAv	450-800	Avalon 1200	Avalon 1100 Glencoe 1200	Brown, apedal, loamy sand to sandy loam topsoil on yellow-brown, apedal, loamy sand to sandy loam subsoil, on a periodical wetting zone with mottled soil colors.	Moderate
mdAv/Cv	450-800	Avalon 1200 Clovelly 1200	Avalon 1100 Glencoe 1200	Brown, apedal, loamy sand to sandy loam topsoil on yellow-brown, apedal, loamy sand to sandy loam subsoil, on weathering rock or mottled soft plinthite.	Moderate
mdCv/Lo	450-700	Clovelly 1200 Longlands 2000	-	Brown to greyish-brown, apedal, loamy sand to sandy loam topsoil on yellow-brown, apedal, loamy sand to sandy loam subsoil on weathering rock. In lower landscape positions, grey, loamy sand subsoils on mottled soft plinthite occur.	Moderate to low
mdKd	450-700	Kroonstad 2000	-	Dark brown, weakly structured, sandy clay loam topsoil on grey, mottled, weakly developed structured, sandy clay subsoil with signs of wetness. The lower horizon is saturated with water for long periods unless drained.	Very low
SHALLOW SOILS					
sDr	200-400	Dresden 1100	Mispah 1000 Clovelly 1200 Hutton 1200	Brown to greyish-brown, apedal, loamy sand to sandy loam topsoil on cemented ferricrete or hard (occasionally weathering) rock. Yellow-brown and red topsoils also occur. Rock outcrops occur occasionally.	Very low
sDr/R	50-250	Dresden 1100	Mispah 1000 Rock	Brown to greyish-brown, apedal, loamy sand to sandy loam topsoil on cemented ferricrete or hard (occasionally weathering) rock. Rock outcrops occur throughout the map unit.	Very low

MAP UNIT	DEPTH (mm)	DOMINANT SOIL FORM(S)	SUB-DOMINANT SOIL FORM(S)	GENERAL DESCRIPTION OF SOILS OCCURRING	AGRICULTURAL POTENTIAL
WETLANDS					
W	0-200	Katspruit 2000	Sepane 1110	Dark grey to dark brown, structureless to weakly structured, sandy loam to sandy clay loam topsoils, on dark brown to black, mottled, structured sandy clay to clay subsoils, often wet. Occur in low-lying areas such as stream beds and valley bottoms. Soils are saturated with water year-round.	None
Dam	-	Dam		Water catchment areas.	None
MISCELLANEOUS AREAS					
B	-	Buildings		Built up areas.	None

The soil textures are loamy sand to sandy clay loam for the topsoil, becoming sandy loam to sandy clay loam in the subsoils. Generally, all of the soils are dystrophic (highly leached) with very low Cation Exchange Capacity (CEC) values. Generally the pH values are low, also indicating acidic conditions. On average, the soils have very low Phosphorous (P) levels due to the low acidity of the soils, which in turn causes P to be fixed in the soil and thus render it unavailable for plant uptake. In addition, most the soils have not been previously and/or recently cultivated which further contributes to the low P levels. The Potassium (K) levels are also extremely low for cultivation of crops, especially vegetables. Organic carbon levels are low to moderate being slightly higher in grassland areas that have not been recently cultivated, and lower in areas that have been cultivated.

The general agricultural potential and the main limiting factors associated with Portion 13, 28, 29, 30 & 40 of the farm Paardeplaats 380 JT and Portion 2 and Remaining Extent of farm Paardeplaats 425 JS, the active and planned mining areas, are given in **Table 9.5**. Approximately 55% of the area comprises soils with moderate to very high potential for agriculture, with 34% having low to moderate to low potential, 33% having very low potential, and 12% having no agricultural potential at all.

Table 9.5: Agricultural Potential.

AGRICULTURAL POTENTIAL	MAP UNIT	LIMITATIONS
Very high	dHu, dCv, dAv, dHu/Cv	Few to none
Moderate	mdHu, mdCv, mdAv, mAv/Cv	Somewhat restricted depth in places, otherwise favourable
Moderate to low	mdCv/Lo	Restricted depth and lower fertility of soils (Lo)
Very low	mdKd, sDr, sDr/R	Shallow soil depth with some rockiness (sDr, sDr/R). High clay content and signs of wetness in subsoils (mdKd)
None	W, Dams, B	Usually no soil available for use

For the areas that are best suited for grazing, the prevailing climatic and other conditions in the area mean that the approximate grazing capacity is around 7 - 8 hectares per livestock unit (ha/LSU).

The soil mapping units were also allocated to a class of pre-mining land capability as indicated in **Table 9.6**.

Table 9.6: Pre-mining Land Capability.

CAPABILITY CLASS	MAP UNIT	AREA
Arable, high	dHu, dCv, dAv, dHu/Cv	31%
Arable, moderate	mdHu, mdCv, mdAv, mAv/Cv	24%
Grazing	mdCv/Lo, sDr	27%
Wilderness	sDr/R	6%
Wetland	mdKd, W, Dam	11%
Other	B	5%

9.6 Terrestrial Biodiversity

9.6.1 Regional Vegetation

The Integrated Paardeplaats Section is situated in the Grassland Biome and within the Mesic Highveld Grassland Bioregion. The western portion of the Glisa Section is situated within the Steenkampsberg Montane Grassland vegetation type (GM 30), while the remaining extent (the eastern portion of the Glisa Section and the Paardeplaats Section) is situated within the Eastern Highveld Grassland vegetation type (Gm 12) (**Figure 9.10**).

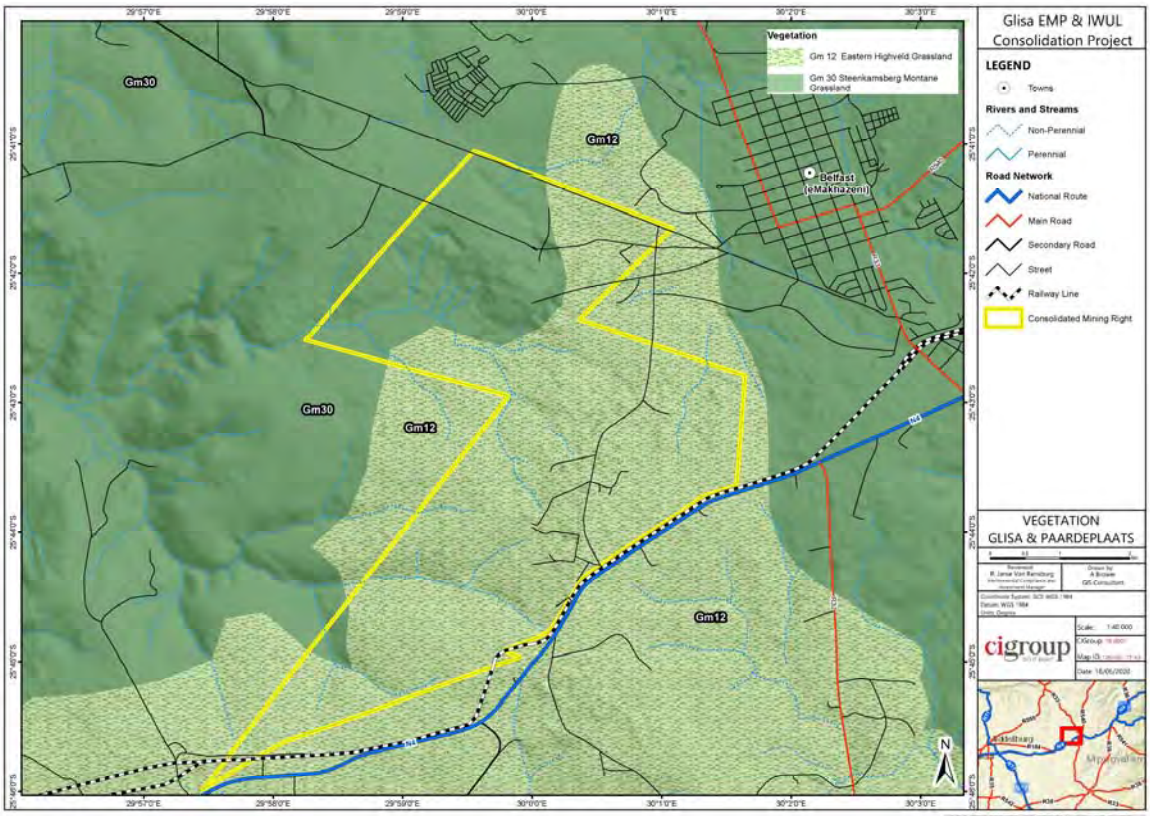

Figure 9.10: Vegetation of the Integrated Paardeplaats Section.

The Eastern Highveld Grassland is characterised by slightly to moderately undulating plains, including some low hills and pan depressions. This vegetation type is considered to be Endangered on the National List of Threatened Terrestrial Ecosystems and is considered approximately 55% altered. It is considered to be poorly protected with only 13 % of its' target percentage protected (Lötter, 2015). The primary factor responsible for this status is due to on-going cultivation activities within the area. The vegetation of the landscape is short dense grassland dominated by the usual highveld grass composition (*Aristida*, *Digitaria*, *Eragrostis*, *Themeda*, *Tristachya* etc) (Mucina & Rutherford, 2012). **Table 9.7** lists the floral species expected to occur within this region.

Table 9.7: Flora Species Characteristics of the Eastern Highveld Grassland.

PLANT FORM	SPECIES
Graminoids[2]	*Aristida aequiglumis, A. congesta, A. junciformis* subsp. *galpinii, Brachiaria serrata, Cynodon dactylon, Digitaria monodactyla, D. tricholaenoides, Elionurus muticus, Eragrostis chloromelas, E. capensis, E. curvula, E. gummiflua, E. patentissima, E. plana, E. racemosa, E. sclerantha, Heteropogon contortus, Loudetia simplex, Microchloa caffra, Monocymbium ceresiiforme, Setaria sphacelata, Sporobolus africanus, S. pectinatus, Themeda triandra, Trachypogon spicatus, Tristachya leucothrix, T. rehmannii, Alloteropsis semialata* subsp. *eckloniana, Andropogon appendiculatus, A. schirensis, Bewsia biflora, Ctenium concinnum, Diheteropogon amplectens, Harpochloa falx, Panicum natalense, Rendlia altera, Schizachyrium sanguineum, Setaria nigrirostris, Urelytrum agropyroides.*
Herbs	*Berkheya setifera, Haplocarpha scaposa, Justicia anagalloides, Pelargonium luridum, Acalypha angustata, Chamaecrista mimosoides, Dicoma anomala, Euryops gilfillanii, E. transvaalensis subsp. setilobus, Helichrysum aureonitens, H. caespititium, H. callicomum, H. oreophilum, H. rugulosum, Ipomoea crassipes, Pentanisia prunelloides subsp. latifolia, Selago densiflora, Senecio coronatus, Hilliardiella oligocephala, Wahlenbergia undulata.*
Geophytic Herbs[3]	*Gladiolus crassifolius, Haemanthus humilis subsp. hirsutus, Hypoxis rigidula var. pilosissima, Ledebouria ovatifolia.*
Succulent Herbs	*Aloe ecklonis.*
Low Shrubs	*Anthospermum rigidum subsp. pumilum, Seriphium plumosum.*

The Steenkampsberg Montane Grassland vegetation type occurs along the Steenkampsberg escarpment that extends from the headwaters of the Waterval River in mountains north-west of Lydenburg, extending southwards through Dullstroom towards Belfast, then eastwards through

[2] Gramanoids means grasses and grass-like plants, such as sedges.

[3] Geophytic means a land plant that survives an unfavourable period by means of underground food-storage organs (e.g. rhizomes, tubers, and bulbs).

Machadodorp to Bambi and Elandshoogte. It is poorly protected yet over 70 % is still considered natural. It was previously mapped as Gm 18 Lydenburg Montane Grassland (100 %) (Mucina & Rutherford, 2012), which was split into Gm 30 and Gm 31 (Dayaram, 2017). A floristic analysis along the Mpumalanga escarpment supports the recognition proposal of two subcentres of plant endemism, namely the Long Tom Pass subcentre and the Steenkampsberg subcentre. Dominant, biogeographically important taxa and endemic taxa are listed in **Table 9.8**.

Table 9.8: Flora Species Characteristics of the Steenkampsberg Montane Grassland.

PLANT FORM	SPECIES
Dominant	*Hilliardiella aristata, Searsia discolour, Rubus ludwigii., Lopholaena coriifolia, Otholobium wilmsii, Tristachya leucothrix, Harpochloa falx, Andropogon schirensis Hochst., Monocymbium ceresiiforme, Acalypha wilmsii, Argyrolobium tuberosum, Helichrysum adenocarpum subsp. adenocarpum* and *Lobelia flaccida*
Biogeographically Important Taxa	*Aloe modesta, Watsonia watsonioides, Disa klugei, Khadia alticola, Brachystelma stellatum*, and *Indigofera longibarbarta*
Endemic Taxa	*Searsia tumulicola var. meeuseana, Crotalaria monophylla, Indigofera hedyantha var. steenkampianus. Kniphofia rigidifolia, Riocreuxia aberrans, Streptocarpus latens, Gladiolus cataractarum, Gladiolus malvinus, Graderia linearifolia, Xysmalobium pedifoetidum, Eucomis vandermerwei, Drimiopsis purpurea*, and *Aloe challisii.*

The Integrated Paardeplaats Section in relation to the Critical Biodiversity Areas (CBAs) for the Mpumalanga Province is presented in **Figure 9.11**. The Glisa Section is heavily modified with some areas classified as other natural areas, whilst the Paardeplaats Section is heavily modified with CBA optimal and CBA irreplaceable areas.

9.6.2 Mining and Biodiversity

Areas within the Integrates Paardeplaats Section have various areas demarcated and classified as High Biodiversity Importance – High Risk for Mining and Moderate Biodiversity Importance – Moderate Risk for Mining in terms of the Mining and Biodiversity Guideline Category (DEA, 2013) (**Figure 9.12**).

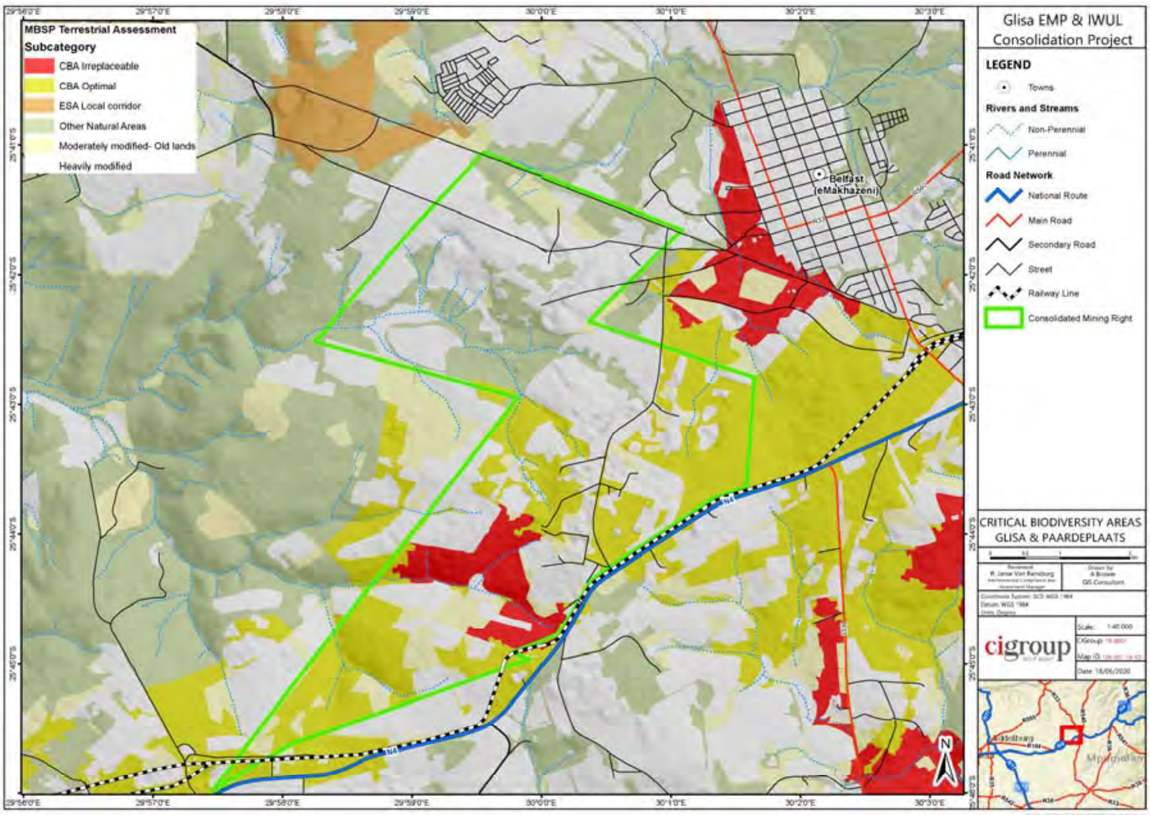

Figure 9.11: Critical Biodiversity Areas of the Integrated Paardeplaats Section.

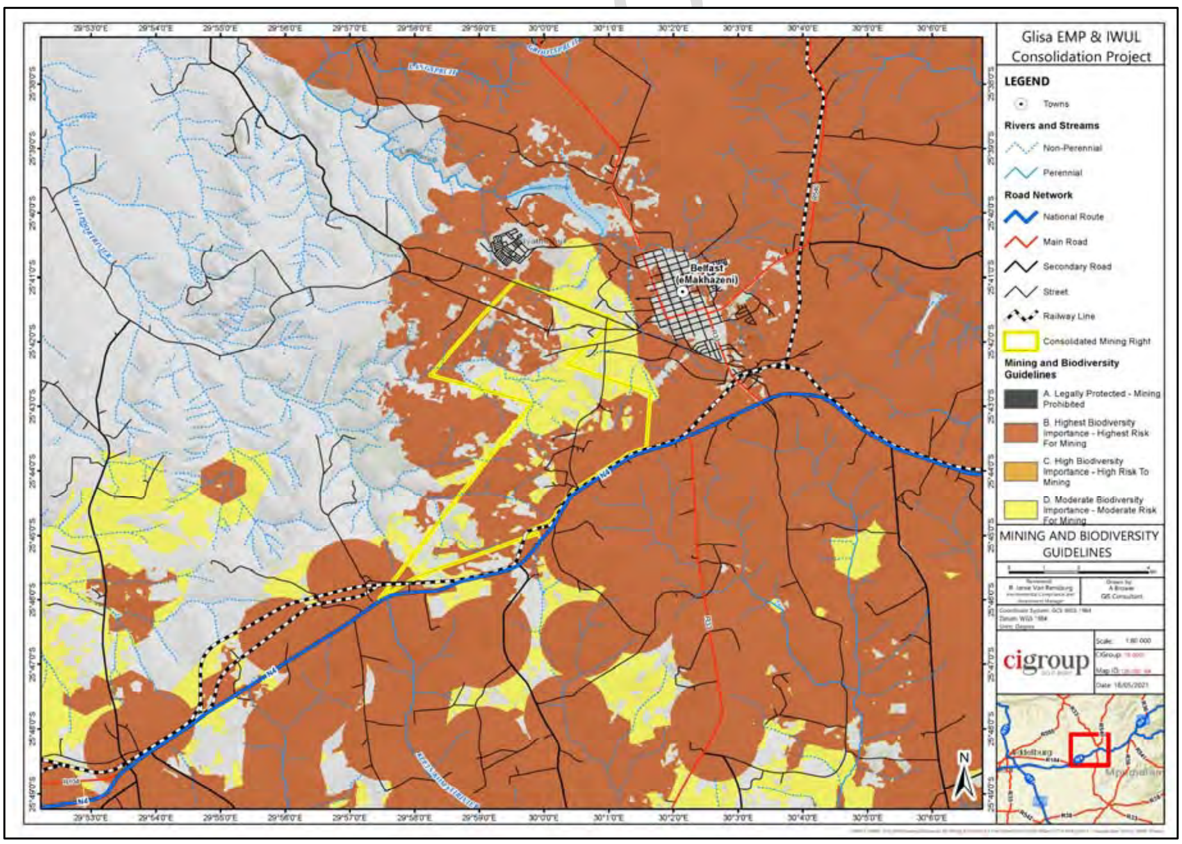

Figure 9.12: Mining and Biodiversity Guidelines for the Integrated Paardeplaats Section.

9.6.3 Species of Conservation Concern

The Integrated Paardeplaats Section is situated within the Quarter Degree Square (QDS) 2529DB, 2529DD, and 2530CA. Based on the results of a search of historical records for the QDS on the Botanical Research and Herbarium Management Software (BRAHMS) New Plants of Southern Africa website (NEWPOSA), a total of 362 Species of Conservation Concern (SCC) are indicated to potentially occur in the area. Of these potentially occurring species, 34 are Red Data listed and may potentially occur within the Integrated Paardeplaats Section (**Table 9.9**).

Table 9.9: Red Data Flora Species Occurring in the Designated QDS.

SPECIES NAME	RED LIST	SOUTH AFRICAN ENDEMIC
Aloe challisii	VU (D2)	Yes
Aloe cooperi subsp. cooperi	LC	No
Aloe modesta	VU (B1ab(iii)+2ab(iii))	Yes
Aloe reitzii var. reitzii	NT	Yes
Anemone transvaalensis	VU (D2)	Yes
Brachystelma minor	VU	Yes
Brachystelma stellatum	Rare	Yes
Crassula setulosa var. deminuta	NE	Yes
Crassula setulosa. var. setulosa	NE	Yes
Cymbopappus piliferus	VU	Yes
Dactylis glomerata	NE	No
Dianthus zeyheri subsp. natalensis	NE	Yes
Disa alticola	VU	Yes
Disa klugei	VU (D2)	Yes
Disa zuluensis	EN	Yes
Eucomis vandermerwei	VU	Yes
Gladiolus cataractarum	EN (B1ab(iii)+2ab(iii); C2a(i))	Yes
Gladiolus malvinus	VU (B1ab(i,ii,iii,iv,v))	Yes
Graderia linearifolia	VU (D2)	Yes
Habenaria barbertoni	NT	Yes
Helichrysum aureum. var. argenteum	NE	Yes
Jamesbrittenia macrantha	NT	Yes
Khadia alticola	Rare	Yes
Khadia carolinensis	VU (A3)	Yes
Kniphofia rigidifolia	LC	Yes
Lydenburgia cassinoides	NT	Yes
Merwilla natalensis	NT	No
Protea parvula	NT	No

SPECIES NAME	RED LIST	SOUTH AFRICAN ENDEMIC
Streptocarpus latens	Rare	Yes
Zantedeschia pentlandii	VU	Yes

NE=Not Evaluated, NT=Near Threatened, VU=Vulnerable, LC=Least Concern, EN=Endangered

9.6.3.1 Protected Flora

Thirteen (13) SCC were encountered within the Integrated Paardeplaats Section during the recent survey in December 2020 (**Figure 9.13**). Eleven (11) species are listed under Schedule 11 Protected Plants (Section 69 (1) (a)) of the Mpumalanga Nature Conservation Act (Act No. 10 of 1998), 1998 (MNCA) and one is a Red Listed species under the South African National Biodiversity Institute (SANBI). Portion 40 (of Paardeplaats) had the highest count of floral SCC within its' portion. Most floral SCC were encountered along and surrounding the Rocky outcrop located in the centre of the farm portion.

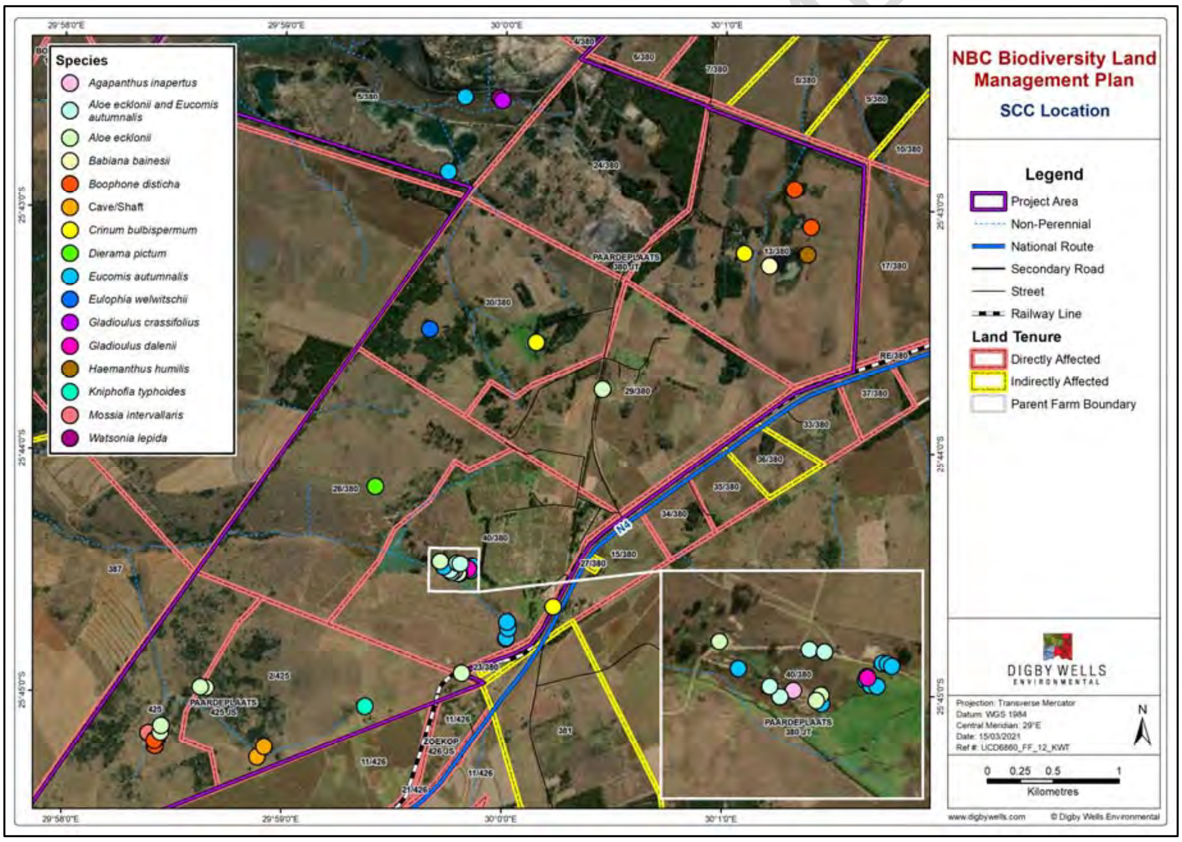

Figure 9.13: Location of Species of Conservation Concern.

9.6.3.2 Protected Fauna

9.6.3.2.1 Mammals

The diverse regional vegetation presents an opportunity to support a variety of mammal species, namely the grassland and wetland habitats. The Virtual Museum of the Animal Demography Unit (ADU) (http://www.adu.org.za) was consulted to investigate the recent recordings of mammal SCC. According to this database, the following SCC have been previously recorded within the designated QDS. Potential mammal SCC that may be encountered in Integrated Paardeplaats Section are listed in **Table 9.10**. Numerous mammal SCC were previously recorded in the ecological assessment conducted in 2012 (EkoInfo CC, 2012), only one mammal SCC, namely a Serval, was recorded during the survey in 2020.

Table 9.10: Mammal SCC Likely to Occur within the Integrated Paardeplaats Section.

FAMILY	SPECIES	COMMON NAME	CONSERVATION STATUS	RECORDED IN 2012
Bovidae	*Hippotragus equinus*	Roan Antelope	EN	-
Bovidae	*Ourebia ourebi*	Oribi	EN	-
Erinaceidae	*Atelerix frontalis*	Southern African Hedgehog	NT	X
Felidae	*Leptailurus serval*	Serval	NT	X
Felidae	*Panthera pardus*	Leopard	VU	-
Hyaenidae	*Hyaena brunnea*	Brown Hyena	NT	X
Orycteropodidae	*Orycteropus afer*	Aardvark	NT	X
Muridae	*Otomys auratus*	Southern African Vlei Rat (Grassland type)	NT	X
Mustelidae	*Aonyx capensis*	African Clawless Otter	NT	X
Rhinolophidae	*Rhinolophus swinnyi*	Swinny's Horseshoe Bat	VU	-
Soricidae	*Crocidura maquassiensis*	Makwassie Musk Shrew	VU	X
Soricidae	*Crocidura mariquensis*	Swamp Musk Shrew	NT	-
Vespertilionidae	*Miniopterus schreibersii*	Schreibers's Long-fingered Bat	NT	-

NE=Not Evaluated, NT=Near Threatened, VU=Vulnerable, LC=Least Concern, EN=Endangered, X=Recorded in 2012

9.6.3.2.2 Birds

According to the Important Bird and Biodiversity Areas (IBA) database, the Integrated Paardeplaats Section falls within the Steenkampsberg IBA (**Figure 9.14**). This area lies in the central South African plateau, and is characterised primarily of rolling high-altitude grasslands, interspersed with rocky outcrops. A very important wetland in the northern portion of this IBA, known as Middlepunt

Vlei, provides habitat for the White-winged Flufftail (CE) (*Sarothrura ayresi*) with the species has been regularly recorded in the Carex-dominated marshes and nests have been recently recorded in the area.

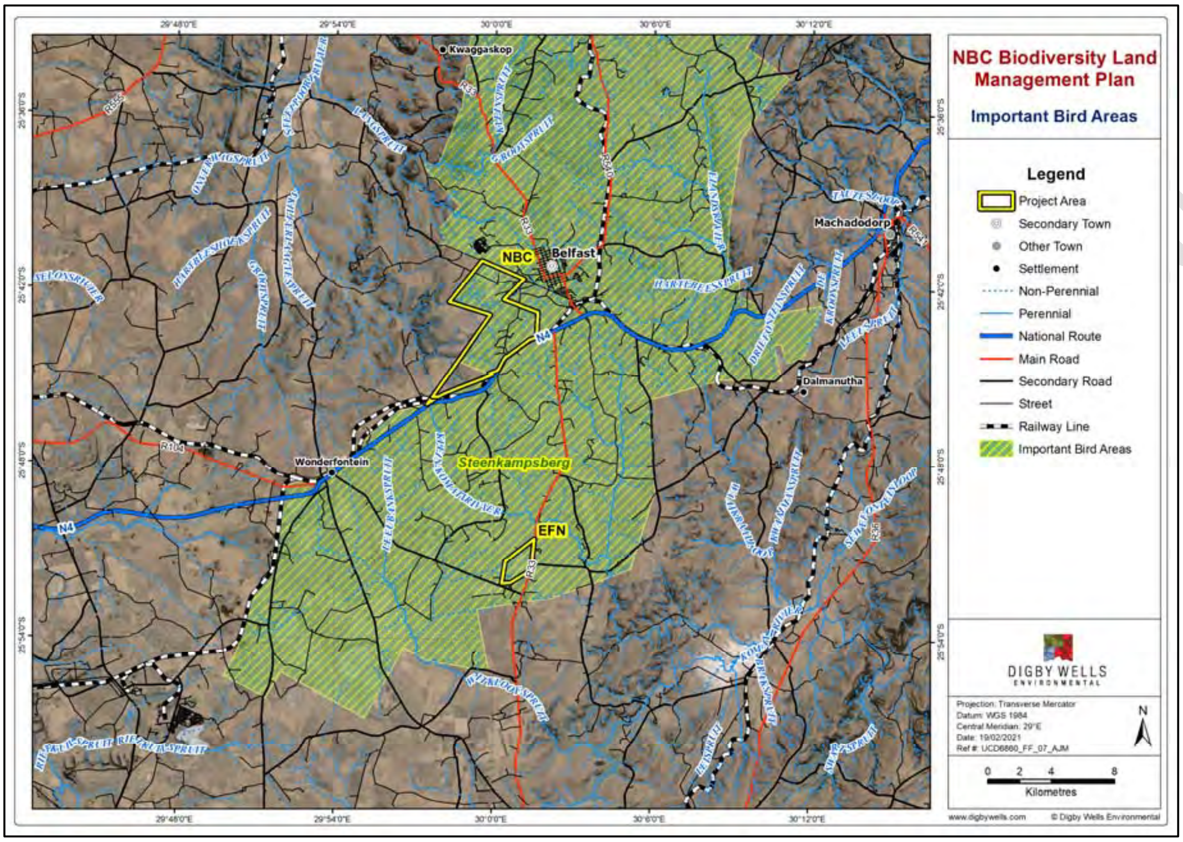

Figure 9.14: Important Bird and Biodiversity Areas of the Integrated Paardeplaats Section.

Birds have been viewed as good ecological indicators, since their presence or absence tends to represent conditions pertaining to the proper functioning of an ecosystem. Bird communities and ecological condition are linked to land cover. As the land cover of an area changes, so do the types of birds in that area (The Bird Community Index, 2007). Land cover is directly linked to habitats within the area of interest. The diversity of these habitats should give rise to many different species. According to the South African Bird Atlas Project (SABAP2) database, 239 species of birds have been identified in Integrated Paardeplaats Project Area; the majority of these birds are comprised of grassland and waterbird species. Of these species, five have been assigned a Red Data status (Taylor MR, 2015) and are listed in **Table 9.11**.

Table 9.11: Potential Bird SCC that may Occur within the Integrated Paardeplaats Section.

FAMILY	SPECIES NAME	COMMON NAME	CONSERVATION STATUS
Gruidae	*Anthropoides paradiseus*	Blue Crane	VU
Gruidae	*Bugeranus carunculatus*	Wattled Crane	VU
Gruidae	*Balearica regulorum*	Grey Crowned Crane	EN
Otididae	*Eupodotis caerulescens*	Blue Korhaan	NT
Phoenicopteridae	*Phoeniconaias minor*	Lesser Flamingo	NT
Threskiornithidae	*Geronticus calvus*	Southern Bald Ibis	VU

NE=Not Evaluated, NT=Near Threatened, VU=Vulnerable, LC=Least Concern, EN=Endangered

9.6.3.2.3 Amphibians

Amphibians are viewed to be good indicators of changes to the whole ecosystem as they are sensitive to changes in the aquatic and terrestrial environments (Waddle, 2006). Most species of amphibians are dependent on the aquatic environment for reproduction. Additionally, amphibians are sensitive to water quality and ultraviolet radiation because of their permeable skin (Gerlanc, 2005).

Wetland clusters are groups of wetlands (within a 1 km buffer) that are considered to function as a unit in the landscape, allowing for important ecological processes such as migration of frogs and insects between wetlands to take place. Numerous pans and wetlands have been identified within the Integrated Paardeplaats Section and thus provide ideal habitat (among others) for the SCC Giant African Bullfrog (*Pyxicephalus adspersus*); thus this species is therefore likely to occur. This is an SCC due to the loss of habitat from negative anthropogenic activities, the Giant African Bullfrog is listed as Near Threatened (NT) in South Africa according to the IUCN.

9.6.3.2.4 Reptiles

Reptiles are ectothermic (cold-blooded) meaning their internal basal temperature is influenced by their surrounding external environment, as a result, reptiles are dependent on environmental heat sources. Thus, many reptiles regulate their body temperatures by basking in the sun, or warmer surfaces (or substrates). Substrates are an important determining factor for identifying which habitats are suitable for which species of reptile. Rocky outcrops and suitable woody vegetation would increase habitat and intern diversity of reptiles within the Integrated Paardeplaats Section. Species richness for reptiles in South Africa is higher the north-eastern parts, and is declining in a south-westerly direction (Alexander, 2007). Areas with highest species richness correspond with the Savanna Biome, while the grassland biome has moderately low reptile species richness. A large component of the grassland biome has been transformed (around 80%), and as a result several reptile species are of conservation importance (Alexander, 2007). Of the potentially occurring reptile species one has been assigned Red Data status (South Africa Reptile Conservation Assessment (SARCA), 2014) and presented in **Table 9.12**.

Table 9.12: Potential Reptile SCC that may Occur within the Integrated Paardeplaats Section.

FAMILY	SPECIES NAME	COMMON NAME	CONSERVATION STATUS
Cordylidae	Chamaesaura aenea	Coppery Grass Lizard	NT

NE=Not Evaluated, NT=Near Threatened, VU=Vulnerable, LC=Least Concern, EN=Endangered

9.6.3.2.5 Invertebrates

Butterflies are a good indication of the habitats available in a specific area (Woodhall, 2005). Butterflies are very sensitive to habitat degradation. Although many species are eurytropes (able to use a wide range of habitats) and are widespread and common, South Africa has many stenotrope (specific habitat requirements with populations concentrated in a small area) species which may be very specialised (Woodhall, 2005). Butterflies are useful indicators as they are relatively easy to locate and catch, and to identify. One SCC that is likely to occur is the Marsh Sylph (*Metisella meninx*) (Vulnerable according to Henning, G. A. (2009) South African Red Data Book: Butterflies). This is a marsh species that requires thick clumps of grass, particularly *Leersia hexandra* (Poacea), and unpolluted environments. A marsh habitat is one of the most easily disrupted habitats and the apparent plight of this species brings it sharply into focus (Henning, 2009).

9.6.4 Flora

The Integrated Paardeplaats Sections' floral composition and distribution has been significantly altered due to the historical and current land practises. Upon site inspection, it was apparent that areas are currently utilised for grazing, homestead settlements and mining activities. As a result of these land use practises, large portions of the Integrated Paardeplaats Section have been subjected to alterations and have transformed the natural habitat. As a result of the land uses, secondary grasslands have developed and constitute as part of a vegetation community. Patches of secondary grassland were found in conjunction with and adjacent to areas of transformed landscapes and wetlands. The majority of the transformed habitats were encountered within the Portion 1 – 5 of the farm Paardeplaats 380 JT. Current and historical mining activities and related infrastructure has resulted in vast proliferation of Alien Invasive Plants (AIPs) and complete transformation of the landscape. There are numerous wetlands within the Integrated Paardeplaats Section which are distinguishable via their composition of wetland indicating species such as Red Cotton Wool Grass (*Imperata cylindrica*), *Cyperus sp*, *Juncus sp*. and *Schoenoplectus sp* (Sedges). The Integrated Paardeplaats Section has been classified into vegetation units and are discussed in the sections that follow.

9.6.4.1 Vegetation Habitats

The site assessment in December 2020 concluded that the vegetation habitats delineated within the Integrated Paardeplaats Section include natural and secondary grasslands, outcrops of rocky sheets, wetlands and areas which have been largely and completely transformed from their original state. Four broadly defined vegetation habitats have been identified and are presented together with the potential floral SCC in **Figure 9.15**. The Integrated Paardeplaats Section comprises of Secondary Grassland, Wetland, Rocky Outcrop and Transformed Habitats.

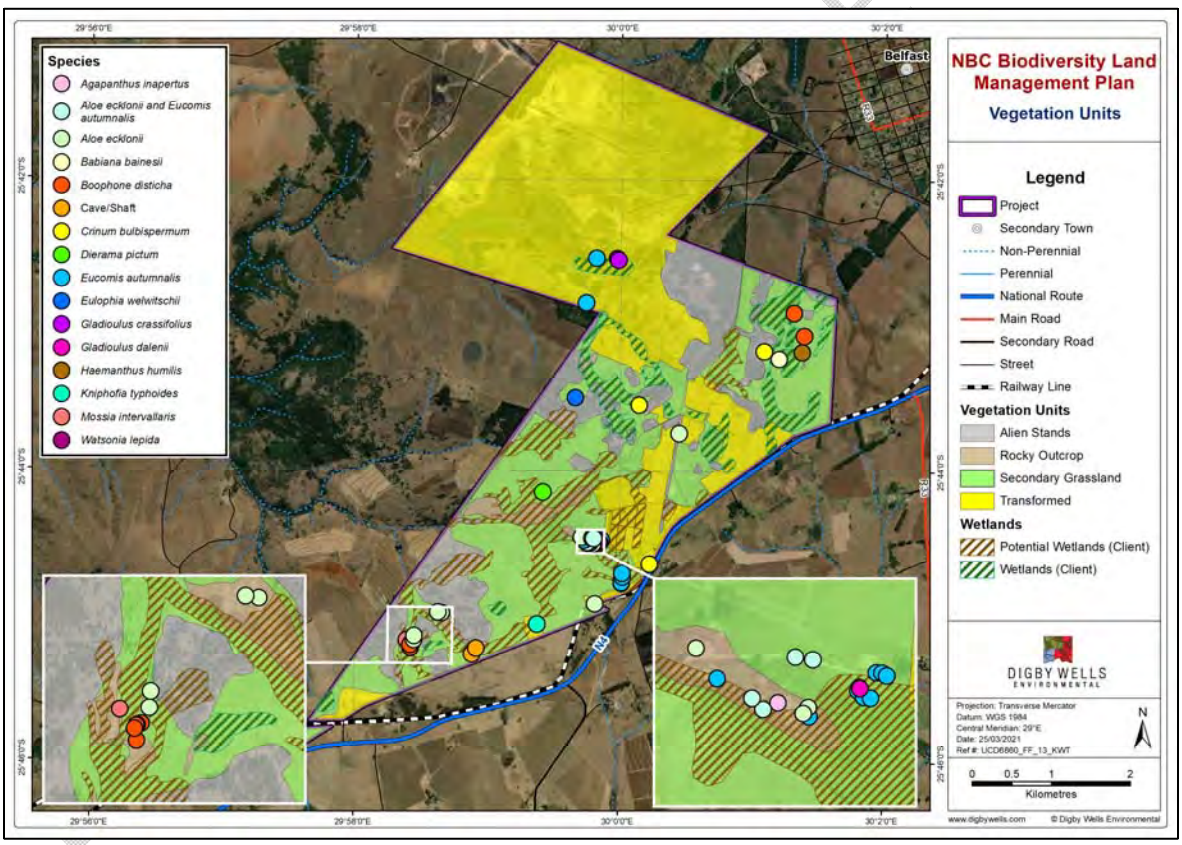

Figure 9.15: Vegetation Units Associated with the SCC.

9.6.4.1.1 Transformed Habitat

For the purpose of this assessment, transformed land refers to areas that have been changed or disturbed to such an extent that all-natural habitats, biota and ecosystem functions have been fragmented or lost. The transformed areas are a direct result from the mining activities and previous land-use practises. Past and current mining activities have completely changed the landscape and permitted AIP proliferation. Most distinguishable negative anthropogenic impacts can be observed in the watercourses within the Integrated Paardeplaats Section. Potential sedimentation from the surrounding mining activities has inundated the surfaces in the immediate surrounding environment, retarding vegetation growth. The sedimentations observed within this area, could potentially be a result from the upstream pollutants from surrounding anthropogenic activities. No vegetation was encountered within the compacted sediments surfaces.

The only plant life observed within this area was *Arundo donax* (Category 1b). It should be noted that the Wetland Vegetation Monitoring Report in 2020 (Tony de Castro, 2020) recorded two floral SCC within the grounds of the transformed area. *Khadia carolinensis* was recorded on the rocky outcrops within Portion 24 of the farm Paardeplaats 380 JT and *Gunnera perpensa* was recorded on the western border of Portion 5 of the farm Paardeplaats 380 JT.

9.6.4.1.2 Exotics

Previous natural grasslands have been altered and/or transformed and have been replaced by carpets of *Pennisetum clandestinum* and pioneering AIP shrubs, trees and forbs such as *Cotoneaster franchetii*, *Acacia mearnsii*, *Datura stramonium*, *Hypericum forrestii*, *Cirsium vulgare*, *Solanum mauritanum*, *Eucalyptus sp*., *Verbena brasiliensis*, and *V. officianalis* can be observed throughout the transformed areas. Remains of old rubble and/or building ruins and previous land practices are observed as unrehabilitated landscapes providing ideal hosting for pioneering AIP species. Vegetation considered in a natural state (where no evidence of transformation was observed) were identified within the margins of the wetland areas and rocky outcrops. Dense stands of *Populus x canescens* were observed along the margins of portion 13 with *Eucalyptus* sp. and *Acacia sp*. stands observed in the riparian slopes of portions 24 and 30 of the farm Paardeplaats 380 JT and portion 2 of the farm Paardeplaats 425 JS. These dense stands of AIPs accelerate due to the favourable growing conditions, they consume large amounts of water, thereby lowing the water table and thereby threatening the water supplies in the ecology of the region (Bromilow, 2010). A list of recorded AIPs is presented in **Table 9.13**.

Table 9.13: AIPs Recorded within the Integrated Paardeplaats Section.

SPECIES	CATEGORY[4]
*Acacia dealbata**	2

[4] In accordance with the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) Alien and Invasive Species List, 2020.

SPECIES	CATEGORY[4]
*Acacia mearnsii**	2
*Amaranthus viridus**	Invasive
*Arundo donax**	1b
*Bidens pilosa**	Invasive
*Callistemon verminallis**	1b
*Centella asiatica**	Invasive
*Cirsium vulgare**	1b
*Conyza bonariensis**	Invasive
*Cortaderia selloana**	1b
*Cotoneaster franchetii**	1b
*Datura stramonium**	1b
*Eucalyptus camaldulensis**	1b
*Eucalyptus diversicolor**	2
*Eucalyptus viminalis**	Invasive
*Gladioulus grandiflora**	Invasive
*Gomphrena celosioides**	Invasive
*Hemerocallis sp.**	Invasive
*Hypericum forrestii**	Invasive
*Lolium perenne**	Invasive
*Nymphoides thunbergiana**	Invasive
*Oenothera rosea**	Invasive
*Oenothera stricta**	Invasive
*Paspalum notatum**	Invasive
*Pennisetum clandestinum**	1b
*Persicaria longiseta**	Invasive
*Phytolacca octanda**	1b
*Pinus patula**	2
*Populus x canescens**	2
*Pyracantha angustifolia**	1b
*Raphanus raphanistrum**	Invasive
*Richardia brasiliensis**	Invasive
*Salix babylonica**	Invasive
*Solanum mauritianum**	1b
*Solanum nigrum**	Invasive
*Solanum sisymbrifolium**	1b
*Tagetes minuta**	Invasive
*Verbena brasiliensis**	1b
*Verbena officianalis**	Invasive

9.6.4.1.3 Secondary Grassland

Secondary grasslands differ from primary grasslands, based on the extent of modification they have undergone. Secondary grasslands have undergone extensive modification and a fundamental shift from their original state, such as cultivated fields and unmonitored grazing, yet they have been allowed to return to their grassland state (SANBI, Grasslands Ecosytems Guidleines: Landscape Interpretation for Planners and Managers., 2013). Although secondary grasslands appear as a counterfeit primary grassland, they differ with respect to species composition, vegetation structure, ecological functioning, and the ecosystem services they deliver (SANBI, 2013). The established secondary grassland in the Integrated Paardeplaats Section presented a well-developed graminoid and herbaceous component. The highest diversity of forbs and graminoids were observed along the rocky slopes transitioning into the rocky outcrops. Fewer disturbances were observed within these slopes and consequently resulted in a high floral diversity. Species encountered along these slopes included *Acalypha angustata, Alloteropsis semialata subsp. eckloniana, Asclepias aurea, Aristida sp, Babiana bainesii, Eragrostis sp., Digitaria sp., Dierama pictum numerous Helichrysum sp., Hermannia lancifolia, Hilliardiella olgocephala, H. aristate, Indigofera hilaris, Lasiosiphon caffer, Ledebouria revoluta, L. ovatifolia,* and *Xysmalobium sp.*
Floral SCC, *Boophone disticha*, were encountered in varying locations throughout the slopes of the grassland and one *Eulophia welwitschia* was observed in the open grassland on Portion 30 of the farm Paardeplaats 380 JT.

The grasslands with easier accessibility to the cattle grazing presented a very low species diversity. The unmonitored grazing (cattle) is placing the remaining extent of the grasslands under pressure and altering the species composition, encouraging pioneer (increaser) species to flourish. This was observed within the southern portion of the Paardeplaats farms portions, namely Portion 2 of the farm Paardeplaats 425 JS and the southern regions of portion 28 & 40 of the farm Paardeplaats 380 JT.

In conjunction with wetlands, grasslands support hydrological processes by acting as sponges, collecting rainwater, and assisting in flood attenuation through reduction of runoff and erosion. They act as critical life supporting systems for an array of biodiversity and endemic and threatened species. Grasslands in south Africa is one the most threatened biomes, with 30% of the biome transformed beyond repair and only 2% formally conserved.

9.6.4.1.4 Rocky Outcrop

Rocky outcrops are geological features that encompass a wide variety of physical environments such as escarpments, overhangs, and cliffs (Fitzsimons, 2017). They support high levels of species diversity and endemism and provide stable micro-climates. They provide ecological refuges for colonial species such as seabirds, bats and swifts for ancient lineages. Rocky outcrops provide steppingstone habitats across landscapes and facilitate the movement of migratory bird species and other wide ranging fauna. As rocky environments are less fertile, steep-sided and less accessible than the surrounding landscapes, they are typically less prone to human disturbances. Nonetheless, rocky outcrops are susceptible to a variety of threats including soil compaction, erosion from livestock and nutrient enrichment and weed invasion.

Numerous rocky outcrops were observed within the Integrated Paardeplaats Section. The rocky outcrops within the Section provide refuge for a variety of floral SCC, such as *Boophane disticha, Haemanthus humilis, Gladiolus dalenii, Mossia intervallaris* and *Aloe ecklonis*. The rocky outcrops within the Section are slightly elevated above the grasslands and host not only forbs but also abundant woody species which were not present in the grassland community. Species included *Erica cerinthoides var. cerinthoides, Chlorophytum trichophlebium, Clutia pulchella, Cheilanthes multifida lacerate, Drypopteris athamantica, Eriospermum abyssinicum, Zaluzianskya katharinae, Pearsonia grandiflora, Pallaea calomelanos, Searsia magalismontana* and *Diospyrus lycoides*. Many of the species encountered within this vegetation unit are representative of the Eastern Highveld Grassland. Fifty-five (55) of the 207 species recorded reside or occurred within the rocky outcrops of the Project area.

9.6.4.1.5 Wetlands

Numerous wetlands have been previously recorded, delineated and monitored within the Project area (Paardeplaats and EFN) (Tony de Castro, 2020) (Wetland Consulting Services (Pty) Ltd, 2020), and updated in the most recent assessment undertaken by Ecology International (Pty) Ltd (2021). Wetlands are discussed in more detail in **Section 9.7** but are included here purely to represent a known vegetation habitat.

9.6.5 Fauna

9.6.5.1 Mammals

A total of thirteen (13) mammal species were recorded during the infield assessments. High faunal activity was observed within the Rocky outcrops, and along the banks of the artificial dams. Various mammals of the Herpestidae (Mongoose) family were observed throughout the numerous wetlands. Tracks of a Water Mongoose were observed in the marshes of the unchanneled valley bottom wetlands. Meerkats were encountered within the rocky outcrops. Numerous sightings of Black-backed Jackal and Scrub Hare were recorded throughout the Integrated Paardeplaats Section. The Rocky outcrops in the Integrated Paardeplaats Section appeared less transformed, possibly due to its inability to traverse or cultivate and showcased most of the fauna activity. It has now provided habitat, as a microclimate refugia, for numerous faunal species and acts as an ecological corridor for the movement of various animals.

Numerous burrows were observed throughout the Integrated Paardeplaats Section but particularly in the farm Paardeplaats 425 JS. According to the EkoInfo CC (2012) Report, numerous burrowing and crepuscular mammals were recorded, namely Bushpig, Porcupine, Aardvark, South African Hedgehog (NT) and Side-striped Jackal (NT). The EkoInfo study in 2012 recorded an additional seventeen (17) species in conjunction with the 2020 study. Additional species are listed in **Table 9.14**. Camera and Sherman traps were set up in this location and observations of Meerkats and Namaqua Rock Mice were captured on the cameras.

Table 9.14: Previous Recordings of Mammalian Species within the Integrated Paardeplaats Section.

FAMILY	SPECIES	COMMON NAME	CONSERVATION STATUS	EKOINFO (2012)
Rumenentia	*Raphicerus campestrus*	Steenbok	LC	x
Suiformes	*Potamochoerus porcus*	Bush Pig	LC	x
Rodentia	*Otomys irroratus*	Vlei Rat	NT	x
Bathyergidae	*Cryptomys hottentotus*	Common Mole Rat	LC	x
Soricidea	*Myosorex varius*	Forest Shrew	LC	x
Soricidea	*Crocidura mariquensis*	Swamp Shrew	LC	x
Soricidea	*Crocidura cyanea*	Red-grey musk Shrew	LC	x
Felidae	*Caracal caracal*	Caracal	LC	x
Canidae	*Canis adustus*	Side-striped Jackal	NT	x
Canidae	*Vulpes chama*	Cape Fox	LC (IUCN)/ TOPS	x
Viverridae	*Genetta tigrina*	Large Spotted Genet	LC	x
Hyaenidae	*Hyaena brunnea*	Brown Hyena	NT	x
Mustillidae	*Aonyx capensis*	African Otter	NT	x
Eulipotyphla	*Atelerix frontalis*	South African Hedgehog	NT	x
Orycteropodidae	*Orycteropus afer*	Aardvark	LC	x
Muridae	*Rhabdomys pumilio*	Four-striped Grass Mouse	LC	-
Vespertilionidae	*Neoromicia capensis*	Cape Serotine Bat	LC	-

LC=Least Concern; NT=Near Threatened,TOPS=Threatened or Protected Species

Ground Squirrels, Scrub Hares and Yellow, Slender and Water Mongoose were observed throughout the Integrated Paardeplaats Section. These species are highly synanthropic meaning they thrive in the presence of human disturbance. No larger mammals were observed apart from cattle. Numerous Black-backed Jackals were also encountered. All encountered and recorded mammals in the 2020 survey are listed in **Table 9.15**.

Table 9.15: Mammal Species Encountered within the Integrated Paardeplaats Section (2020).

FAMILY	SPECIES NAME	COMMON NAME	CONSERVATION STATUS	FARM PORTIONS
Canidae	*Lupulella(Canis) mesomelas*	Black-backed Jackal	LC	13/380 JT
Rodentia	*Aethomys namaquensis*	Namaqua Rock Mouse	LC	13/380 JT
Rodentia	*Hystrix africaeaustralis*	Porcupine	LC	2/425 JS
Rodentia	*Tater asp.*	Gerbil	LC	29/380 JT
Felidae	*Leptailurus serval*	Serval	NT (SANBI) TOPS & CITES	28/380 JT
Bovidae	*Sylvicapra grimmia*	Common Duiker	LC	40/380 JT
Herpestidae	*Cynictis penicillata*	Yellow Mongoose	LC	30/380 JT
Herpestidae	*Atilax paludinosus*	Water Mongoose	LC	28/380 JT
Herpestidae	*Galerella sanguinea*	Slender Mongoose	LC	29/380 JT
Herpestidae	*Suricata suricatta*	Meerkat	LC	28/380 JT
Leporidae	*Lepus saxatilis*	Scrub Hare	LC	13, 28, & 40/380 JT and 2/425 JS
Sciuridae	*Xerus inauris*	Southern African Ground Squirrel	LC	2/425 JS

One mammal SCC was recorded, a Serval, captured by the camera traps within the central region of Portion 30 of the farm Paardeplaats 380 JT. A strong presence of Serval was recorded in the EkoInfo (2012) Report. Evidence of high numbers of the IUCN Near Threatened species were recorded, indicating a viable extant population in the area which may require further investigations. Servals are found in many protected areas within South Africa and are included on CITES Appendix II and protected under national legislation (TOPS regulations) (SANBI, 2018). It is listed as Least Concern (LC) globally and Near Threatened (NT) nationally on the IUCN Red List. Effective conservation of Serval depends on the conservation of wetlands, particularly wetlands in fragmented landscapes. Wetlands form a micro habitat in a mosaic of farmland for several wetland-dependent species; they are reservoirs of small mammal populations that are major dietary components of servals. Consequently, if wetlands are protected in a mosaic of farmland use, the landscape may support the persistence of serval populations.

The Integrated Paardeplaats Section has historically and is currently subjected to land transformations (mining activities) and heavy subsistence utilisation. This directly and indirectly alters the in-situ species composition. Taking into consideration the previous ecological assessments conducted for the Integrated Paardeplaats Section, a considerable decline in mammal species composition has been noted from the results of the 2020 field investigations suggesting poor land management practices and anthropogenic encroachment.

9.6.5.1.1 Birds

Birds are viewed as good ecological indicators, as their presence or absence tends to represent conditions of a functioning ecosystem. The direct link between bird diversity and land cover portrays a direct indication of the habitats in the area of interest. According to the South African Bird Atlas Project (SABAP2) database, 239 species of birds have been identified in the area, the majority of these birds comprising of grassland and waterbird species. Eighty eight (88) birds were recorded during the field assessment in December 2020 (**Table 9.16**).

Table 9.16: Recorded Bird Species within the Integrated Paardeplaats Section (2020).

FAMILY	SPECIES NAME	COMMON NAME	CONSERVATION STATUS
Accipitridae	*Buteo buteo vulpinus*	Steppe Buzzard	LC
Accipitridae	*Elanus caeruleus*	Black-winged Kite	LC
Accipitridae	*Haliaeetus vocifer*	African Fish Eagle	LC
Acrocephalidae	*Acrocephalus baeticatus*	African Reed-warbler	LC
Acrocephalidae	*Iduna natalensis*	Dark-capped Yellow Warbler	LC
Alaudidae	*Calandrella cinerea*	Red-capped Lark	LC
Alaudidae	*Mirafra fasciolata*	Eastern Clapper Lark	LC
Anatidae	*Alopochen aegyptiacus*	Egyptian Goose	LC
Anatidae	*Anas erythrorhyncha*	Red-billed Teal	LC
Anatidae	*Anas undulata*	Yellow-billed Duck	LC
Anatidae	*Dendrocygna viduata*	White-faced Duck	LC
Anatidae	*Netta erythrophthalma*	Southern Pochard	LC
Anatidae	*Plectropterus gambensis*	Spur-winged Goose	LC
Anhingidae	*Anhinga rufa*	African Darter	LC
Apodidae	*Apus barbatus*	African Black Swift	LC
Apodidae	*Apus caffer*	White-rumped Swift	LC
Apodidae	*Tachymarptis melba*	Alpine Swift	LC

FAMILY	SPECIES NAME	COMMON NAME	CONSERVATION STATUS
Ardeidae	*Ardea cinerea*	Grey Heron	LC
Ardeidae	*Ardea melanocephala*	Black-headed Heron	LC
Ardeidae	*Bubulcus ibis*	Cattle Egret	LC
Ardeidae	*Egretta intermedia*	Yellow-billed Egret	LC
Charadriidae	*Charadrius tricollaris*	Three-banded Plover	LC
Charadriidae	*Vanellus armatus*	Blacksmith Lapwing	LC
Charadriidae	*Vanellus coronatus*	Crowned Lapwing	LC
Charadriidae	*Vanellus senegallus*	African Wattled Lapwing	LC
Cisticolidae	*Cisticola ayresii*	Wing-snapping Cisticola	LC
Cisticolidae	*Cisticola fulvicapilla*	Neddicky	LC
Cisticolidae	*Cisticola juncidis*	Zitting Cisticola	LC
Cisticolidae	*Prinia flavicans*	Black-chested Prinia	LC
Coliidae	*Colius striatus*	Speckled Mousebird	LC
Columbidae	*Columba arquatrix*	African Olive-pigeon	LC
Columbidae	*Columba guinea*	Speckled Pigeon	LC
Columbidae	*Streptopelia capicola*	Cape Turtle-dove	LC
Columbidae	*Streptopelia semitorquata*	Red-eyed Dove	LC
Columbidae	*Streptopelia senegalensis*	Laughing Dove	LC
Corvidae	*Corvus capensis*	Cape Crow	LC
Cuculidae	*Chrysococcyx caprius*	Diderick Cuckoo	LC
Cuculidae	*Cuculus solitarius*	Red-chested Cuckoo	LC
Falconidae	*Falco amurensis*	Amur Falcon	LC
Fringillidae	*Crithagra gualris*	Streaky-headed Seedeater	LC
Fringillidae	*Crithagra mozambicus*	Yellow-fronted Canary	LC
Hirundinidae	*Cecropis cucullata*	Greater Striped Swallow	LC
Hirundinidae	*Hirundo albigularis*	White-throated Swallow	LC
Hirundinidae	*Hirundo fuligula*	Rock Martin	LC
Hirundinidae	*Hirundo rustica*	Barn Swallow	LC
Hirundinidae	*Hirundo spilodera*	South African Cliff-swallow	LC
Hirundinidae	*Riparia cincta*	Banded Martin	LC
Hirundinidae	*Riparia paludicola*	Brown-throated Martin	LC
Laniidae	*Lanius collaris*	Common (Southern) Fiscal	LC
Laniidae	*Telophorus zeylonus*	Bokmakierie	LC
Laridae	*Chlidonias hybrida*	Whiskered Tern	LC
Locustellidae	*Bradypterus baboecala*	Little Rush-warbler	LC
Motacillidae	*Anthus cinnamomeus*	African Pipit	LC
Motacillidae	*Macronyx capensis*	Cape Longclaw	LC
Motacillidae	*Motacilla capensis*	Cape Wagtail	LC

FAMILY	SPECIES NAME	COMMON NAME	CONSERVATION STATUS
Muscicapidae	*Cossypha caffra*	Cape Robin-chat	LC
Muscicapidae	*Saxicola torquatus*	African Stonechat	LC
Nectariniidae	*Chalcomitra amethystina*	Amethyst Sunbird	LC
Nectariniidae	*Nectarinia famosa*	Malachite Sunbird	LC
Numididae	*Numida meleagris*	Helmeted Guineafowl	LC
Passeridae	*Passer melanurus*	Cape Sparrow	LC
Phalacrocoracidae	*Phalacrocorax africanus*	Reed Cormorant	LC
Phalacrocoracidae	*Phalacrocorax carbo*	White-breasted Cormorant	LC
Phasianidae	*Pternistis natalensis*	Natal Spurfowl	LC
Phasianidae	*Pternistis swainsonii*	Swainson's Spurfowl	LC
Ploceidae	*Euplectes afer*	Yellow-crowned Bishop	LC
Ploceidae	*Euplectes orix*	Southern Red Bishop	LC
Ploceidae	*Euplectes progne*	Long-tailed Widowbird	LC
Ploceidae	*Ploceus capensis*	Cape Weaver	LC
Ploceidae	*Ploceus velatus*	Southern Masked Weaver	LC
Ploceidae	*Quelea quelea*	Red-billed Quelea	LC
Podicipedidae	*Tachybaptus ruficollis*	Little Grebe	LC
Pycnonotidae	*Pycnonotus tricolor*	Dark-capped Bulbul	LC
Rallidae	*Fulica cristata*	Red-knobbed Coot	LC
Rallidae	*Gallinula chloropus*	Common Moorhen	LC
Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt	LC
Scolopacidae	*Gallinago nigripennis*	African Snipe	LC
Scolopacidae	*Tringa nebularis*	Common Greenshank	LC
Scopidae	*Scopus umbretta*	Hamerkop	LC
Sturnidae	*Lamprotornis bicolor*	Pied Starling	LC
Threskiornithidae	*Bostrychia hagedash*	Hadeda Ibis	LC
Threskiornithidae	*Plegadis falcinellus*	Glossy Ibis	LC
Threskiornithidae	*Threskiornis aethiopicus*	African Sacred Ibis	LC
Turdidae	*Turdus litsitsirupa*	Groundscraper Thrush	LC
Viduidae	*Vidua macroura*	Pin-tailed Whydah	LC
Zosteropidae	*Zosterops capensis*	Cape White-eye	LC

LC=Least Concern; VU=Vulnerable; EN= Endangered; NT=Near Threatened; TOPS=Threatened or Protected Species

Although not directly confirmed during the field assessment, a pair of Grey Crowned Cranes (*Balearica regulorum*), were previously sighted by the landowners in Portion 13 of the farm Paardeplaats 380 JT. The landowner (Mr Wilkie) also reported that the pair would regularly visit/reside on the site (pers. comm. Mr Wilkie 15 December 2020). These Cranes are a Red Listed species and are listed as Endangered (BirdLife International, 2021). This species is not a migratory species although has been known to make use of variable local and seasonal movements depending on food availability. They nest in solitary pairs and are generally found in wetlands such as marshes, pans and dams with tall emergent vegetation. Its' diet primarily consists of insects, frogs, lizards, crabs and is known to feed on the seed heads of sedges. The species population has been threatened by the loss and degradation of wetland breeding areas through drought-related changes in land-use. Impacts include cultivation, overgrazing, heavy use of agricultural pesticide, declines in fallowing practices, high sedimentation rates, uncontrolled fires, and changes in the hydrological regimes (BirdLife International, 2021). Unsolicited harvesting (egg-collecting and hunting) and indirect disturbances from the hunting of larger animals and ducks in wetlands has prompted the decline in their numbers. The numerous pans and wetlands within the integrated Paardeplaats Project area provide ideal habitat for this species.

The assessment revealed that five bird SCC may occur within the Integrated Paardeplaats Section. The previous ecological assessments (EkoInfo, 2012) recorded several bird SCC (**Table 9.17**), the majority of which are associated with wetland habitats and moist grasslands. The wetland systems are earmarked with high ecological functioning and act as important dispersal corridors for many of the terrestrial bird species. Areas with facultative wetland flora (*Imperata cylindrica, Helicotrichon turgidulum* and *Arundinella nepalensis*) provide potential breeding and foraging habitats for SCC, in particular the African Grass Owl (VU) and African Marsh Harrier (EN) (EkoInfo CC, 2012). These areas are confined to wetland communities and structurally reminiscent of open grasslands. The artificial dams conform to an interconnected system of dams and water bodies with high seasonal variability among each other in terms of water levels. Therefore, it is anticipated that these systems experience an influx of species at the varying water levels and changes in season. They also provide refuge for large congregations of waterfowl.

Table 9.17: Previously Recorded Bird Species within the Integrated Paardeplaats Section.

FAMILY	SPECIES	COMMON NAME	CONSERVATION STATUS
Tytonidae	*Tyto capensis*	African Grass Owl	VU
Saigittariidae	*Sagittarius serpentarius*	Secretarybird	VU
Accipitridae	*Circus ranivorus*	African Marsh Harrier	EN

LC=Least Concern; VU=Vulnerable; EN= Endangered; NT=Near Threatened; TOPS=Threatened or Protected Species

9.6.5.1.2 Herpetofauna

Herpertofauna is defined as reptiles and amphibians inhabiting a given area. Reptiles are ectothermic (cold-blooded) meaning they are organisms that control body temperature through external means. As a result, reptiles are dependent on environmental heat sources. Due to this, many reptiles regulate their body temperature by basking in the sun, or in warmer areas. Substrate is an important factor determining which habitats are suitable for which species of reptile. According to Carruthers (2001), a number of factors influence the distribution of amphibians, but because amphibians have porous skin they generally prosper in warm and damp habitats. The presence of suitable habitat within the Integrated Paardeplaats Section (wetland and grassland areas) provides a number of different species of amphibians.

The brevity of the survey meant that relatively few reptiles were observed compared to that of mammals and birds. During the field assessment, three amphibian species were identified within the wetland, pan and dams, via its call and by direct sightings, and included the Delalande's River Frog (*Amietia delalandii*), Sand Frog (*Tomopterna sp.*) and the Boettger's Caco (*Cacosternum boettgeri*) (all Least Concern) (**Table 9.18**). The Boettger's Caco is abundant in grassy areas and it can breed in almost any small, temporary water body such as pools in inundated grasslands, culverts and other rain-filled depressions. Its predominant prey is mosquitos, and it is prey to the Yellow-billed Egret (*Ardea intermedia*) and the Giant African Bullfrog (*Pyxicephalus adspersus*) (Scott, 2021).

Table 9.18: Recorded Herpetofauna Species within the Integrated Paardeplaats Section.

SPECIES	FARM PORTION
Common Brown Water Snake	28/380 JT
African Striped Skink	40/380 JT
Sand Frog	13/380 JT
Boettger's Caco	13/380 JT
Delalande's River Frog	2/425 JS

Reptiles are notoriously difficult to comprehensively detect during short field surveys, due to many species in this group naturally occurring at low densities and being inherently illusive. Two species of reptile was identified, namely an African Striped Skink (*Trachylepis striata*) and the Common Brown Water Snake (*Lycodonomorphus rufulus*) (both Least Concern). The Skink was encountered in the transformed habitat in and amongst old building rubble and the Water Snake was encountered near the dam in Portion 28 of the farm Paardeplaats 380 JT. The rocky outcrops identified within the Integrated Paardeplaats Section provide crucial refugia for numerous herpetofauna species. The EkoInfo (2012) Report recorded numerous *Psammophylax rhombeatus* (Rhombic Skaapstekers) incubating eggs within the rocky ridges or under rocks that had been previously stacked by humans. The remaining grassland and wetland habitats provide both hunting sites and shelter for herpetofauna, primarily amphibians colonizing the wetlands which in turn attracts reptile predators.

The observed species diversity for both reptiles and amphibians was considerably low. The weather during the field survey was wet and overcast, this may have hindered the presence of herpetofauna (specifically reptile) species within the Integrated Paardeplaats Section. Nevertheless, the large AIP stands, and large areas of previously disturbed grasslands contribute to the decreasing reptile diversity. There is no current explanation for the low species composition of amphibians as numerous water bodies and systems were found throughout the Section. **Table 9.19** lists the previously recorded herpetofauna within the Project area, no SCC were encountered during the previous surveys.

Table 9.19: Previously Recorded Herpetofauna Species within the Integrated Paardeplaats Section.

SPECIES	COMMON NAME	CONSERVATION STATUS
Amphibians		
Amietia angloensis	Angola River Frog	LC
Ametia fuscigula	Cape River Frog	LC
Amietophrynus garmani	Eastern Olive Toad	LC
Breviceps adspersus	Common Rain Frog	LC
Cacosternum boettgeri	Boettger's Dainty Frog	LC
Kassina senegalensis	Bubbling Kassina	LC
Semnodactylus wealii	Rattling Frog	LC
Strongylopus fasciatus	Striped Stream Frog	LC
Strongylopus grayii	Gray's Stream Frog	LC
Xenopus laevis	African Clawed Frog	LC
Reptiles		
Afrotyphlops bibronii	Bibon's Blind Snake	LC
Hemachatus haemachatus	Rinkhals	LC
Leptotyphlops scutifrons	Peter's Threadsnake	LC
Psammophis crucifer	Cross Marked Grass Snake	LC
Psammophylax rhombeatus	Rhombic Skaapsteker	LC
Trachylepis capensis	Cape Skink	LC
Trachylepis punctatissima	Speckled Rock Skink	LC
Trachylepis varia	Variable Skink	DD
Varanus niloticus	Nile Monitor	LC

LC=Least Concern; VU=Vulnerable; EN= Endangered; NT=Near Threatened; DD=Data Deficient

9.6.5.1.3 Invertebrates

Invertebrates are the main components of faunal diversity in grasslands, playing substantial roles in ecosystem processes including nutrient cycling and pollination. Grassland invertebrate communities are heavily dependent on plant diversity and production within a given system

(Barnett and Facey, 2016). During the field survey in December 2020, a total of 34 invertebrates were observed and are listed in **Table 9.20**. The SCC, Marsh Sylph (*Metisella meninx*), was recorded during the 2020 survey in the Transformed Habitat within the Unchanneled Valley Bottom Wetland of Portion 5 of the farm Paardeplaats 380 JT. *M. meninx* is an obligate wetland species and depends on the occurrence of *Leersia hexandra* (Rice Grass), of which has been recorded in majority of the wetland habitats. Henning (2009) states that this species requires unpolluted marsh habitats. The adults tend to roost low down in the wetland vegetation, above the water level – which makes the susceptible to unexpected flooding. Adults rely on nectar to replenish their energy demands, of which has been noted to be obtained from *Verbena bonariensis, V. brasililiensis,* and *Persicaria spp* (all of which were recorded within the wetland habitats).

Table 9.20: Recorded Invertebrate Species within the Integrated Paardeplaats Section.

COMMON NAME	SPECIES NAME	CONSERVATION STATUS
Freshwater crab	*Potamonautes flavusjo*	LC
Red pumpkin beetle	*Aulacophora foveicollis*	LC
Garden fruit chafer	*Pachnoda sinuata*	NE
Hook-winged net-winged beetle	*Lycus melanurus*	NE
Spotted cucumber beetle	*Diabrotica undecimpunctata*	LC
Gaudy commodore	*Precis octavia sesamus*	LC
Marsh Sylph	***Metisella meninx***	**VU**
European Beewolf	*Philanthus triangulum*	LC
African honey bee	*Apis mellifera scutellata*	LC
Orange plume moth	*Stenodacma wahlbergi*	LC
Garden acraea butterfly caterpillar	*Acraea horta*	LC
Two-spotted ground beetle	*Anthia thoracica*	LC
Mountain white spot moth caterpillar	*Mesocelis montana*	LC
Cherry spot moth caterpillar	*Diaphone eumela*	LC
Paper wasp	*Polistes marginalis*	LC
Cleg fly	*Haematopota spp*	LC
Brown Veined White Butterfly	*Belenois aurota*	LC
Navy dropwing (female)	*Trithemis furva*	LC
Tussock Moth Caterpillar	*Laelia sp.*	LC
Black vine weevil	*Otiorhynchus sulcatus*	LC
Red legged tick	*Rhipicephalus evertsi evertsi*	LC
Grass stick insect	*Maransis rufolineatus*	LC
Blue emperor	*Anax imperator*	LC
Snouted harvester termites	*Trinervitermes*	LC
Grasshopper (with striped hind leg)	*Vitticatantops humeralis*	LC
Grasshopper (with yellow spots)	*Ochrophlebia cafra*	LC

COMMON NAME	SPECIES NAME	CONSERVATION STATUS
Velvet spider	*Dresserus spp*	LC
Spider wasp	*Hemipepsis*	LC
Robber fly	*Gonioscelis ventralis*	LC
Grass moth	*Ancylolomia spp*	NE
Short-tailed Ichneumon Wasp	*Enicospilus*	LC
Geranium Bronze	*Cacyreus marshalli*	LC
Black miliipede	*Doratogonus*	LC
Twig wilter	*Anoplocnemis spp.*	LC

LC=Least Concern; VU=Vulnerable; EN= Endangered; NT=Near Threatened; DD=Data Deficient

9.7 Freshwater Ecosystems

9.7.1 Biophysical Attributes

9.7.1.1 Freshwater Bioregional Context

The Integrated Paardeplaats Section is located within the Southern Temperate Highveld freshwater ecoregion, which is delimited by the South African interior plateau sub-region of the Highveld aquatic ecoregion, of which the main habitat type, in terms of watercourses, is regarded as Savannah-Dry Forest Rivers. Aquatic biotas within this bioregion have mixed tropical and temperate affinities, sharing species between the Limpopo and Zambezi systems. The Southern Temperate Highveld freshwater ecoregion is considered to be bio-regionally outstanding in its biological distinctiveness and its conservation status is regarded as Endangered. The ecoregion is defined by the temperate upland rivers and seasonal pans (Nel et al., 2004; Darwall et al., 2009; Scott, 2013).

9.7.1.2 Associated Aquatic Ecosystems

The National Water Resource Strategy (NWRS-1) originally established 19 Water Management Areas (WMAs) within South Africa and proposed the establishment of the 19 Catchment Management Agencies (CMAs) to correspond to these areas. In rethinking the management model and based on viability assessments with respect to water resources management, available funding, capacity, skills and expertise in regulation and oversight, as well as to improve integrated water systems management, the original 19 designated WMAs have been consolidated into nine WMAs.

The Integrated Paardeplaats Section is located predominantly within the newly revised Olifants WMA, which now also includes the Letaba River catchment. Accordingly, the main rivers include the Elands River, the Wilge River, the Steelpoort River, the Olifants River, and the Letaba River. The Olifants River originates to the east of Johannesburg and flows in a northerly direction before gently turning to the east. It is joined by the Letaba River before it enters into Mozambique. Two small isolated areas (one on the Integrated Paardeplaats Section eastern boundary and one on the Integrated Paardeplaats Section southern boundary) fall within the Inkomati-Usuthu WMA.

The Integrated Paardeplaats Section is located within the upper reaches of the B41A quaternary catchment, with the two isolated areas within the Inkomati-Ushutho WMA area located within the upper reaches of the X11D quaternary catchment (**Figure 9.16**). As such, several non-perennial watercourses, and more specifically various wetland systems, are associated with the study area as historically delineated by Wetland Consulting Services. Watercourses draining to the west flow into the Skilferlaagtespruit, while the watercourses draining northwards flow into the Langspruit. The Skilferlaagtespruit flows into the Grootspruit (sub-quaternary B41A-01025) and, after its confluence with the Langspruit (sub-quaternary B41A-01002), it becomes the Steelpoort River.

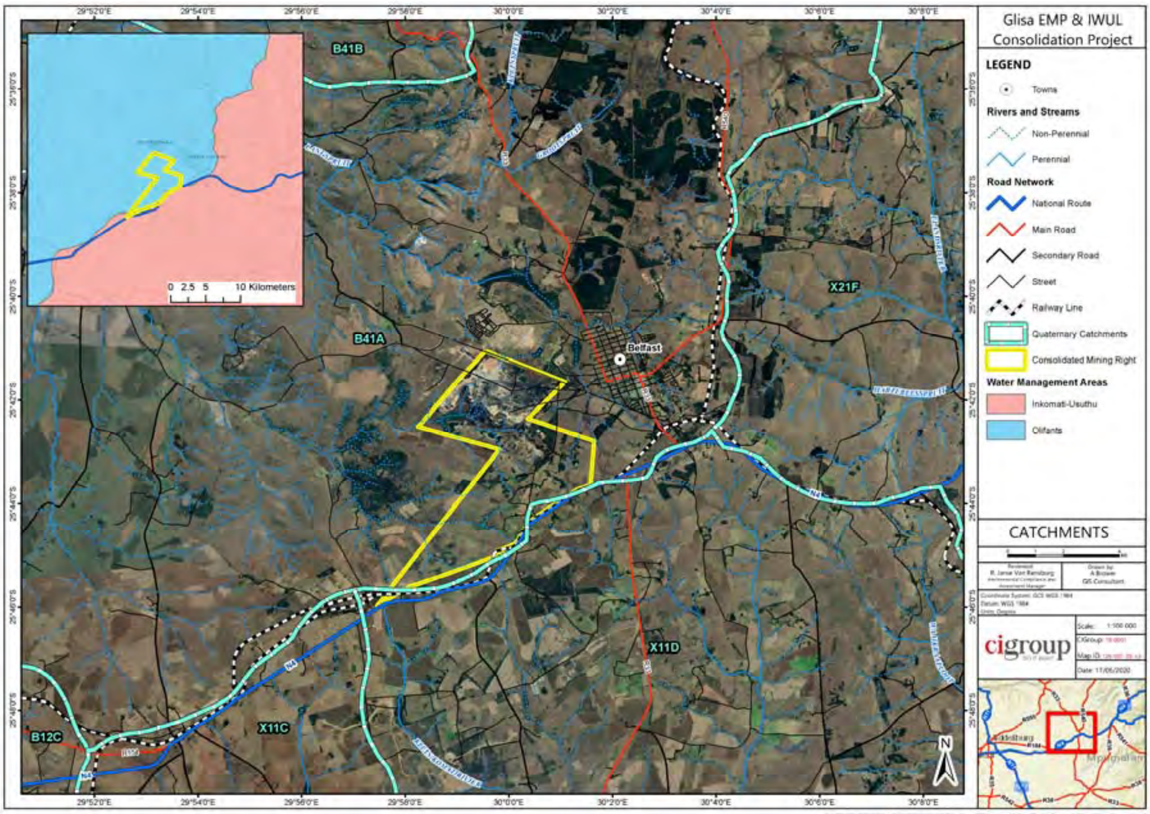

Figure 9.16: Integrated Paardeplaats Section WMA and Quaternary Catchments.

9.7.1.3 National Freshwater Ecosystem Priority Areas

The National Freshwater Ecosystem Priority Areas (NFEPA) project represents a multi-partner project which aims to identify Freshwater Ecosystem Priority Areas (FEPAs) to meet national biodiversity goals for freshwater ecosystems and to develop a basis for enabling effective implementation of measures to protect FEPAs, including free-flowing rivers. Based on current outputs of the NFEPA project (Nel *et al*., 2011) (**Figure 9.17**), the watercourses draining to the north and east form part of the surrounding catchment's river FEPAs, while the catchment draining to the west has been classified as a Fish Support Area (FSA).

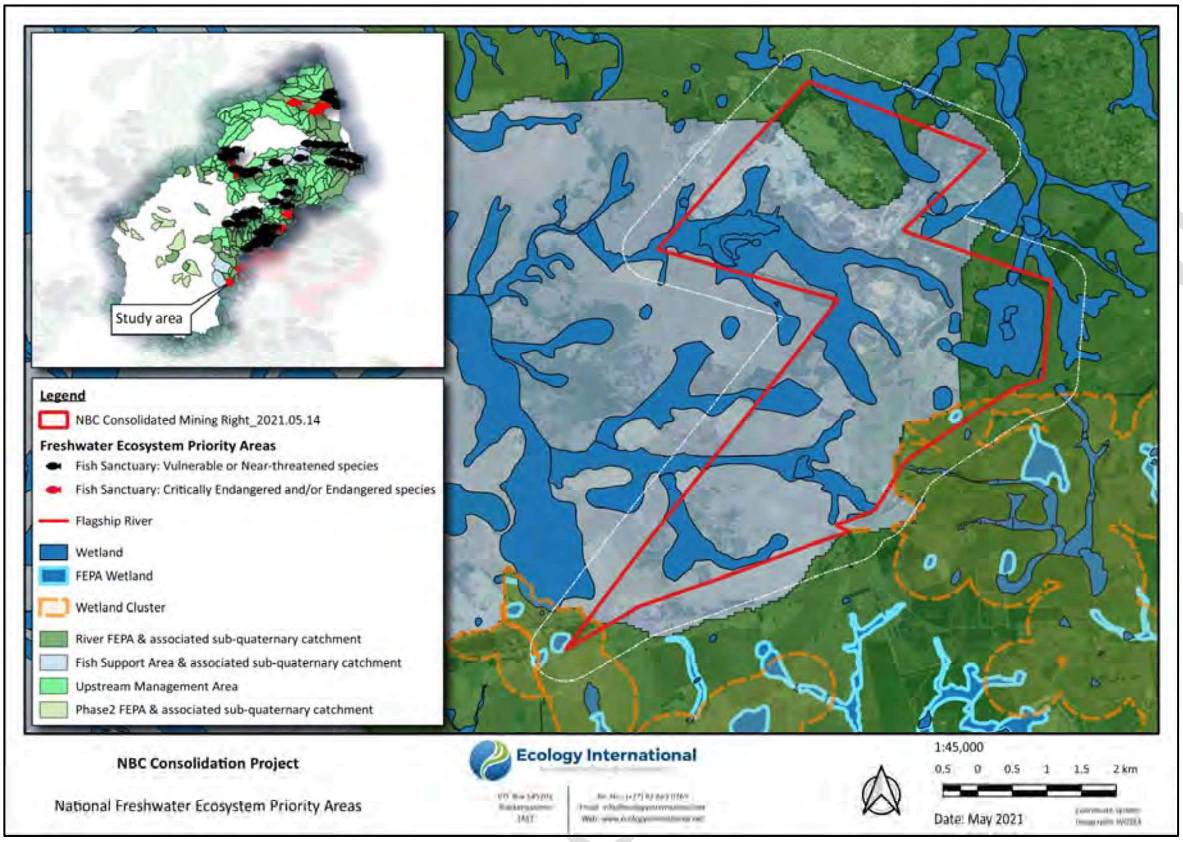

Figure 9.17: National Freshwater Ecosystem Priority Areas associated with the Integrated Paardeplaats Section.

SANBI recently undertook a wetland mapping exercise for the Mpumalanga Highveld region in order to expand on the detailed wetland delineations undertaken in adjacent catchments, for inclusion into the NFEPA project (Mbona *et al*., 2015). Mpumalanga Tourism and Parks Agency (MTPA) recognises that wetlands are specialised systems that perform various ecological functions and play an integral role in biodiversity conservation. The project sought to map the extent, distribution, condition and type of freshwater ecosystems in the Mpumalanga Highveld coal belt. The delineations were based on identifying wetlands on Spot 5 imagery within the Mpumalanga Highveld boundary and supported by Google Earth imagery, 1:50 000 contour lines, 1:50 000 river lines, data from previous studies in the area, and data from the original NFEPA wetlands layer. Hydrogeomorphic (HGM) units were identified at a desktop level and confirmed by means of ground-truthing. According to Mbona *et al*. (2015), while various wetland areas were noted to be associated with the study area, only one wetland unit (associated with a larger wetland cluster) was identified as a FEPA wetland based on the revised wetland mapping inventory for the Mpumalanga Highveld region (**Figure 9.17**).

9.7.1.4 Mpumalanga Biodiversity Sector Plan

A systematic conservation plan for Mpumalanga was published as the Mpumalanga Biodiversity Sector Plan (Mpumalanga Tourism and Parks Agency, 2014), with the aim to maintain biodiversity conservation targets. In the plan, the most important habitat categories to be taken into consideration in any environmental assessment process are:

- Critical Biodiversity Areas (CBAs): Areas that are required to meet biodiversity targets for species, ecosystems or ecological processes. These need to be kept in a natural or near-natural state, with no further loss of habitat or species. This category is split into:
    - CBA Irreplaceable Areas: These areas are required to meet biodiversity pattern and/or ecological processes targets. They are further subdivided into:
        - Irreplaceable: representing the only localities for which the conservation targets for one or more of the biodiversity features contained within can be achieved, i.e. there are no alternative sites available; and
        - High Irreplaceable: representing areas of significantly high biodiversity value, but there are alternate sites within which the targets can be met for the biodiversity features contained within, but there are not many;
    - CBA Irreplaceable Linkages: These are areas within landscape corridors that, due to modification of the natural landscape, represent the only remaining and highly constrained linkages which, if lost, would result in the breakage of the large corridor network as a whole. Their conservation is vital in maintaining the linkage of the corridor and its associated biodiversity related processes;
    - CBA Optimal Areas: Areas selected to meet biodiversity pattern and/or biodiversity process targets. Alternative sites might be available to meet biodiversity targets. These areas can, furthermore, support suitable habitat for red and orange listed faunal and floral species;
- Ecological Support Areas (ESAs): Areas determined to be functional but not necessarily entirely natural areas, which are required to ensure the persistence and maintenance of biodiversity patterns and ecological processes within the CBAs. Mpumalanga distinguishes following categories related to biodiversity outside protected areas:
    - ESA Species Specific: Areas required for the persistence of specific species. They may be modified, but a change in current land use to anything other than rehabilitated land, would most likely result in a loss of that species from the area identified; and
    - ESA Corridors: These facilitate ecological and climate change processes and to create a linked landscape for the conservation of species within a fragmented landscape.

According to the latest revision of the freshwater component of the provincial biodiversity sector plan (Mpumalanga Tourism and Parks Agency, 2019), the Integrated Paardeplaats Section is primarily associated with Heavily Modified and Ecological Support Areas, with isolated Critical Biodiversity Areas (**Figure 9.18**).

9.7.2 Wetland Ecology

9.7.2.1 Wetland Delineation

The wetlands/watercourses as historically delineated by Wetland Consulting Services were scrutinised at a desktop level prior to the field assessment of April 2021. These delineations were updated based as presented in **Figure 9.19**.

9.7.2.2 System Characterisation

The watercourses within the study area were classified according to the classification system (Ollis et al., 2013) as Inland Systems, falling within the Highveld Aquatic Ecoregion, and the Mesic Highveld Grassland Group 4 and Group 6 Wetland Vegetation Types (Mbona et al., 2015). These watercourses were further classified at Level 3 and Level 4 of the classification system as summarised in **Table 9.21**.

Ninety (90) hydro-geomorphic (HGM) units (**Figure 9.19**) were identified within the Integrated Paardeplaats Section comprising a total of 440.22 ha of which 311.63 ha comprised Hillslope Seep wetlands, 29.95 ha comprised Channelled Valley Bottom wetlands, 86.99 ha comprised Unchannelled Valley Bottoms, and 10.28 ha comprised Depressions (or Pans). In addition, 20 impoundments were observed within the study area covering 75.75 ha in extent, while 14 mine water bodies covering 66.57 ha were observed. It is also important to note that these HGM units were assessed only within the study area and some of the systems observed formed part of greater wetland systems falling outside of the bounds of investigation associated with this study. Both the impoundments and the mine waterbodies, while mapped and indicated in **Figure 9.19** were regarded as artificial systems and were thus not subjected to further analysis in terms of the WET-Health, WET-Ecoservices, and Ecological Importance and Sensitivity tools.

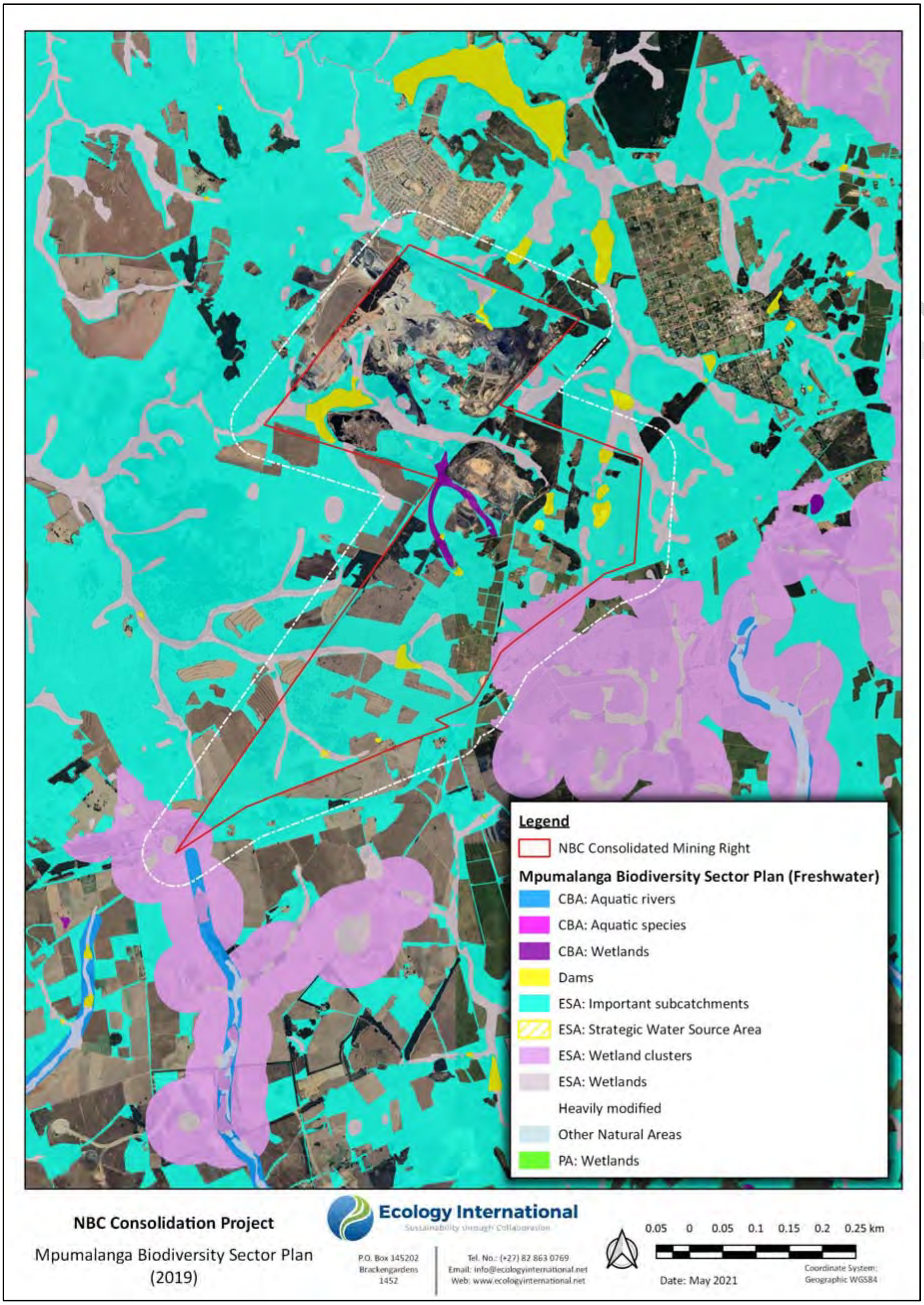

Figure 9.18: Mpumalanga Biodiversity Sector Plan (2019).

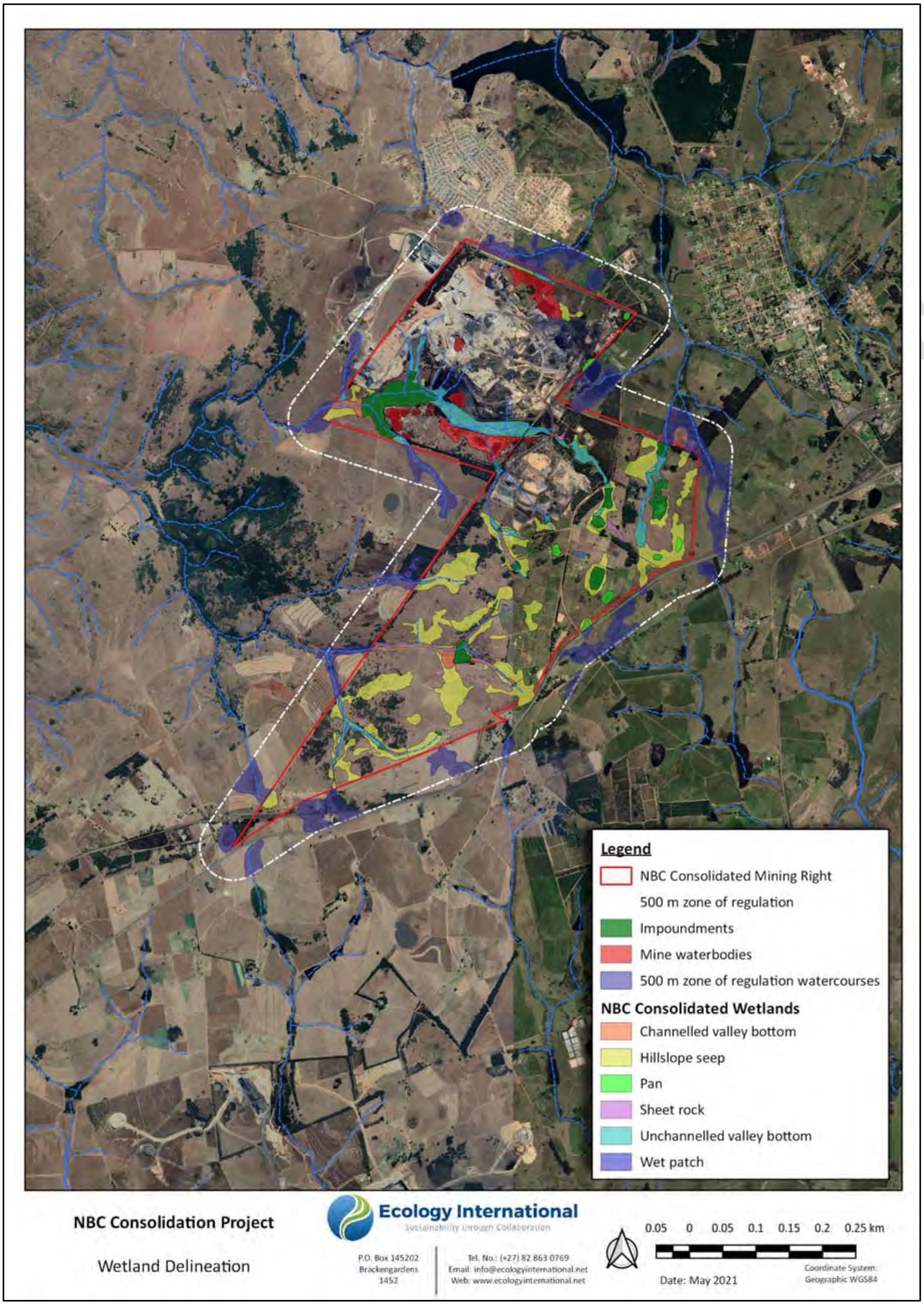

Figure 9.19: Wetlands/Watercourses within the Integrated Paardeplaats Section.

Table 9.21: Characterisation of the Watercourses within the Integrated Paardeplaats Section.

LEVEL 3: LANDSCAPE UNIT	LEVEL 4: HGM TYPE
Valley floor: the base of a valley, situated between two distinct valley side-slopes, where alluvial or fluvial processes typically dominate.	Channelled valley-bottom wetland: a valley-bottom wetland with a river channel running through it.
	Unchannelled valley-bottom wetland: a valley-bottom wetland without a river channel running through it.
Slope: an inclined stretch of ground typically located on the side of a mountain, hill or valley, not forming part of a valley floor. Includes scarp slopes, mid-slopes and foot-slopes.	Hillslope seep: a wetland located on gently to steeply sloping land and dominated by colluvial (I.e., gravity-driven) unidirectional movement of water and material down-slope.
Plain: an extensive area of low relief, generally characterized by relatively level, gently undulating or uniformly sloping land with a very gentle gradient that is not located in a valley.	Depression: an inland aquatic ecosystem with closed or near-closed elevation contours, which increases in depth, and within which water typically accumulates.

9.7.2.3 Present Ecological State

The health of a wetland can be defined as a measure of the deviation of wetland structure and function from the wetland's natural reference condition (Macfarlane *et al*., 2009). The wetlands associated with the Integrated Paardeplaats Section have been impacted by a long history of agricultural and recreational land uses as well as impacts related to mining.

The major impacts to the wetlands/watercourses identified through the health assessments can be summarised as follows:

- Historical opencast and underground mining activities have been taking place in the vicinity of the Integrated Paardeplaats Section since 1980, with impacts to water quality and fragmentation of the wetland systems observed.
- HGM units severely affected by fragmentation include HGM 1, 2, 3, 23, 46, 47 and 48.
- The upper portions of HGM 9 and HGM 10 have been destroyed due to infilling and stockpiling.
- Surface infrastructure development such as offices, the mining complex, roads, trenches and stockpiles have resulted in direct losses of wetland habitat over the years, and impacts to the natural hydrological setting, as well as the creation of preferential flow paths and altered water retention and distribution profiles.
- Geomorphological changes include impacts relating to sedimentation and deposition as a result of the clearing of vegetation for roads and infrastructure.

- Impaired water quality related to the historical mining activities at the Glisa Section has affected HGM 1, 2, 3 and 16, however, opencast mining activities are likely to have resulted in impacts to the regional aquifer, which may impact water quality of the associated valley bottom wetlands present in the study area.
- Numerous impoundments were observed on wetland systems throughout the study area. HGM 24, HGM 25, HGM 31, HGM 32 and HGM 33 have been impacted in terms of the geomorphology as well as water quality due to the presence of trout dams on these systems. Further, deep and shallow flooding by the observed impoundments has resulted in severe alterations to the natural wetting regimes of HGM 16, 23, 27, 43, 47, 58, 67, 69, 77 and 80.
- Historical plantations and infestations of *Acacia mearrnsii* (Wattle), *Populus x canescens* (Poplars) and *Eucalyptus sp* (Bluegums) have resulted in impacts to HGM 1, 2, 19, 20, 21, 22, 23, 29, 52, 55, 67, 74, 76, 78, 83 and 86.
- Historical modifications to the landscape in the vicinity of HGM 62, 63, 71 and 72 have impacted on the geomorphological and vegetation integrity of these systems.
- Historical cultivation has impacted the integrity of the natural vegetation in the vicinity of HGM 68, while ongoing cultivation activities in the catchment of HGM 76, 79, 81, 83, 86 and 87 increase the potential for impacts to water quality and increased sediment loads within the catchment.

The identified wetlands were assessed according to the WET-Health methodology as described by Macfarlane *et al.* (2008) and were broadly classified as Largely Natural (Category B), Moderately Modified (Category C), Largely Modified (Category D) and Seriously Modified (Category E). The results of these assessments (derived from both desktop and field-based verification) are presented in **Figure 9.20**.

9.7.2.4 Wetland Ecological Service Provision

The general features of each HGM unit were assessed in terms of function, and the overall importance of the HGM unit was then determined at a landscape level. The systems associated with the Integrated Paardeplaats Section may be regarded as of Moderately Low to Moderately High (**Figure 9.21**) importance in terms of service provision and functionality. Key services provided are generally related to streamflow regulation, sediment trapping and the assimilation of toxicants and nutrients from the surrounding land use activities. Biodiversity maintenance is regarded as high to very high across almost all the HGM units indicating the importance for conservation of these systems as well as their role in the provision of habitat and natural migration corridors. Erosion control and flood attenuation services were also generally regarded as important services, albeit to a lesser extent.

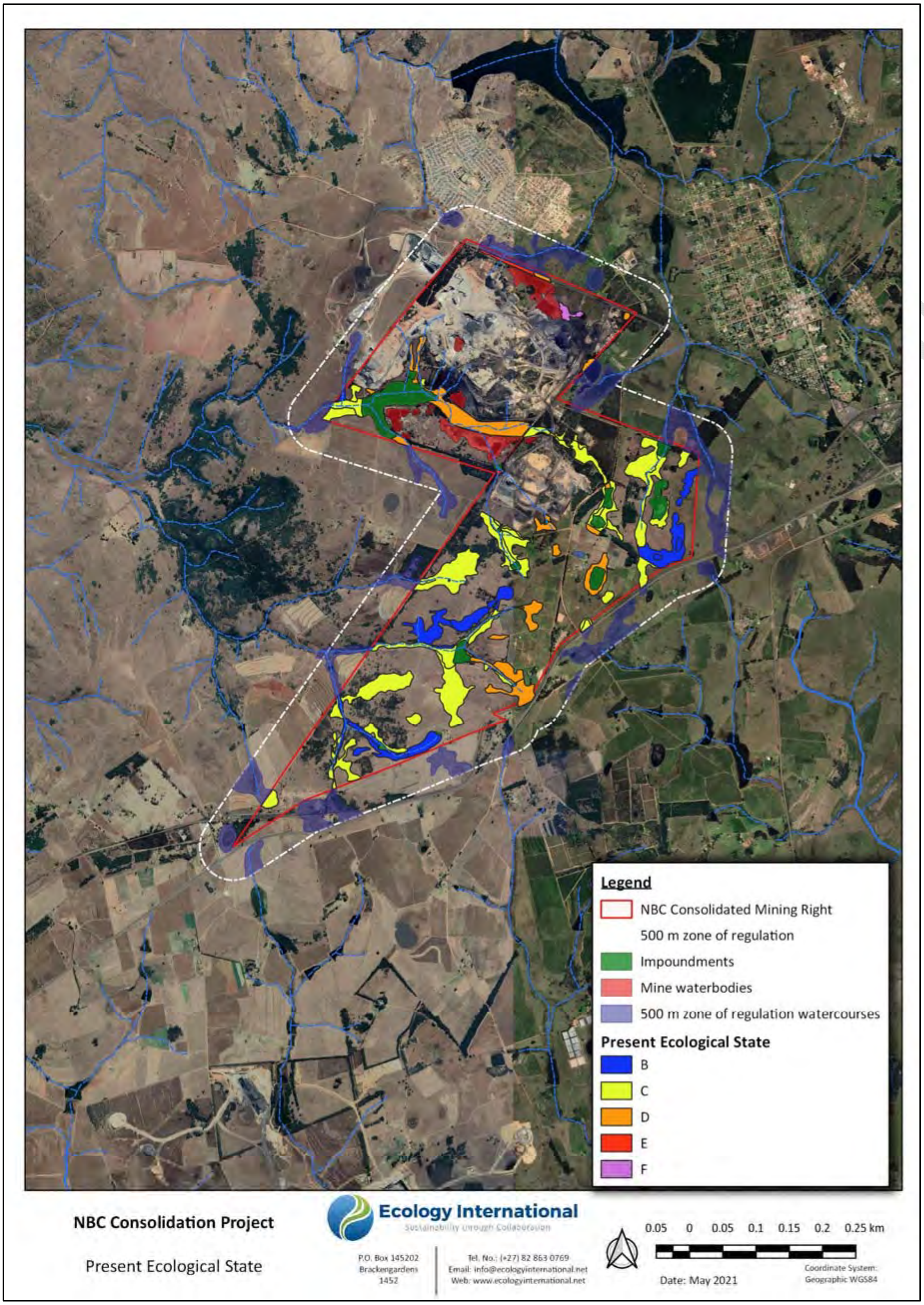

Figure 9.20: The Present Ecological State of the Wetlands/Watercourses within the Integrated Paardeplaats Section.

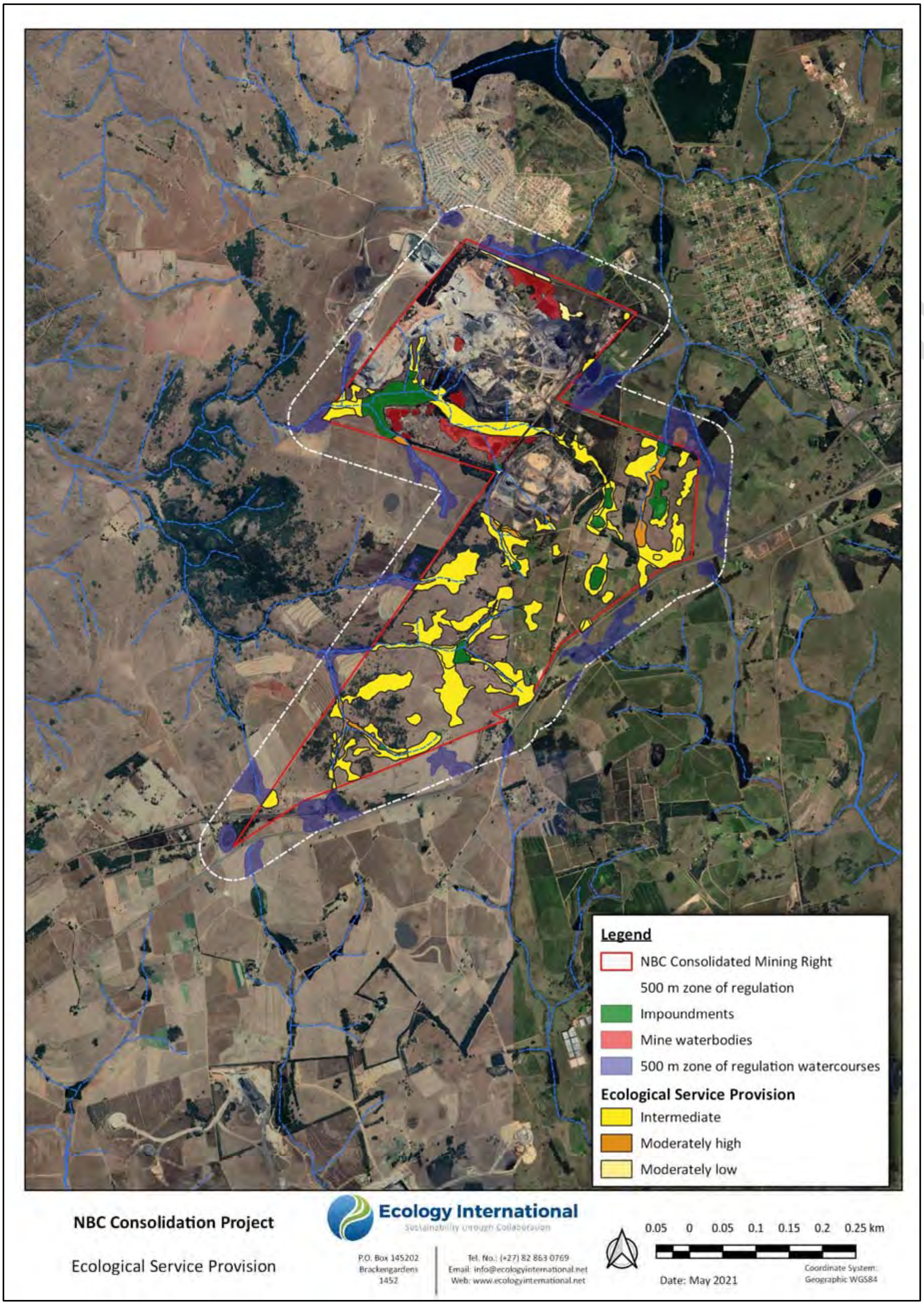

Figure 9.21: Ecological Service Provision of the Wetlands/Watercourses within the Integrated Paardeplaats Section.

9.7.2.5 Ecological Importance and Sensitivity

Ecological Importance and Sensitivity for each wetland was evaluated in terms of:

- Ecological Importance;
- Hydrological Functions; and
- Direct Human Benefits.

The wetlands associated with the Integrated Paardeplaats Section were regarded as of Moderate and High Ecological Importance and Sensitivity (**Figure 9.22**), being important in terms of ecological importance (biodiversity maintenance) and their hydrological functions. Direct human benefits were related to the provision of water for agropastoral activities, as well as for recreational use and tourism (i.e., trout fishing and birding opportunities), however, these were generally associated with the valley bottom systems rather than with the hillslope seeps.

9.7.3 Aquatic Assessment

A long-term biomonitoring program has been in place at the Glisa Section of the Integrated Paardeplaats Section, which has sought to identify potential spatial and temporal impacts associated with the operation of the mine on the receiving aquatic environment. Given the availability of recent data (September 2019 and July 2020), a full assessment of all the watercourses associated with this portion of the study area was considered unnecessary. For the purposes of this study, the available historical data was reviewed and used to characterise and contextualise the receiving aquatic environment associated with the Glisa Section. While an aquatic baseline assessment of the Paardeplaats Section was carried out in 2011, a more recent assessment was required to reflect the current baseline conditions.

The location of each site considered in the current assessment is presented in **Figure 9.23** whilst the co-ordinates and a brief description of each site is provided in **Table 9.22**.

9.7.3.1 Water Quality

Aquatic communities are influenced by numerous natural and human-induced factors, including physical, chemical and biological factors. The assessment of water quality variables in conjunction with assessment of biological assemblages is therefore important for the interpretation of results obtained during biological investigations. **Table 9.23** provides the in situ water quality data obtained at each site applicable to this study during the most recent biomonitoring survey conducted in February 2020 and the aquatic baseline assessment carried out in April 2021.

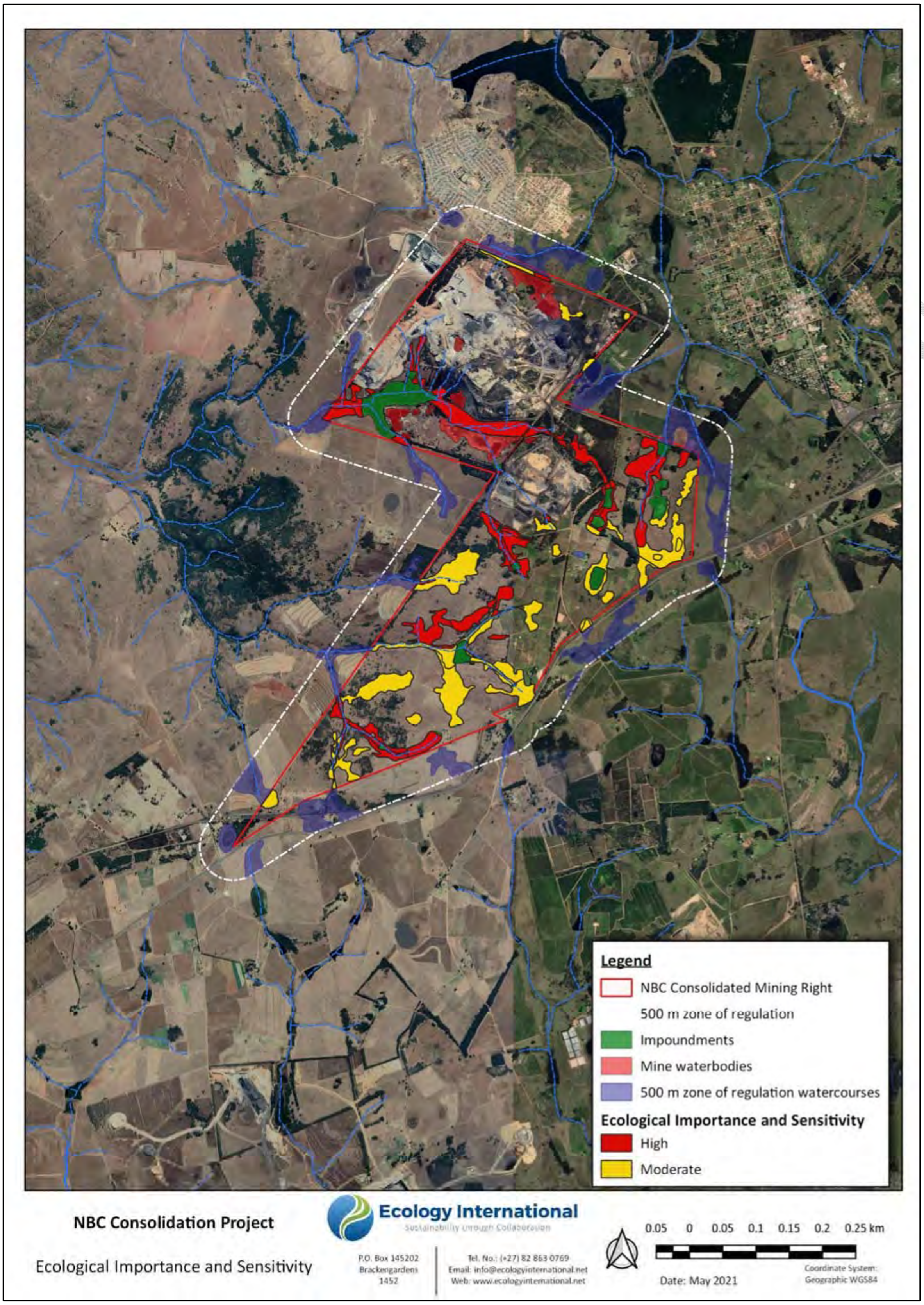

Figure 9.22: Ecological Importance and Sensitivity of the Wetlands/Watercourses within the Integrated Paardeplaats Section.

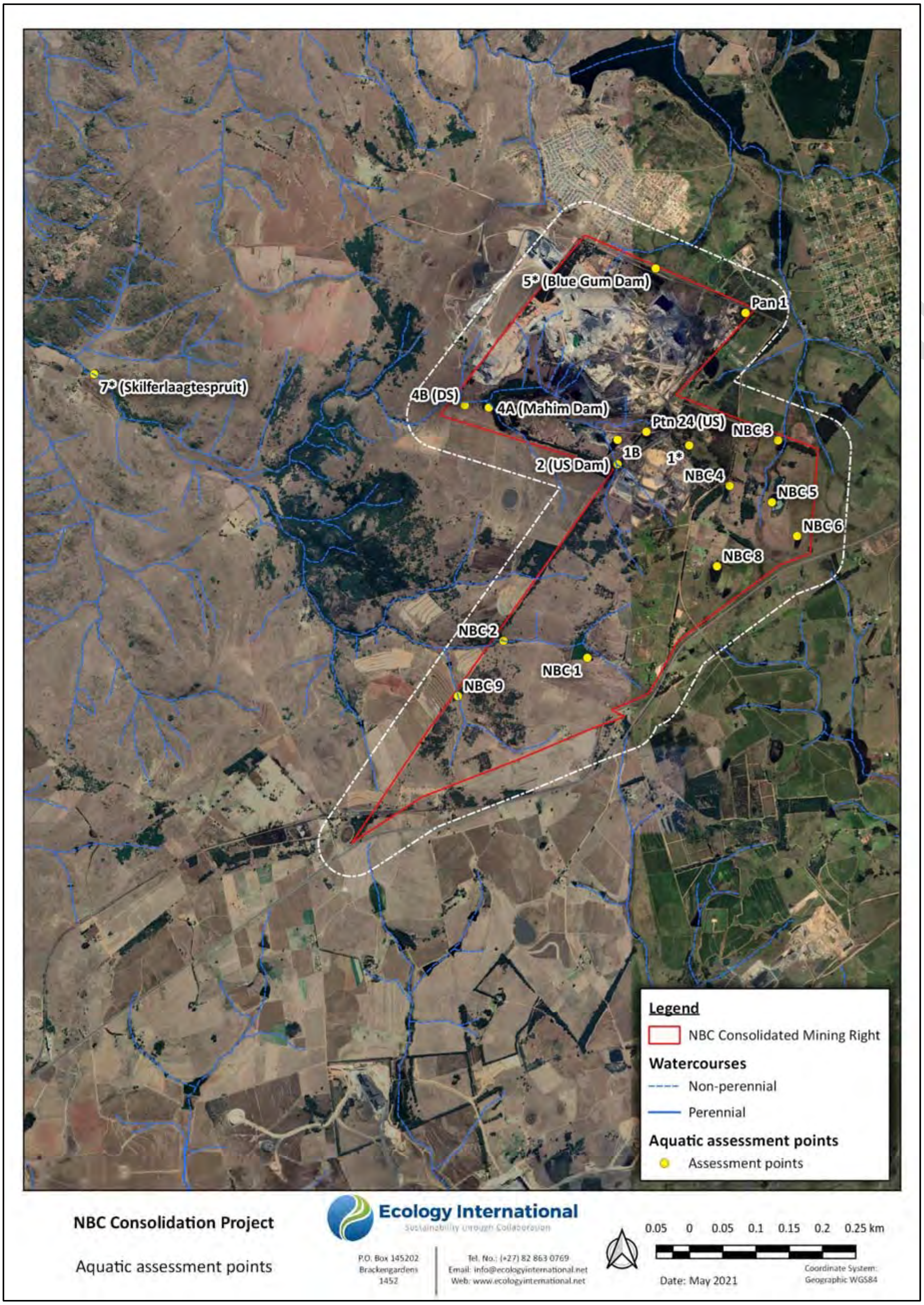

Figure 9.23: Aquatic Assessment Locations.

Table 9.22: Description of Aquatic Assessment Sampling Sites.

SITE	CO-ORDINATES	DESCRIPTION	PROTOCOLS
GLISA SECTION BIOMONITORING SITES			
Ptn 24 (US)	25°42'39.12"S 30° 0'6.21"E	Upstream wetland draining Portion 24	Water quality, habitat integrity, diatoms
2 (US Dam)	25°42'54.92"S 29°59'50.65"E	Dam at inflow into existing Glisa Coal Mine study area and should exclude most potential Glisa impacts (mining and river diversion).	Water quality, habitat integrity, macroinvertebrates, fish, diatoms
1B	25°42'43.02"S 29°59'53.94"E	Upstream part of Mahim Dam	Diatoms
4A (Mahim Dam)	25°42'27.35"S 29°58'41.13"E	Mahim Dam, downstream of most Glisa Coal Mine potential and existing impacts.	Water quality, habitat integrity, macroinvertebrates, fish
4B (DS)	25°42'26.22"S 29°58'28.13"E	Tributary draining away from Mahim Dam and exiting the western boundary of the Glisa property.	Water quality, habitat integrity, macroinvertebrates, fish, diatoms
5* (Blue Gum Dam)	25°41'19.60"S 30° 0'11.20"E	Site in stream draining in northerly direction, downstream of all existing Glisa Coal Mine impacts.	Water quality, habitat integrity, macroinvertebrates, diatoms
7* (Skilferlaagtespruit)	25°42'11.10"S 29°55'8.00"E	Site in Skilferlaagtespruit (Steelpoort) some distance downstream of Glisa study area. This site is downstream of existing and potential future Glisa Coal Mine activities, and has good potential as a biomonitoring site.	Water quality, habitat integrity, macroinvertebrates, fish
Pan 1	25°41'41.30"S 30° 0'59.76"E	Non-perennial pan in NE corner of study area	Water quality, habitat integrity, macroinvertebrates, diatoms
ADDITIONAL SITES ASSESSED DURING APRIL 2021			
NBC 1	25°44'29.37"S 29°59'34.33"E	Water storage dam located on a channelled valley bottom wetland	Water quality, macroinvertebrates, diatoms

SITE	CO-ORDINATES	DESCRIPTION	PROTOCOLS
NBC 2	25°44'21.08"S 29°58'49.00"E	Channelled valley bottom flowing into an unnamed tributary of the Steelpoort River.	Water quality, macroinvertebrates, diatoms
NBC 3	25°42'43.37"S 30° 1'17.29"E	Farm dam in valley bottom wetland draining into the Langspruit	Water quality, macroinvertebrates, diatoms
NBC 4	25°43'5.52"S 30° 0'51.16"E	Farm dam in a valley bottom wetland	Water quality, macroinvertebrates, diatoms
NBC 5	25°43'13.49"S 30° 1'13.99"E	Farm dam in valley bottom wetland draining into the Langspruit	Water quality, macroinvertebrates, diatoms
NBC 6	25°43'29.97"S 30° 1'27.60"E	Seasonal depression	Water quality, diatoms
NBC 8	25°43'44.70"S 30° 0'44.37"E	Seasonal pan modified into a permanent storage dam	Water quality, diatoms
NBC 9	25°44'47.96"S 29°58'24.45"E	Unchannelled valley bottom flowing into an unnamed tributary of the Steelpoort River	Water quality, diatoms

Within the Olifants WMA, the classification and development of Resource Quality Objectives (RQOs) was completed (Department of Water and Sanitation, 2016a). While RQOs for water quality were not gazetted for the quaternary catchments associated with Integrated Paardeplaats Section, the DHSWS did undertake the development of an Integrated Water Quality Management Plan (IWQMP) for the Olifants WMA in which Water Quality Planning Limits (WQPLs) were developed at a finer scale (management units) to help achieve the management class and RQOs for particular areas, as they are set at a finer resolution and take local users and uses into account. The objective of using WQPLs is to provide a mechanism through which the balance between sustainable and optimal water use and protection of the water resource can be achieved. What is important is that WQPLs are aligned to the RQOs and do not contradict the objectives gazetted (Department of Water and Sanitation, 2016b). As such, *in situ* water quality data collected during the study were compared to WQPLs developed for Management Unit 66 of the Steelpoort sub-catchment (**Table 9.23**). Values noted to exceed designated WQPLs are indicated in red.

Table 9.23: *In situ* Water Quality Variables.

	SITE	TEMP. (°C)	pH	ELECTRICAL CONDUCTIVITY (mS/m)	DISSOLVED OXYGEN (mg/ℓ)	DISSOLVED OXYGEN (% sat)
RQO*		-	-	-	-	-
WQPL**	Guideline values	-	6.5-8.4	30.00	9.00	-
GLISA SECTION BIOMONITORING SITES (CLEANSTREAM, 2020)	Ptn 24 (US)	21.5	6.5	159.8	-	-
	2 (US Dam)	24.4	6.7	114.4	5.7	84.6
	1B	19.9	6.9	245.0	5.2	70.3
	4A (Mahim Dam)	22.3	6.9	257.0	6.2	98.9
	4B (DS)	26.6	6.6	145.9	2.8	42.2
	5* (Blue Gum Dam)	22.0	8.4	138.6	8.0	124.0
	7* (Skilferlaagtespruit)	19.2	6.9	50.2	7.3	101.3
	Pan 1	27.6	6.6	70.2	4.1	64.9
ADDITIONAL SITES ASSESSED DURING APRIL 2021	NBC 1	17.2	7.90	136.0	7.02	77.5
	NBC 2	18.6	7.57	138.1	8.06	84.1
	NBC 3	17.2	7.27	142.4	2.89	29.9
	NBC 4	20.9	8.43	143.7	8.70	98.8
	NBC 5	21.0	7.79	140.8	6.37	71.3
	NBC 6	20.5	6.93	138.9	5.91	68.4
	NBC 8	22.9	7.94	137.5	8.28	98.5
	NBC 9	15.3	6.60	138.7	5.49	54.8

* Resource Quality Objective for RU54 (Department of Water and Sanitation, 2016a)

** Water Quality Planning Limit for Management Unit 59 of the Steelpoort sub-catchment (Department of Water and Sanitation, 2016b)

Electrical conductivity values were high across much of the study area. It would be valuable to reassess these values in future monitoring surveys to identify any emerging trends or impacts, especially as the study area is situated within the upper reaches of the Steelpoort River catchment and has been identified as important in terms of fish support. During the February 2020 biomonitoring assessment, high electrical conductivity values were observed in the Mahim Dam (represented by sites 1B and 4A). The Mahim Dam and the Blue Gum Dam form part of the dirty water system for NBC and as such, high salinities are to be expected. Similarly, the high salinities observed throughout the Integrated Paardeplaats Section, are reflective of the types of systems (wetlands and impoundments), where salinities are often naturally elevated as these systems often act as sinks for salts and nutrients, however, the potential exists for contamination of the regional aquifer due to historical mining activities since 1980, which may have contributed to the elevated electrical conductivity values observed in some areas of the site.

pH values at all sites were found to fall within the guideline values stipulated for optimal aquatic life, with the exception of Site NBC 4, where the pH was observed as somewhat alkaline during the April 2021 assessment.

In situ dissolved oxygen values obtained for the study area during the April 2021 assessment, while below the WQPL value for the management unit, were not deemed to be of concern at most sites when taken in context of the characteristics of the associated watercourses with the exception of sites 4B, Pan 1, NBC 3, NBC 6, NBC 9. The extremely low values observed at sites 4B and NBC 3 are usually indicative of extremely polluted and/or stagnant systems with either a high chemical or biological oxygen demand, the latter often being the case in wetland systems or impoundments.

Temperature values at each of the sites were regarded as natural according to the seasonal temperature variations for each survey and the nature of the system at each site.

9.7.3.2 Aquatic Habitat

The Integrated Paardeplaats Section falls within the upper reaches of the Steelpoort River catchment in an area comprising plateau grasslands, mountain slopes and shallow valleys. As such, the terrain lends itself to the formation of numerous hillslope seep wetlands and the presence of valley bottom wetland features becoming more channelled further downstream.

9.7.3.2.1 Index for Habitat Integrity

Habitat integrity refers to the maintenance of a balanced, integrated composition of physico-chemical and habitat characteristics on a temporal and spatial scale that are comparable to the characteristics of natural habitats of the region. The habitat integrity status of a watercourse will essentially provide the template for a certain level of biotic integrity to be realised. In this sense, the assessment of the habitat integrity of a river can be seen as a pre-cursor of the assessment of biotic integrity. It follows that in this context habitat integrity and biotic integrity together constitutes ecological integrity.

The ecological condition of the instream and riparian habitat associated with the assessment area was determined through the application of the Index for Habitat Integrity, Version 2 (IHI-96-2; Kleynhans, pers. comm., 2015), which was also used to provide a surrogate for the riparian vegetation component of the integrated EcoStatus model. While the recently upgraded IHI-96-2 replaces the relatively comprehensive and expensive IHI assessment model developed by Kleynhans (1996), it is important to note that the IHI-96-2 does not replace the IHI model developed by Kleynhans *et al.* (2008a), which should preferably be applied where sufficient data is available (i.e., intermediate and comprehensive Reserve Determinations). Consequently, the IHI-96-2 model is meant to be used in cases where a relatively large number of river reaches needs to be assessed, budget and time provisions are limited, and/or detailed available information is lacking (i.e., rapid Reserve Determinations and for RHP purposes).

The use of aerial photography and observations made during the field assessment were used to inform the adapted IHI model, which allows for a rapid, field-based, visual assessment of modifications to a number of pre-selected biophysical drivers within a localised portion of the associated hydrogeomorphic unit (Kemper, 1999). Further, it is important to note that this index is only applicable to channelled watercourses. For the assessment of habitat for unchanneled valley bottom wetlands, depressions and hillslope seep wetlands refer to **Section 9.7.2.3**. **Table 9.24** presents the results obtained following the application of the IHI approach within the channelled valley bottom system at site NBC 2 during the April 2021 freshwater assessment as well as the results obtained at site 4B and site 7 during the February 2020 biomonitoring assessment.

Table 9.24: IHI Values Obtained for the Instream and Riparian Components.

	Site	Component	RQO*	IHI Value	Ecological Category
Glisa Section biomonitoring sites (Cleanstream, 2020)	4B (DS)	Instream	C	47	D
		Riparian	C	59	C/D
	7* (Skilferlaagtespruit)	Instream	C	74	C
		Riparian	C	77	B/C
Additional site assessed during April 2021	NBC 2	Instream	C	80	B/C
		Riparian	C	70	C

* Resource Quality Objective for RU54, quaternary catchment B41A (Department of Water and Sanitation, 2016a)

According to Cleanstream (2020) the Skilferlaagtespruit has been impacted by invasive alien trees (mainly *Acacia mearnsii* [wattles]), erosion and increased sedimentation due to trampling by cattle. At site 4B (downstream of Mahim Dam), alien invasive weeds, such as *Conyza bonariensis* were problematic, while inundation, impacts to water quality and the colonisation of monospecific stands of *Typha* reeds have resulted in a deviation from the required RQO for the catchment.

At site NBC2, the instream integrity was categorised as Largely Natural to Moderately Modified (Ecological Category B/C, while the riparian integrity was categorised as Largely Natural (Ecological Category C). Instream impacts were largely related to elevated Electrical Conductivity concentrations, while impacts to the riparian zone were limited to dense stands of *Acacia mearnsii* (Wattle).

Habitat integrity in the Skilferlaagtespruit as well as at site NBC 2 fell within the RQOs for streams within this portion of the Steelpoort River catchment and more specifically, within the B41A quaternary catchment.

9.7.3.2.2 Invertebrate Habitat Assessment System

The Invertebrate Habitat Assessment System (IHAS, Version 2.2), developed by McMillan (1998), has routinely been used in conjunction with the South African Scoring System (SASS) as a measure for the variability in the amount and quantity of aquatic macroinvertebrate biotopes available for sampling. However, according to a recent study conducted within the Mpumalanga and Western Cape regions, the IHAS method does not produce reliable scores with regard to the suitability of habitat at sampling sites for aquatic macroinvertebrates and the performance of the IHAS seems to vary between geomorphologic zones and between biotope groups (Ollis *et al.*, 2006). Therefore, more testing of the IHAS method is required before any final conclusion can be made regarding the accuracy of the index.

Further, the IHAS index was developed for use within riverine systems. The watercourses associated with the assessment area comprised largely wetland habitat and impoundments and as such, the IHAS index was not considered suitable for the majority of the watercourses such as was sampled within the study area. The establishment of impoundments, however, generally leads to the creation of new biotopes for exploitation by waterborne biota, such as a shoreline with marginal vegetation, open water and bottom substrate. An adaptation of the IHAS method was retained for the purposes of this assessment, as the basic data remains of value and is suitable for the comparison of sampling effort across the various sites based on available invertebrate habitat. Results are presented relative to an “ideal” aquatic macroinvertebrate sampling habitat and need to be interpreted with caution taking into consideration the nature of the watercourse surveyed. Results obtained during the February 2020 biomonitoring assessment, as well as the April 2021 freshwater assessment are presented in **Table 9.25** and **Figure 9.24**.

Table 9.25: Adapted IHAS Values During the February 2020 and April 2021 Assessments.

SITE	IHAS SCORE	DESCRIPTION
GLISA SECTION BIOMONITORING SITES (CLEANSTREAM, 2020)		
Dam 2	36.36	Poor
1B	30.91	Poor
4A	36.36	Poor
4B (DS)	29.09	Poor
7* (Skilferlaagtespruit)	78.18	Excellent
Pan 1	34.55	Poor
Blue Gum Dam	32.73	Poor
ADDITIONAL SITES ASSESSED DURING APRIL 2021		
NBC 1	41.82	Poor
NBC 2	41.82	Poor
NBC 3	43.64	Poor
NBC 4	50.91	Poor
NBC 5	43.64	Poor

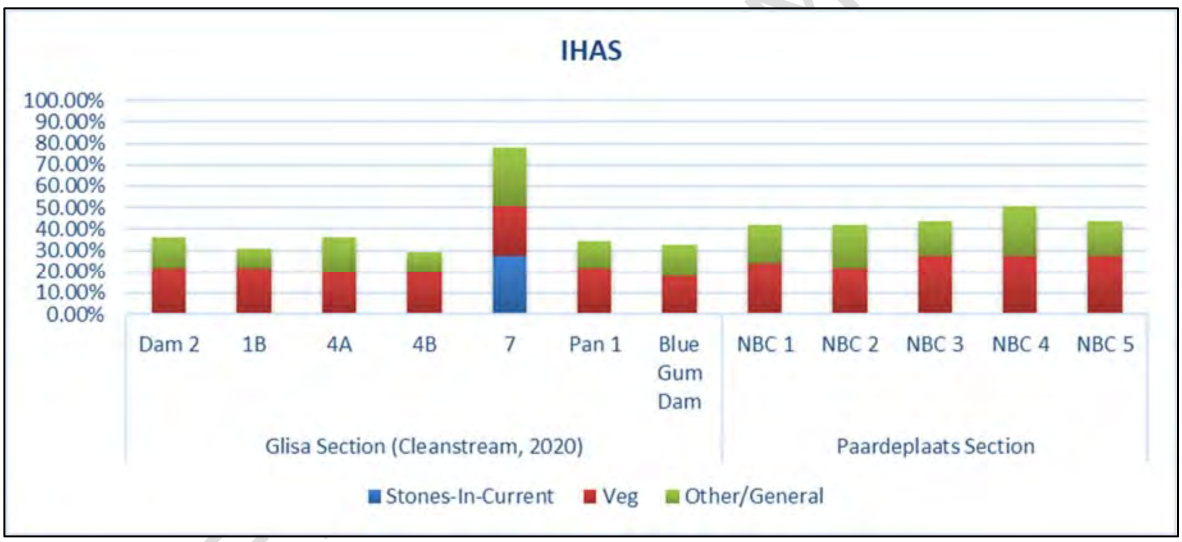

Figure 9.24: IHAS Biotope Values for Sites Assessed During the Aquatic Biomonitoring Assessments.

All of the sites sampled were determined to have poor availability of habitat for colonisation by aquatic macroinvertebrates with the exception of site 7 on the Skilferlaagtespruit. This is largely as a consequence of the impounded nature of the systems at each site. Lack of hydraulic diversity in these systems and the dominance of vegetation and mud deposits will have played a large role in shaping the aquatic macroinvertebrate assemblages expected to occur at each site. Species expected to occur at these sites were likely to be limited to those with a preference for the water column and those adapted for survival in aquatic vegetation and the muddy substrates observed.

9.7.3.3 Aquatic Macroinvertebrates

According to Darwall *et al.* (2009), two species of Crabs, 14 species of Molluscs and approximately 58 species Odonata (dragonflies and damselflies) have distribution ranges that extend across the Integrated Paardeplaats Section. During the February 2020 biomonitoring survey (Cleanstream, 2020), a total of 33 aquatic macroinvertebrate families (representing 11 orders) were sampled across the sampling sites within the Glisa Section. During the April 2021 assessment, a total of 36 aquatic macroinvertebrate families (representing 11 orders and including a species of Copepoda) were sampled across the Paardeplaats Section.

The macroinvertebrate data collected at each site during the February 2020 and April 2021 assessments are presented in **Table 9.26**. It should be noted that the SASS5 protocol was developed specifically for flowing rivers and streams. As such, as the majority of the sites comprised wetlands and/or impoundments (with the exception of the Skilferlaagtespruit and the channelled system in the vicinity of NBC 2), the SASS5 and MIRAI should be applied and interpreted with caution. The results do, however, still provide valuable information and a basis of comparison which may be used as a measure of spatial impact.

Table 9.26: Aquatic Macroinvertebrate Results Obtained During the February 2020 and April 2021 Assessments.

SITE	NO. OF ORDERS	NO. OF TAXA	SASS5 SCORE	ASPT
GLISA SECTION BIOMONITORING SITES (CLEANSTREAM, 2020)				
Dam 2	6	14	60	4.29
1B	5	8	36	4.50
4A	9	13	60	4.62
4B	4	5	22	4.40
7	9	19	101	5.32
Pan 1	4	13	56	4.31
Blue Gum Dam	6	13	59	4.54
ADDITIONAL SITES ASSESSED DURING APRIL 2021				
NBC 1	8	22	88	4.00
NBC 2	9	17	83	4.88
NBC 3	10	20	81	4.05
NBC 4	8	18	88	4.89
NBC 5	9	19	82	4.32

All of the sites were dominated by taxa tolerant of very low and low water quality (**Figure 9.25**). The presence of taxa tolerant of moderate levels of water quality at all of the sites with the exception of site 4B, indicates that water quality was generally not likely to be a limiting factor of the assemblages observed. Species from the order Hemiptera were noted to represent the most abundant aquatic macroinvertebrates at all the sites. Assemblage patterns of aquatic macroinvertebrates reflect the geohydrological regime of a particular site, thus, the lack of hydraulic diversity within many of the sites sampled, was likely to contribute to the incidence of a high diversity of air-breathing taxa (**Figure 9.25**) with a preference for aquatic and marginal vegetation.

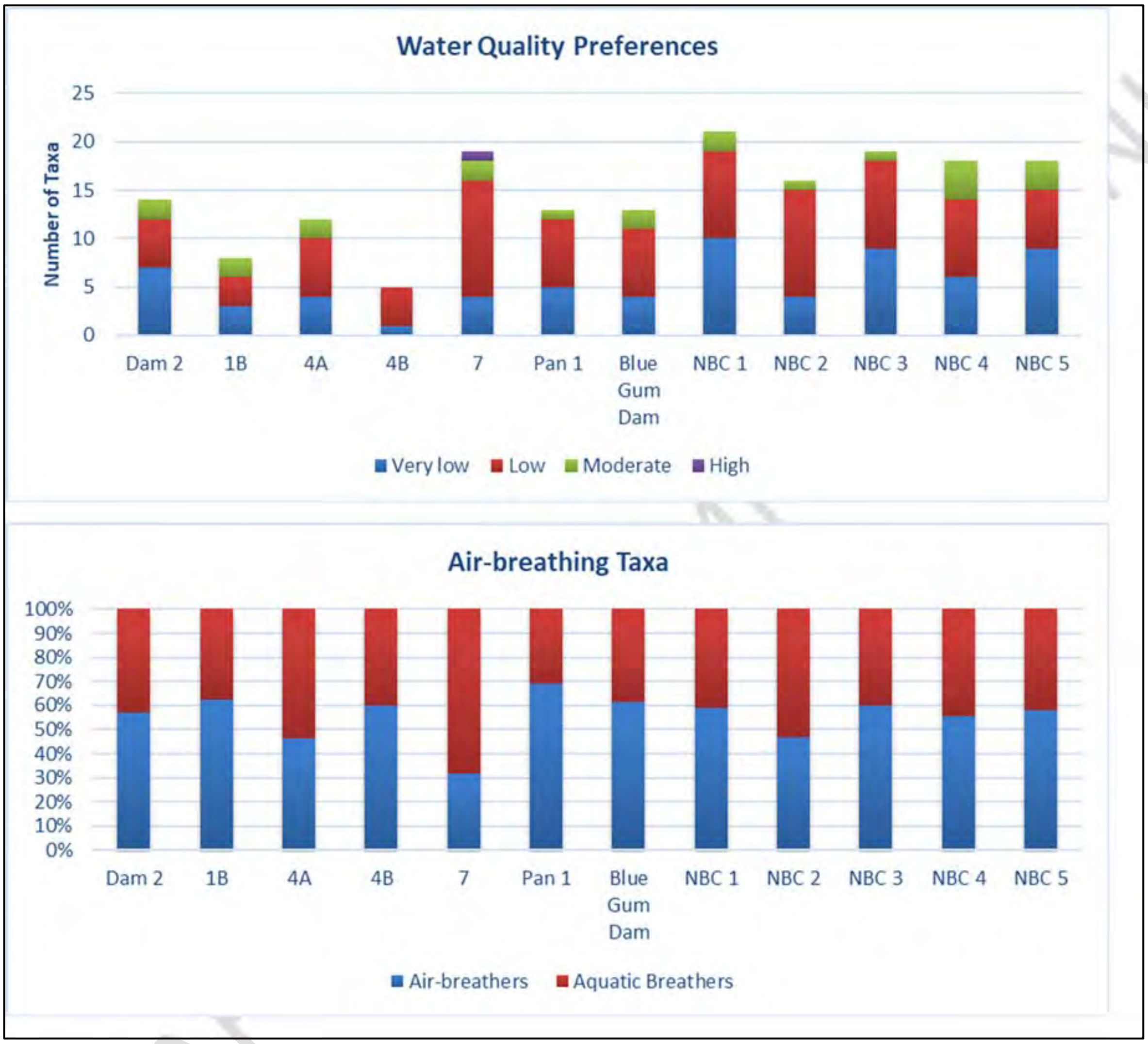

Figure 9.25: Aquatic Macroinvertebrate Assemblage Preference Profiles Based on Thirion (2008; revised 2016) for Taxa Collected during the February 2020 and April 2021 Aquatic assessments.

9.7.3.3.1 Present Ecological State

Due to the nature of the associated watercourses and the lack of suitable indices for the assessment of lentic ecosystems, no determination of the PES based on biotic assemblages could be conducted for sites within the impoundments, pans or unchanneled valley bottom systems present on the majority of the Integrated Paardeplaats Section. For this reason, the Macro-Invertebrate Response Assessment Index (MIRAI; Thirion, 2008) was only applied to site 7 on the Skilferlaagtespruit and to site NBC 2 within a channelled system to determine the PES according to the most acceptable method. Chutter (1998) developed the SASS protocol as an indicator of water quality. It has since become clear that SASS gives an indication of more than mere water quality, but rather a general indication of the present state of the invertebrate community. Because SASS was developed for application in the broad synoptic assessment required for the River Health Programme (RHP; now the River EcoStatus Monitoring Programme (REMP)), it does not have a particularly strong cause-effect basis. The aim of the MIRAI, on the other hand, is to provide a habitat-based cause-and-effect foundation to interpret the deviation of the aquatic invertebrate community (assemblage) from the reference condition (Thirion, 2008). This does not preclude the calculation of SASS scores should they be required. However, the use of the MIRAI is now the accepted approach for determining the PES of riverine watercourses and as such is used by the Department within the River EcoStatus Monitoring Programme (REMP; previously the River Health Programme purposes, or RHP).

The results of the MIRAI applied to data obtained in the February 2020 and April 2021 assessments (**Table 9.27**) indicate that the downstream resources associated with the Integrated Paardeplaats Section may be considered to be in a Moderately Modified (site 7 on the Skilferlaagtespruit) and Moderately to Largely Modified (site NBC 2) state. The Ecological Category obtained for site NBC 2 falls slightly below the RQO for a stream in the B41A catchment. The main driver of change was determined to be related to flow modification, likely related to upstream impoundments within the study area.

Table 9.27: PES of the Aquatic Macroinvertebrate Assemblages of Sites Assessed During the February 2020 and April 2021 Assessments.

	Site	RQO*	MIRAI Score	Ecological Category
Glisa Section biomonitoring site (Cleanstream, 2020)	7* (Skilferlaagtespruit)	C	76.45	C
Additional site assessed during April 2021	NBC 2	C	58.79	C/D

* Resource Quality Objective for RU54, quaternary catchment B41A (Department of Water and Sanitation, 2016a)

9.7.3.4 Ichthyofauna

According to Cleanstream (2020), an estimated eight fish species (**Table 9.28**) are expected to occur within the reaches currently included within the mine's active biomonitoring programme. Previous biomonitoring assessments conducted for the mine have confirmed the presence of three of the eight expected fish species at Site 7 within the Skilferlaagtespruit which drains both the Glisa and Paardeplaats Sections of the mine, including *Enteromius* sp. 'Lowveld-Incomati' (a member of the Chubbyhead Barb group; previously identified as *Enteromius anoplus*), *Enteromius* sp. *nov. 'South Africa'* (Sidespot Barb; previously identified as *Enteromius neefi)* and *Clarias gariepinus* (Sharptooth Catfish). Further, while *Enteromius* sp. 'Lowveld-Incomati' is routinely noted as being the dominant species present at biomonitoring Site 7, *Enteromius* sp. *nov. 'South Africa'* appears to co-exist with the species in all assessments conducted thus far. In contrast, *Clarias gariepinus* appears to be transient at the Site 7, with only one individual having been recorded at the site during the February 2018 assessment.

Table 9.28: Fish Species Expected and Confirmed to be Present Within the Skilferlaagtespruit (Cleanstream, 2020).

SCIENTIFIC NAME	COMMON NAME	CONSERVATION STATUS*	PRESENCE CONFIRMED
Amphilius uranoscopus	Stargazer (Mountain-Catfish)	LC	
Chiloglanis pretoriae	Shortspine Suckermouth	LC	
Clarias gariepinus	Sharptooth Catfish	LC	X
Enteromius sp. 'Lowveld-Incomati'	Chubbyhead Barb group	DD	X
Enteromius sp. nov. 'South Africa'	Sidespot Barb	NT	X
Labeobarbus polylepis	Bushveld Smallscale Yellowfish	LC	
Pseudocrenilabrus philander	Southern mouthbrooder	LC	
Tilapia sparrmanii	Banded Tilapia	LC	

* DD = Data Deficient; LC = Least Concern; NT = Near Threatened

It should be noted that recent taxonomic studies on species previously identified within the larger area has resulted in changes to the scientific names of some species expected to be present. These include the following:

- *Enteromius sp.* 'Lowveld-Incomati' (member of the Chubbyhead Barb complex; currently regarded as Data Deficient). It is recognised that many records currently ascribed to *E. motebensis* and *E. anoplus* in the eastern Lowveld may be synonymous with a new species *Enteromius sp. nov. "Ohrigstad"* proposed by Engelbrecht & Van Der Bank (1996), which was assessed previously as taxonomically Data Deficient by Darwall et al. (2009). Further genetic studies done on the Chubbyhead Barb complex by Da Costa (2012) suggested further separation of the complex into distinct lineages, with the species collected within the present study area corresponding with Lineage E, which included almost all specimens from the Incomati River system (except some morphologically distinct specimens included into clades A and D, respectively) and specimens from Limpopo River system. This lineage was further subdivided into three minor groups: 1) sub-group 1 with unique haplotype from the Olifants River (Limpopo system); 2) sub-group 2 with seven populations from five rivers of the Crocodile River (Incomati system); and 3) sub-group 3 with mixing populations from Limpopo and Incomati systems (Da Costa, 2012). Based on the spatial distribution of sample records from Da Costa (2012), the species collected during the routine biomonitoring assessments conducted for the mine appear to most likely correspond with sub-group 3 of Lineage E as assessed by Da Costa (2012). Further still, preliminary genetic analyses of the *Enteromius* group conducted at a finer scale by Mpumalanga Tourism and Parks Agency within the Klein Dwars, Groot Dwars, Spekboom and Ohrigstad catchments (unpublished data) suggests even further genetic differentiation within the group and suggested the high likelihood of several undescribed species belonging to the species complex to be present within the upper catchments of the larger Steelpoort River catchment. Although the conservation status of the species complex itself has been determined to be of Least Concern, very recent studies have described several new species from the complex, while more new species descriptions expected. It is therefore clear that further studies are required to understand the geographic ranges and thus conservation status of the unique populations of this *Enteromius* group to determine the significance of those specimens present within the Skilferlaagtespruit at biomonitoring Site 7 where the species is determined to be dominant, and the conservation status for the lineage present within the Skilferlaagtespruit as such is considered Data Deficient;

- *Enteromius sp. nov. 'South Africa'* (Sidespot Barb; currently regarded as Near Threatened). Similar to *Enteromius neefi* Greenwood, 1962 which was described from the Kabompo River in northern Zambia, and identified as *Enteromius sp. 'neefi cf. South Africa'* in Darwall et al. (2009). Populations of the southern *Enteromius cf. neefi* occur in headwater streams of the Limpopo system south to the Phongolo River and south-west into the Vaal River in South Africa and Swaziland. The taxonomic status of the southern *Enteromius cf. neefi* still needs to be determined, but it is likely they are an undescribed species. The recent Red List assessment was based only in the southern *Enteromius cf. neefi* and was referred to as *Enteromius sp. nov. 'South Africa'* (Roux & Hoffman, 2017). Although the geographical distribution is fairly widespread within the Limpopo System in South Africa, many subpopulations are isolated and are severely impacted on by threats. In Swaziland, only a single record was found in over 200 collection sites and it was assessed as regionally Critically Endangered in Swaziland (Bills et al., 2004). The species is experiencing continuous threats such as forestry and associated sedimentation and river crossings preventing fish movement as well as stream regulation and mining with associated pollution. Although it is known from a large number of locations and is still widespread, the impacts of the multiple threats for the species could lead to its decline and it is thus assessed as Near Threatened within the latest IUCN Red List Assessment, although is it acknowledged that this species should be monitored to assess the impacts of these threats (Roux & Hoffman, 2017).

Underestimation of species diversity has been identified as a major impediment to implementation of effective conservation strategies to prevent biodiversity loss (see Bickford et al., 2007). For example, recent studies conducted by Chakona et al. (2015) between geographically isolated populations of the Goldie Barb (*Enteromius pallidus*) added to a growing body of evidence that freshwater fish diversity in southern Africa has been underestimated, and that major taxonomic revision is required in order to properly inform on their conservation status and actions required to ensure long-term diversity.

9.7.3.4.1 Present Ecological State

According to Cleanstream (2020), the ecological state of the Skilferlaagtespruit downstream of the study area may be considered moderately modified (Ecological Category C). This is, however, based on the assumption that although not sampled, all eight expected fish species are still present in this section of the Skilferlaagtespruit, albeit in reduced frequency of occurrence. However, the confidence of the ecological state score will increase as more surveys are conducted to verify the presence/absence of fish species within this river reach.

The primary impacts responsible for deterioration in the fish assemblage are expected to be related to reduced flows (flow modification by dams in catchment), sedimentation of bottom substrates (increased erosion primarily associated with agricultural activities) and the potential presence of alien fish species.

9.7.3.4.2 Non-native Species

For the purpose of the present study, alien species are defined as those that have been introduced from outside the political boundaries of South Africa, whereas extralimital species are species native to South Africa that have been translocated into areas where they do not naturally occur. Within the context of the present study, non-native species are therefore collectively taken to include both alien and extralimital species.

According to a local landowner, at least two dams within the north-eastern extent of the study area corresponding to sites NBC 3 and NBC 5, have been stocked with *Oncorhynchus mykiss* (Rainbow Trout). With its native distribution range being the western seaboard of the United States of America, Canada and north-western Mexico, eggs of this species were first successfully imported into South Africa in 1897. Fish hatched were used as breeding stock, and consignments of ova being sent to various parts of southern Africa from 1899 onwards and establishing within the Lydenberg district as early as the mid-1920s (De Moor & Bruton, 1988). According to the unified framework proposed by Blackburn et al. (2011), *O. mykiss* can be classified as a fully invasive species, with individuals dispersing, surviving and reproducing at multiple sites across a greater or lesser spectrum of habitats and extent of occurrence (Ellender & Weyl, 2014)

9.7.3.5 Diatom Assemblages

Given the nature of the watercourses associated with the NBC Consolidation project and the need to provide a biological basis for monitoring potential impacts associated with the current and proposed activities, the assessment of the diatom assemblage present at all biomonitoring sites was deemed a suitable tool. **Table 9.29** provides a summary of the results obtained following a detailed assessment of the diatom assemblages at selected sites during the February 2020 biomonitoring assessment and the April 2021 assessment.

Table 9.29: Diatom Results Obtained for Sites Assessed During the February 2020 and April 2021 Assessments.

SITE	NO SPECIES	SPI SCORE*	WATER QUALITY CLASS	CATEGORY	POLLUTION TOLERANT VALUES (%)	VALVE DEFORMITIES (%)**
GLISA SECTION BIOMONITORING SITES (CLEANSTREAM, 2020)						
2 (US Dam)	16	19.4	High quality	A	6	0
Pan 1	28	14.2	Good quality	B/C	32	0
4B (DS)	31	13.1	Moderate quality	C	44	0
ADDITIONAL SITES ASSESSED DURING APRIL 2021						
NBC 1	20	18.2	High quality	A	6.5	0.5
NBC 2	38	16.1	Good quality	B	11	0
NBC 3	36	13.7	Moderate quality	C	37.5	0
NBC 4	13	18.6	High quality	A	6	0
NBC 5	29	13.4	Moderate quality	C	39.5	0.5
NBC 6	29	17.2	Moderate quality	A/B	10	0
NBC 8	18	16.8	Good quality	B	10.5	0
NBC 9	29	17.9	High quality	A/B	4	0

*SPI tends to be more sensitive to organic pollution, as opposed to salts and metals more often associated with mining activities.

**Valve deformities generally indicate the presence of metals which may cause toxicity.

9.7.3.5.1 2 (US Dam)

The diatom-based water quality of DAM 2 in February 2020 was *High* with an SPI score of 19.4 (Ecological Category A). Pollution Tolerant Valves (PTVs) made up 6% of the total count in February 2020, which suggested that organic pollution levels were very low. Nutrient levels and salinity concentrations were elevated. Species diversity was moderate and the diatom community was dominated by *Achnanthidium minutissimum,* suggesting that fresh inundation recently occurred and that oxygenation rates were high and biological water quality was high. The sub-dominance of *Encyonopsis subminuta* and *Synedra rumpens* further reflect the high biological water quality at the time of sampling. *Brachysira neoexilis* was also dominant and while found in clean, oligo- to mesotrophic waters, is tolerant to mining effluents, especially effluents containing uranium (Cattaneo et al. 2004; Herlory, 2013). This could be an indication of possible mining impact; however, additional monitoring data would be needed to substantiate this, as other key indicator species associated with mining impact occurred at very low abundance. No valve deformities were noted suggesting that toxicity levels were below detection limits at the time of sampling or bio-availability was limited.

9.7.3.5.2 Pan 1

Within Pan 1, the biological water quality of the pan is characterised as *Good* and the driving metric associated with biological water quality change is organic pollution. However, according to Cleanstream (2020), there has been a steady but slight deterioration in biological water quality between 2017 and 2020 due to increasing organic pollution. This may be associated with the adjacent settlement. An increase in the abundance of indicator species associated with industrial activity has also been observed in 2019 and 2020, suggesting increased impacts due to mining over the past two years. The 2020 diatom results indicated that in the wet season, the impact of the mine is exacerbated when good rain periods occur, and runoff is increased. Valve deformities have been present at various times throughout monitoring, but within general threshold limits, suggesting that the bio-availability of metals is limited or absent.

9.7.3.5.3 Site 4B (DS)

The biological water quality of Site 4B is characterised as *Moderate* but is variable, with conditions deteriorating in the wet season. The driving metrics associated with biological water quality change is organic pollution and nutrient levels. According to Cleanstream (2020) inundation in 2020 resulted in increased organic pollution, salinity concentrations and nutrient levels suggesting that increased runoff contributed to deteriorated biological water quality. No valve deformities were noted throughout monitoring, suggesting that the bio-availability of metals is absent. Key indicator species associated with industrial effluent, occurring at higher abundance in February 2020 compared to September 2019 included *Navicula veneta* and *Brachysira neoexilis*, suggesting that increased runoff contributed to deteriorated biological water quality. No valve deformities were noted suggesting that metal toxicity levels were below detection limits at the time of sampling or bio-availability was limited.

9.7.3.5.4 NBC 1

Site NBC 1 obtained a Specific Pollution sensitivity Index (SPI) score of 18.2, reflecting *High* biological water quality (Ecological Category A). Nutrient levels and salinity concentrations were regarded as moderate based on the diatom assemblage collected, while organic pollution levels were considered low. Valve deformities occurred at an abundance of 0.5% and within general threshold limits, suggesting that metal toxicity was below detection limits, with limited bio-availability. Further analysis of the various indices within OMNIDIA suggested pollution levels were moderate at the time of sampling. The diatom community consisted mainly of species from the genus *Achnanthidium*, associated with elevated flow and high oxygenation rates. Other dominant and sub-dominant species generally had a preference for acidic, oligotrophic waters and included *Fragilaria crotonensis, Brachysira neoexilis* and *Nitzschia acidoclinata*. Diatom data indicates that anthropogenic related impacts are minimal.

9.7.3.5.5 NBC 2

Site NBC 2 obtained a SPI score of 16.1, reflecting *Good* biological water quality (Ecological Category B). Nutrient levels and salinity concentrations were regarded as moderate based on the diatom assemblage collected, while organic pollution levels were considered low. No valve deformities were noted within the diatom assemblage collected at Site NBC 2 during April 2021, suggesting that metal toxicity was below detection limits, with limited bio-availability. Further analysis of the various indices within OMNIDIA suggested pollution levels were moderate at the time of sampling.

The diatom community generally had a preference for *Good* to *High* biological water quality and consisted mainly of species from the genus *Achnanthidium*, which has a preference for high oxygenation rates and recent elevated flow. *Eunotia* species with a preference for acidic conditions and very sensitive to deteriorated water quality was also dominant and included *Eunotia minor* and *Eunotia paludosa*. Recently elevated flow resulted in an influx of nutrient and organic loading as reflected by the dominance of *Gomphonema parvulum*. Diatom data indicates that anthropogenic related impacts are minimal.

9.7.3.5.6 NBC 3

Site NBC 3 obtained a SPI score of 13.7, reflecting *Moderate* biological water quality (Ecological Category C). Nutrient levels, organic pollution and salinity concentrations were regarded as moderate based on the diatom assemblage collected. No valve deformities were noted within the diatom assemblage collected at Site NBC 3 during April 2021, suggesting that metal toxicity was below detection limits, with limited bio-availability. Further analysis of the various indices within OMNIDIA suggested pollution levels were moderate at the time of sampling. Species from the genus *Achnanthidium* were dominant reflecting high oxygenation rates and recent inundation. While sensitive species were present, their abundance was generally low while species with a preference for *Moderate* water quality was prolific at all abundance levels. Runoff entering the dam may contain higher nutrient and organic loads resulting in some deterioration of the overall biological water quality of the dam. Key indicator species for anthropogenic impact occurred at low abundance suggesting that while some impact is evident, it is not considered a concern.

9.7.3.5.7 NBC 4

Site NBC 4 obtained a SPI score of 18.6, reflecting *High* biological water quality (Ecological Category A; Table 12). Based on the diatom assemblage collected, nutrient levels and organic pollution levels were considered low while salinity concentrations were regarded as moderate. No valve deformities were noted within the diatom assemblage collected at NBC 4 during April 2021, suggesting that metal toxicity was below detection limits, with limited bio-availability. Further analysis of the various indices within OMNIDIA suggested pollution levels were slight at the time of sampling. Dominant species had a preference for acidic, electrolyte poor, oligotrophic water and included *Brachysira neoexilis* and *Eunotia naegeli* which dominated the community by 86%. Diatom data indicates that anthropogenic related impacts are minimal.

9.7.3.5.8 NBC 5

Site NBC 5 obtained a SPI score of 13.4, reflecting *Moderate* biological water quality (Ecological Category C). Nutrient levels, organic pollution and salinity concentrations were regarded as moderate based on the diatom assemblage collected. Valve deformities occurred at an abundance of 0.5% and within general threshold limits, suggesting that metal toxicity was below detection limits, with limited bio-availability. Further analysis of the various indices within OMNIDIA suggested pollution levels were moderate at the time of sampling. Species associated with elevated flow dominated the diatom community and included *Achnanthidium minutissimum* and *Synedra rumpens*. This suggested that the dam was recently inundated by water containing elevated nutrient and organic loads. *Synedra rumpens* are well adapted to high sedimentation rates (Van de Vijver *et al.,* 2002) influenced by water temperature and water level fluctuations (Kelly *et al.,* 2005). While sensitive species were present, their abundance was generally low while species with a preference for *Moderate* water quality was prolific at all abundance levels. Key indicator species for anthropogenic impact occurred at low abundance suggesting that while some impact is evident, it is not considered a concern.

9.7.3.5.9 NBC 6

Site NBC 6 obtained a SPI score of 17.2, reflecting *High* biological water quality (Ecological Category A/B). In addition, salinity concentrations and organic pollution levels were regarded as low, while nutrient levels were considered very low. Analysis of the various indices within OMNIDIA suggested pollution levels were slight. No valve deformities were noted within the diatom assemblage collected at Site D6 during April 2021, suggesting that metal toxicity was below detection limits, with limited bio-availability. The diatom community consisted mainly of species that generally have a preference for oligotrophic, acidic conditions. The dominant *Eunotia* and *Frustulia* species are very sensitive to deteriorated water quality. Diatom data indicates that anthropogenic related impacts are minimal.

9.7.3.5.10 NBC 8

Site NBC 8 obtained a SPI score of 16.8, reflecting *Good* biological water quality (Ecological Category B). Salinity concentrations were regarded as moderate based on the diatom assemblage collected, while nutrient levels and organic pollution levels were considered low. No valve deformities were noted within the diatom assemblage collected at Site NBC 8 during April 2021, suggesting that metal toxicity was below detection limits, with limited bio-availability. Further analysis of the various indices within OMNIDIA suggested pollution levels were slight at the time of sampling. Dominant species had a preference for acidic, electrolyte poor, oligotrophic water and included *Brachysira neoexilis* and a variety of *Eunotia* species. Diatom data indicates that anthropogenic related impacts are minimal.

9.7.3.5.11 NBC 9

Site NBC 9 obtained a SPI score of 17.9, reflecting *High* biological water quality (Ecological Category A/B). In addition, salinity concentrations nutrient levels and organic pollution levels were regarded as low. Analysis of the various indices within OMNIDIA suggested pollution levels were slight. No valve deformities were noted within the diatom assemblage collected at NBC 9 during April 2021, suggesting that metal toxicity was below detection limits, with limited bio-availability. The diatom community consisted mainly of species that generally have a preference for oligotrophic, acidic conditions and very sensitive to deteriorated water quality that included a variety of *Eunotia* species, *Gomphonema parvulum* var. *parvulius* and *Fragilaria crotonensis*. The dominant *Eunotia* and *Frustulia* species are very sensitive to deteriorated water quality. Diatom data indicates that anthropogenic related impacts are minimal.

Summary

Assessment of the diatom assemblage determined that the biological water quality at the majority of the sites were *Good* to *High* with sensitive species dominating. Site NBC 3, NBC 5 and 4B were the only sites with *Moderate* biological water quality. The diatom data suggested that runoff entering these dams may contain higher nutrient and organic loads resulting in some deterioration of the overall biological water quality.

Diatom assemblage data for the Paardeplaats Section (Glisa Section data unavailable) was further subjected to hierarchical cluster analysis and non-metric Multi-Dimensional Scaling (MDS), the results for which are presented as **Figure 9.26** and **Figure 9.27**.

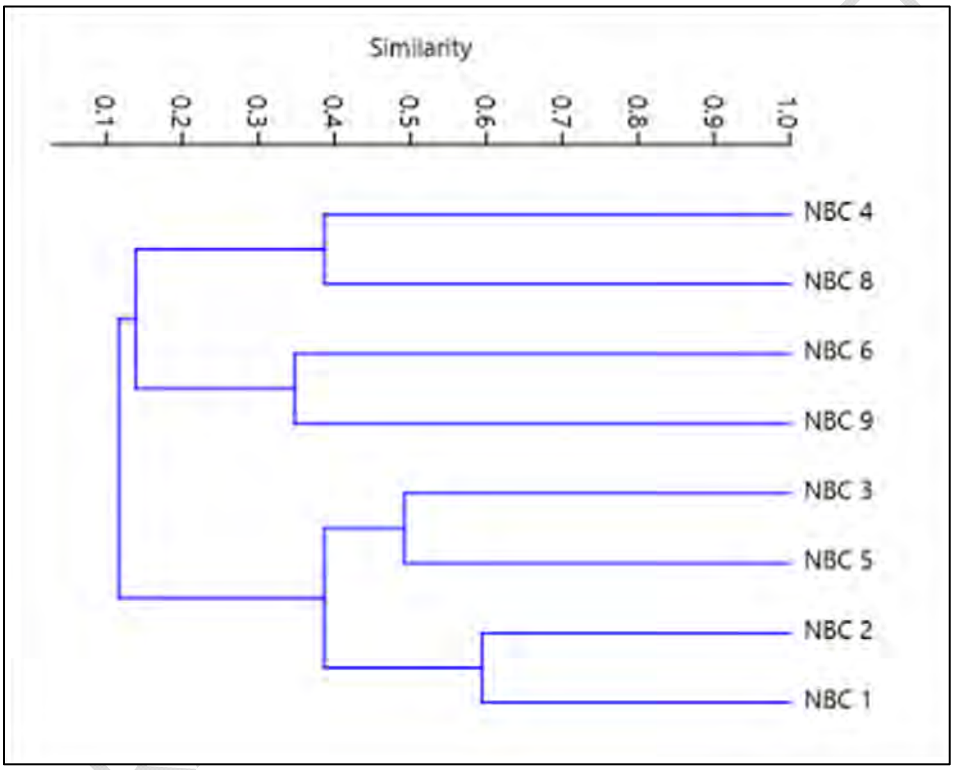

Figure 9.26: Bray-Curtis Similarity Ranked Cluster Analysis Based on Diatom Assemblages Collected During April 2021.

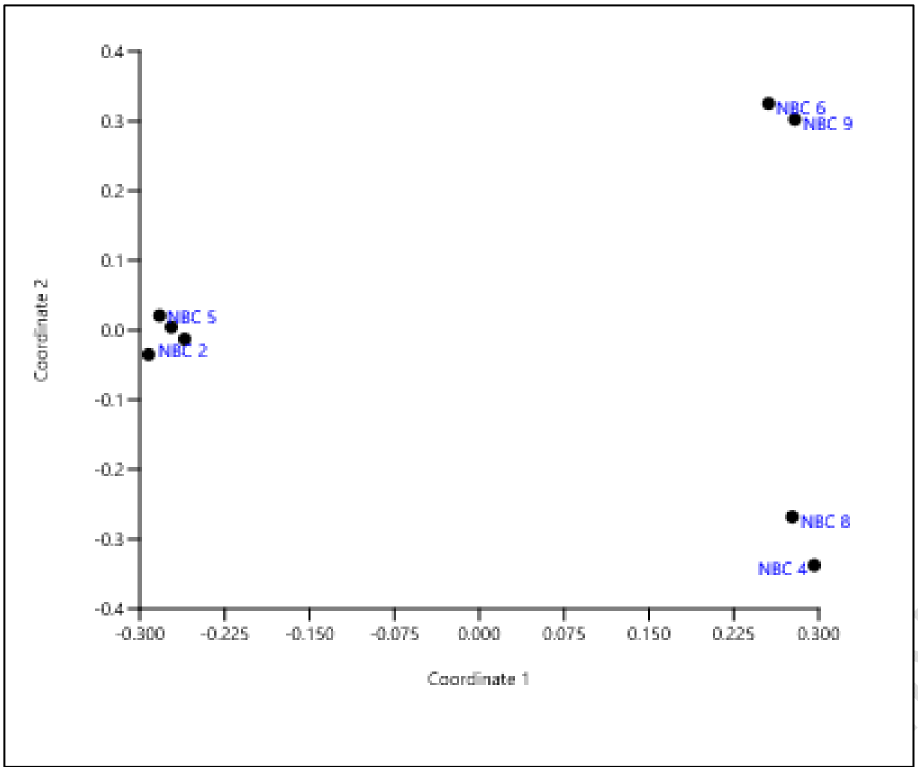

Figure 9.27: Non-metric Multi-dimensional Scaling (MDS) Ordination of Diatom Assemblages Based on the Bray-Curtis Similarity Matrix.

The cluster analysis revealed different levels of similarity and groupings between sites which were confirmed in the MDS ordination. Broad groupings of the diatom assemblages associated with the more natural wetland systems as opposed to those systems that were heavily impounded were observed as well as similarities of species occurring along the same linear system such as with NBC 3 and NBC 5, and NBC 1 and NBC 2. NBC 6 (situated in a natural depression) and NBC 9 (situated on an unchanneled valley bottom) were regarded as indicative of the diatom assemblages to be expected in the natural and relatively unimpacted HGM units throughout the site.

9.7.3.6 Aquatic Toxicity

The addition of toxicity tests to evaluate water quality for water bodies affected by effluent discharge is helpful in adding causal information to water quality assessments, as standard rapid bioassessment methods represent a summation parameter that integrates several overlapping effects on fauna such as saproby, toxins, habitat degradation and physical disturbances.

According to Cleanstream (2020), water for toxicological testing at the Glisa Section of the NBC was limited to selected pollution control dams (PCDs) (i.e., the Gijima and Blue Gum Dams) to evaluate the toxicity of the mine water present. This was done by means of a screening-level toxicity assessment utilising four levels of biological hierarchy. The results of the February 2020 assessment at sites applicable to the present study area are presented in **Table 9.30**.

Table 9.30: Toxicity results and Hazard Classifications Obtained during the 2020 Biomonitoring Survey (Cleanstream, 2020).

SITE	*Allivibrio fischeri* bioluminescent test 30 min	*Selenastrum capricornutum* test 72 hours	*Daphnia magna* acute toxicity test 48 hours	*Poecilia reticulata* acute toxicity test 96 hours	HAZARD CLASSIFICATION
Gijima	51% stimulation	10	10	0	Class I – No acute hazard
Blue Gum Dam	44% stimulation	9	0	0	Class I – No acute hazard

The screening results indicated a low level of toxicological risk to the aquatic macroinvertebrate assemblages at the Blue Gum Dam. Despite the low levels of toxicity observed, it is important to note that bacterial stimulation under natural circumstances, while not regarded as a significant toxicological threat to the receiving environment, does highlight potential impact in both PCDs. The results indicate some level of impact on the lower trophic levels, correlating with the water quality data which indicates somewhat impaired water quality in the mine PCDs (**Section 9.7.3.1**).

9.8 Surface Water

The Integrated Paardeplaats Section is located in a hilly area at an altitude of approximately 1,855 - 1,920 mamsl. The site area is in the upper catchment region of the Steelpoort River, Grootspruit and Langspruit, and the main water course flowing through the mine area is the Mahim stream (**Figure 9.28**). The topography of the Paardeplaats Section slopes in a northerly direction towards a non-perennial tributary of the Grootspruit flowing from south to north approximately 13 km west of the site. The Glisa Section slopes in a westerly direction towards the Grootspruit.

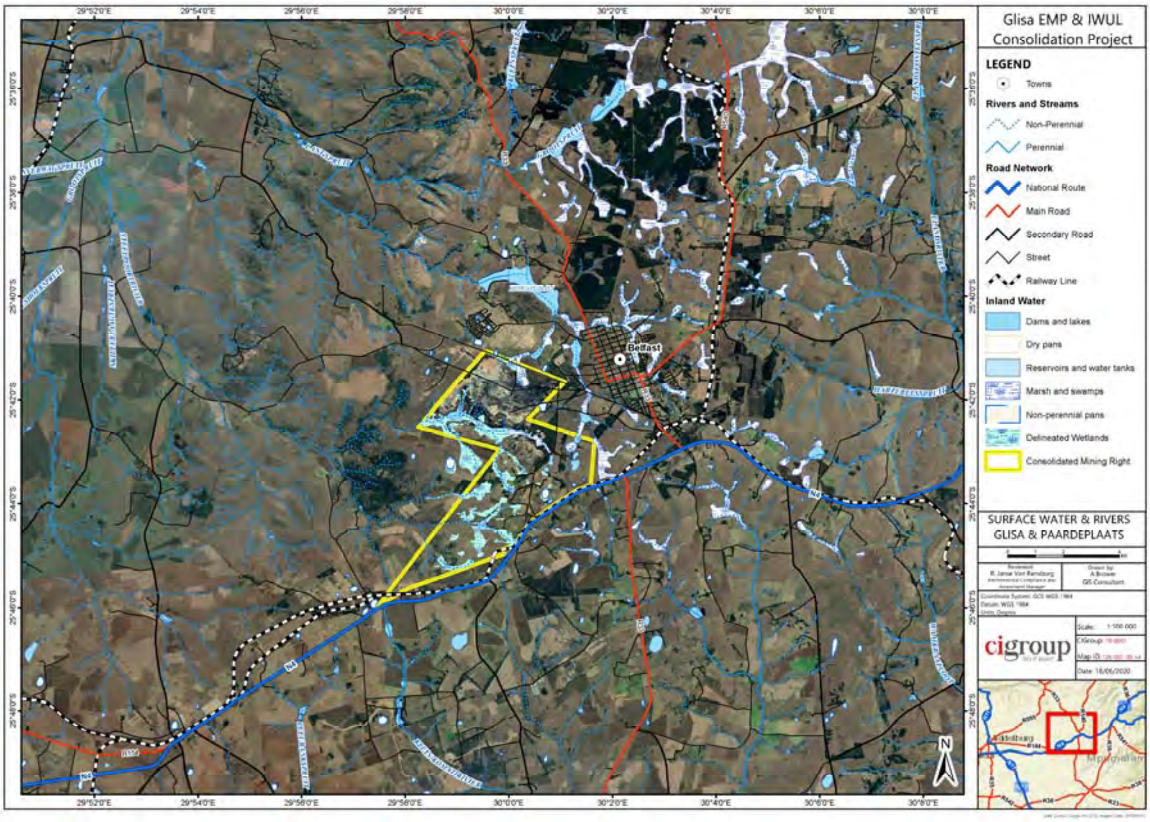

Figure 9.28: Surface Water of the Integrated Paardeplaats Section.

9.8.1 Water Management Area

The Integrated Paardeplaats Section is located in quaternary catchment B41A which forms part of the Olifants River Catchment, within the Olifants Water Management Area (WMA) (). The Olifants River originates near Bethal in the Highveld of Mpumalanga, initially flowing northwards before curving eastwards and reaching Mozambique via the Kruger National Park. In Mozambique, the Olifants River joins the Limpopo River before discharging into the Indian Ocean. The Olifants WMA falls within portions of the Gauteng, Mpumalanga, and Limpopo. Provinces. The main tributaries of this WMA are the Wilge, Elands and Ga-Selati Rivers on the left bank, and the Steelpoort, Blyde and Klaserie Rivers on the right bank.

From a water management perspective in the Olifants WMA, the following institutions are important:

- The bilateral Joint Water Commission between South Africa and Mozambique;
- Limpopo Water Course Commission with membership by South Africa, Botswana, Zimbabwe, and Mozambique;
- Irrigation boards, which are being transformed into Water User Associations;
- Lepelle and Ekangala Water Boards;
- District and local municipalities;

- The Olifants River Forum;
- Olifants reference group established as part of a public participation process to establish the Catchment Management Agency (CMA); and
- The Interim Catchment Management Committees set up during the CMA process.

9.8.2 Surface Water Hydrology

The main water resources near the site are the Grootspruit and Steelpoort rivers and a few non-perennial streams. The Mahim Dam is situated in the south western corner of the site and retains most of the surface water that drains the area. A main water divide separates the direction of drainage on site in two main directions, namely:

- to the North East towards the Blue Gum Dam; and
- to the South West towards Mahim Dam.

The 1:50 and the 1:100 year flood events for the Mahim stream, which drains towards the Mahim Dam, were modelled by GCS (2011b) and are presented in **Figure 9.29**. A 100 m buffer zone has been applied to each river section within the Glisa Section.

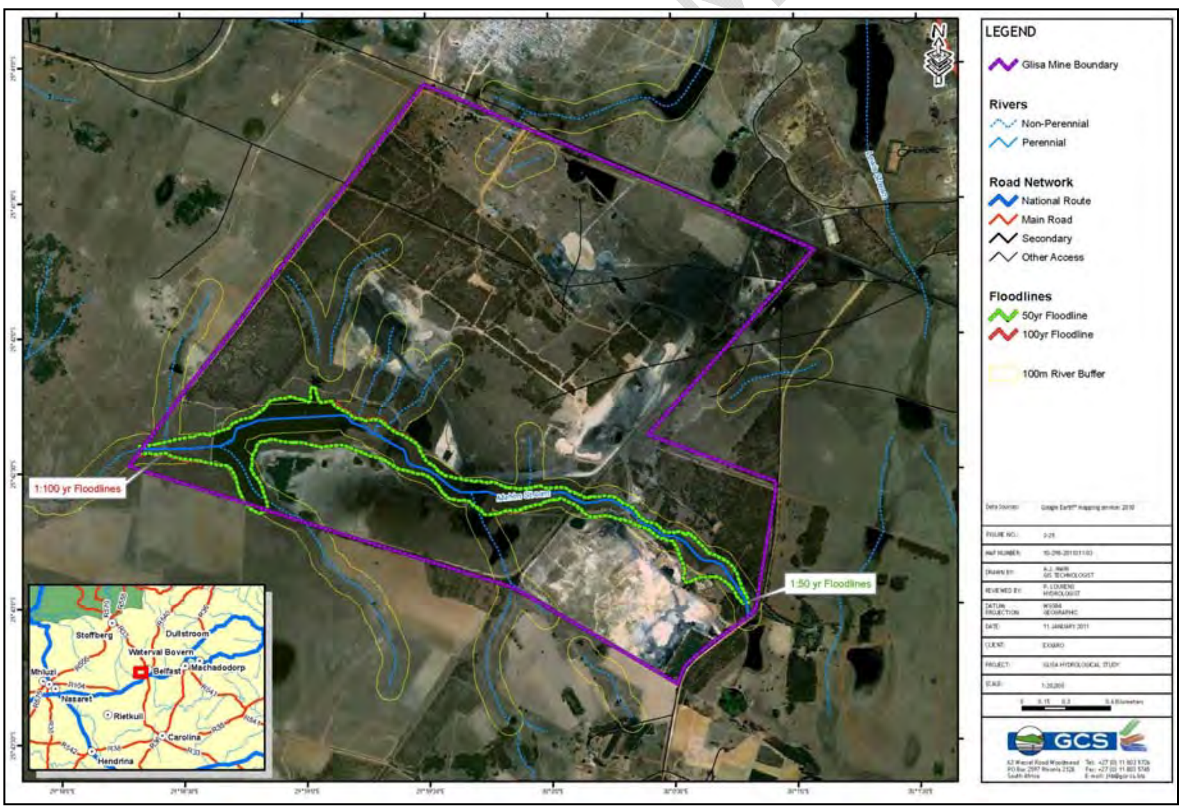

Figure 9.29: Floodline Delineation of the Mahim Stream (GCS, 2011b).

9.8.3 Surface Water User Survey

A surface water user survey was undertaken using data from the DHSWS Water Authorisation and Registration Management System (WARMS). The surface water user's survey focussed on the B41A quaternary catchment, and the following water user sectors were identified:

- Agriculture: Irrigation;
- Agriculture: Watering Livestock;
- Mining; and
- Water Supply Services.

The total number of registered surface water users in quaternary catchment B41A, consisting of companies and individuals, is 51. Many of the users' abstract water from boreholes, whilst others abstract water from dams (Dullstroom Town Dam, Hadeco Dam, Kraaispruit Dam, and Leeuklip Dam) and streams/rivers (Dorpspruit, Langespruit, Langloopspruit, Kleinspruit, Olifant River, Selons River, Steelpoort River, Steelpoortspruit, and Sterkspruit). According to the WARMS database, the annual water volumes abstracted by users vary considerably and range from 12 – 2,682,500 m^3/a. The identified water user locations are presented in relation to the NBC Glisa and Paardeplaats Sections in **Figure 9.30**.

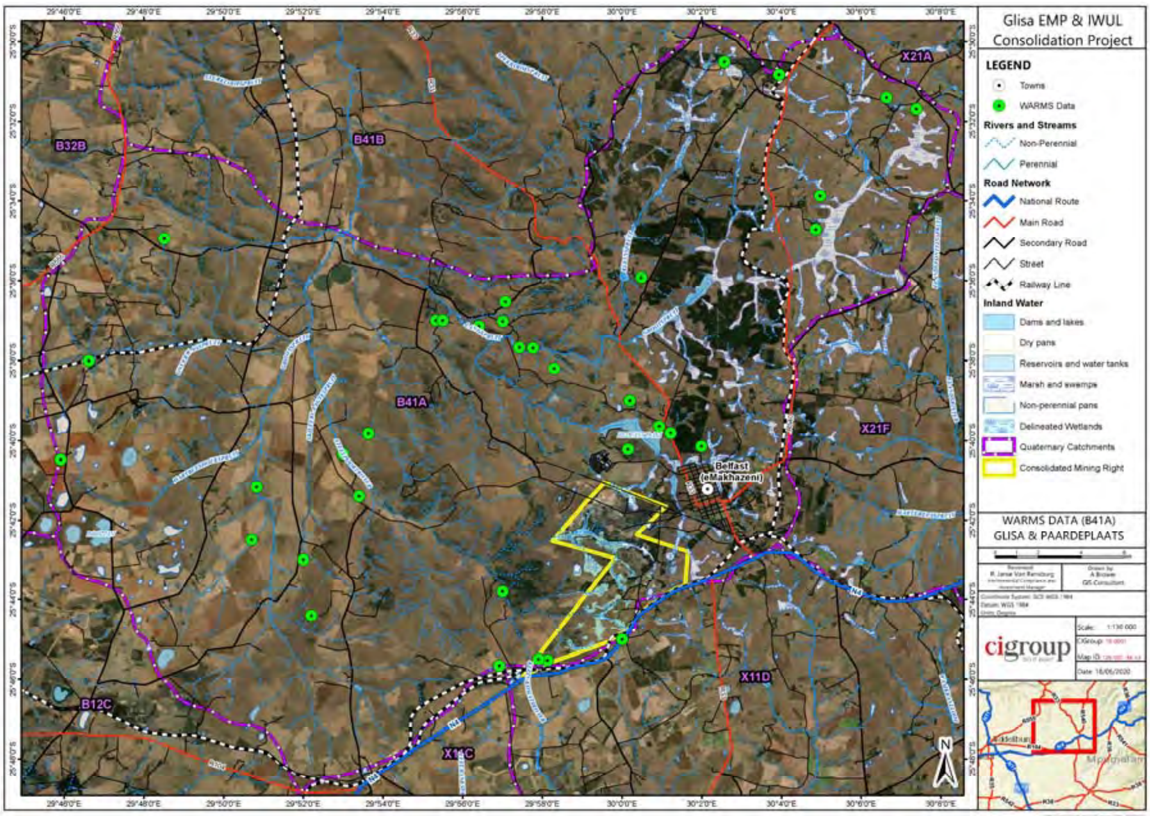

Figure 9.30: Distribution of Registered Water Users in relation to the Integrated Paardeplaats Section.

9.9 Mean Annual Runoff

The Integrated Paardeplaats Section falls within quaternary catchment B41A. Expected naturalised runoff data for quaternary catchment B41A was extracted from the WR2012 database (Bailey & Pitman, 2015) for years 1920 - 2010 and is 55.88 millimetres per year (mm/yr). Furthermore, data from relevant hydrogeological databases including, the Groundwater Resource Directed Measures (GRDM), was obtained from the DHSWS and are presented in **Table 9.31**. The calculated Mean Annual Runoff (MAR) from the tributaries surrounding the Sections contribute 7.8% of the MAP received (**Figure 9.31**).

Table 9.31: Summarised B41A Quaternary Catchment Information (GRDM, 2012)

QUATERNARY CATCHMENT	TOTAL AREA (km²)	RECHARGE (mm/yr)	CURRENT USE (l/s)	RAINFALL (mm/yr)	BASEFLOW (mm/yr)
B41A	764.5	64.7	0.4	714.5	5.99

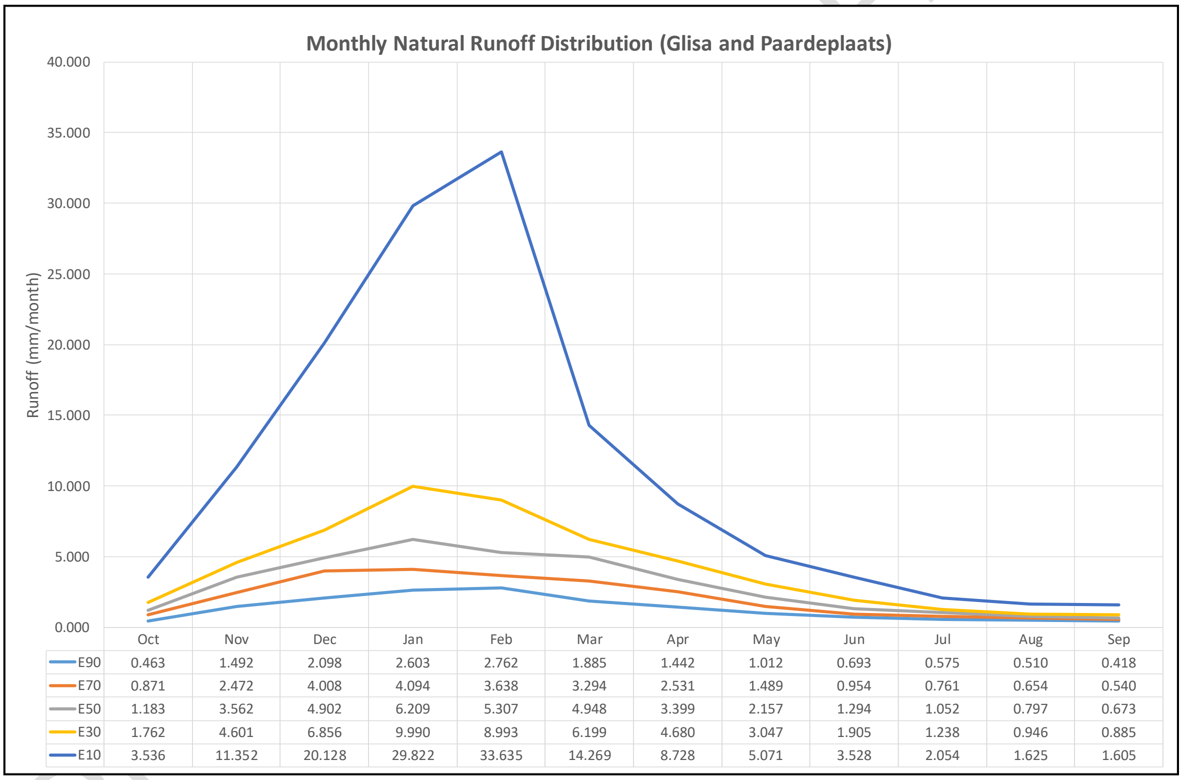

Figure 9.31: B41A Quaternary Seasonal Distribution of the Mean Monthly Runoff.

Runoff calculations are required to determine runoff from the opencast pits, RoM Pads, stockpiles and the CSWP at Integrated Paardeplaats Section. Runoff factors in the Section and at the CSWP together with recharge onto backfilled (rehabilitated) opencast pit areas were estimated based on factors and values given by Hodgson and Kranz (1998) and previous studies (Exxaro, 2017) and are presented in **Table 9.32**.

Table 9.32: Estimated Runoff and Recharge Factors for the Integrated Paardeplaats Section.

ASSUMED RUNOFF COEFFICIENTS	PERCENTAGE (%) OF MAP
Runoff ROM Pad/Plant Area	20
Recharge Rehabbed Spoils	5 to 15 (10)
Recharge Spoils (Unrehabilitated)	22
Runoff Pit Workings	40
Mahim Runoff Seepage	12
Runoff Spoils	5

9.10 Groundwater

According to the 1:500 000 Hydrogeological map series 2530 Nelspruit (Du Toit et al., 1999) the Integrated Paardeplaats Section is underlain by an intergranular and fractured type of aquifer with an average borehole yield ranging between 0.1 and 0.5 litres per second (l/s).

9.10.1 Aquifer Characterisation

The Integrated Paardeplaats Section is characterised by secondary aquifers with groundwater usually located in fractures, joints, bedding planes and within the weathered zone formed in the Ecca Group. Little to no flow occurs in the rock matrix of the Ecca Group. No evidence was found of structural controls (preferential pathways) on groundwater flow. Based on the underground mining plans it was concluded that dykes are not present at the depth of mining (GCS, 2011a).

A total of seven (7) boreholes (GB1, GB1R, GB2 – GB7) were drilled by GCS (Pty) Ltd (GCS) in October 2010 (GCS, 2011a), with borehole depths ranging between 19 - 49 meters (m). Major water strikes were encountered between 14 – 33 m. Based on the findings of the drilling programme, it was found that groundwater flow in the aquifer occur within fault zones (GB3) and at the bedding plane fractures of the coal seam roofs and floors (GB5 and GB6), while flow in the lesser aquifer will occur at the bedding plane fracture of the contact between the weathered sandstone and carbonaceous shale (GB2)/fresh rock contact (GCS, 2011a). Hodgson & Krantz (1998) list the annual recharge figure for the aquifer system as between 1 - 3% of the MAP.

The groundwater study undertaken for Portion 24 of the Glisa Section (GCS, 2002) yielded relatively low transmissivities ranging between 0.29 - 0.5 square metres per day (m^2/d). A hydraulic conductivity for the aquifer was given as 0.007 metres per day (m/d). Backfill material in rehabilitated pits has a higher transmissivity and porosity than the host rock. Reported aquifer storativity values range between 0.223 - 0.225 characteristic for backfilled material.

Constant rate aquifer testing was conducted on GB2, GB3, GB5, GB6 and the WATER_BOREHOLE in October 2010. The aquifer test data was interpreted using the Cooper-Jacob (1946) and Theis methods, and the results from these tests show transmissivity values ranging between 0.22 - 23.1 m^2/d. (GCS, 2011a). Boreholes GB2, GB6 and WATER_BOREHOLE intersected minor water bearing features while boreholes GB3 and GB5 represented the main water bearing fractures in the aquifer and transmissivity values for GB3 (4.7 m^2/d) and GB5 (23.89 m^2/d) are an order of magnitude higher than for other boreholes.

The aquifer vulnerability and classification maps of South Africa classify the underlying aquifer as a minor aquifer which is moderately vulnerable. A minor aquifer can be fractured or potentially fractured rocks that do not have a high primary hydraulic conductivity, or other formations of variable hydraulic conductivity. Aquifer extent may be limited and water quality variable. Although these aquifers seldom produce large quantities of water, they are important for both local supplies and in supplying base flow for rivers (Parsons and Conrad, 1998)

9.10.2 Hydrocensus

Milnex conducted a hydrocensus between 13 - 16 August 2019. Fourteen (14) boreholes were identified on portions 1, 2, 5 and 24 of Paardeplaats 380 JT known as the Glisa Section (**Table 9.33**). One (1) borehole, BH1A was located on portion 30 of Paardeplaats 380 JT, the Paardeplaats Section. Borehole, BH1B could not be located.

Seventeen (17) boreholes were identified surrounding the Integrated Paardeplaats Section on the remaining farm portions of Paardeplaats 380 JT. Four (4) boreholes were identified on Paardeplaats 425 JS, however BH2A was filled with rocks and PD-BH1 was locked. Five (5) boreholes were located on Leeuwbank 427 JS and are mainly used for domestic and stock watering purposes.

Three (3) boreholes were located on Zoekop 426 JS, however no access to N4BH and BHT could be obtained. Three (3) boreholes were located on Klipfontein 385 JS; however no access could be obtained to these boreholes. Two (2) boreholes were located on Weltevreden 381 JT and two (2) boreholes were located on Rietvalley 387 JS, however no access to EVD1 could be obtained due to a locked gate. The locations of identified boreholes are presented in **Figure 9.32**.

Table 9.33: Hydrocensus Borehole Co-ordinates and Owner Details (2019).

BOREHOLE ID	COORDINATES (WGS, 1984)		OWNER	ADDRESS	COMMENTS
	LATITUDE	LONGITUDE			
PAARDEPLAATS 380 JT					
GW01	-25.70390	29.97693	North Block Complex (Pty) Ltd	5/380	Clear and odourless
GW02	-25.68516	29.99222		1/380	Clear and odourless
BH1	-25.68911	30.00286		2/380	Clear and odourless
BH2	-25.68832	30.00085		2/380	Clear and odourless
BH3	-25.69022	29.99671		2/380	Monitoring borehole
BH6	-25.71164	29.99161		5/380	Monitoring borehole
BH7	-25.71461	29.99796		5/380	Monitoring borehole
BH8	-25.71578	30.01237		24/380	Clear and odourless
BH9	-25.72023	30.00800		24/380	Could not locate
BH11	-25.71263	30.00031		5/380	Could not locate
BH12	-25.70339	29.98664		5/380	Clear and odourless
BH13	-25.70956	29.99391		5/380	Artesian well
BH14	-25.71084	30.00162		5/380	Clear and odourless
BH15	-25.71375	29.99263		5/380	Clear and odourless
BH1A	-25.725760	29.989220		30/380	Monitoring borehole
BH1B	-25.725720	29.989290			Monitoring borehole
TBH1	-25.701213	30.014042	Lucas Maseko: Thandani Communal Property Association	6/380	Pump broken
TBH2	-25.700302	30.014050			Clear and odourless. Residents complain about the quality
FJ1	-25.701549	30.032365	Mr Willie	9/380	No access, gate was locked. Owner did not answer phone calls
FJ2	-25.701993	30.032782			
FJ3	-25.707077	30.032781			
HBL1	-25.712356	30.044587	Hilton Basil Lack	RE/11/380	No Access
HBL2	-25.712644	30.043170			
WBH	-25.720076	30.019218	Neville Wilkie	13/380	Borehole still in use
PD-BH3	-25.748937	29.998362	Paardeplaats Community	15/380	Clear and odourless
PD-BH4	-25.748831	29.998504			
HEN1	-25.717029	30.037396	Hilton Basil Lack	17/380	No Access
HEN2	-25.717038	30.037426			
HADECBH	-25.728564	30.009185	Hadeco: manager Kevin	29/380	Clear and odourless
GMBH2	-25.72555	30.010036			Murky and ironlike odours
PR-BH1	-25.727851	30.033683	Logistics	38/380	Owner refused entry

BOREHOLE ID	COORDINATES (WGS, 1984)		OWNER	ADDRESS	COMMENTS
	LATITUDE	LONGITUDE			
HBH	-25.735059	30.003330	Hadeco: manager Kevin	40/380	Borehole still in use
HFTN	-25.746137	30.002450	Solomon Mahlangu	RE/380	No Access
PAARDEPLAATS 425 JS					
BH2A	-25.755870	29.967580	Phumulani Agri Village	425	Filled with rocks
BH2B	-25.755830	29.967680	Phumulani Agri Village		-
PD-BH1	-25.750824	29.989157	No access owner not available	2/425	No access, borehole locked
PD-BH2	-25.751829	29.989633	Paardeplaats Community		Clear and odourless
LEEUWBANK 427 JS					
LUB1	-25.779369	29.952101	Gert Roos	RE/427	Used for domestic and general farm functions
LUB2	-25.779801	29.951370			Used for domestic and general farm functions
LUB3	-25.782393	29.951684			Used for stock watering
LUB10	-25.77277	29.95534			Used for stock watering
LUB11	-25.77897	29.95093			Used for stock watering and domestic
ZOEKOP 426 JS					
LUB9	-25.772194	29.973809	-	6/426	Used for stock watering
N4BH	-25.751487	29.997956	Paardeplaats Community	11/426	No access
BHT	-25.762841	29.971351	Mr L.Moroka: Sunbery Accommodation	3/426	No access
KLIPFONTEIN 385 JS					
MF1	-25.701388	29.974454	Masina Farming	3/385	No access
MF2	-25.688050	29.967353			
MF3	-25.698098	29.973830			

BOREHOLE ID	COORDINATES (WGS, 1984)		OWNER	ADDRESS	COMMENTS
	LATITUDE	LONGITUDE			
WELTEVREDEN 381 JT					
PD-BH5	-25.749521	29.999642	Paardeplaats Community	381	Clear and odourless
HBH2	-25.735892	30.036236	Johan Burger	RE/1/381	Borehole still in use
RIETVALLEY 387 JS					
EVD1	-25.720076	29.980274	Solomon Mahlangu	2/387	No access, gate was locked. Owner did not answer phone calls
BH-P10	-25.71191	29.98438			Monitoring borehole

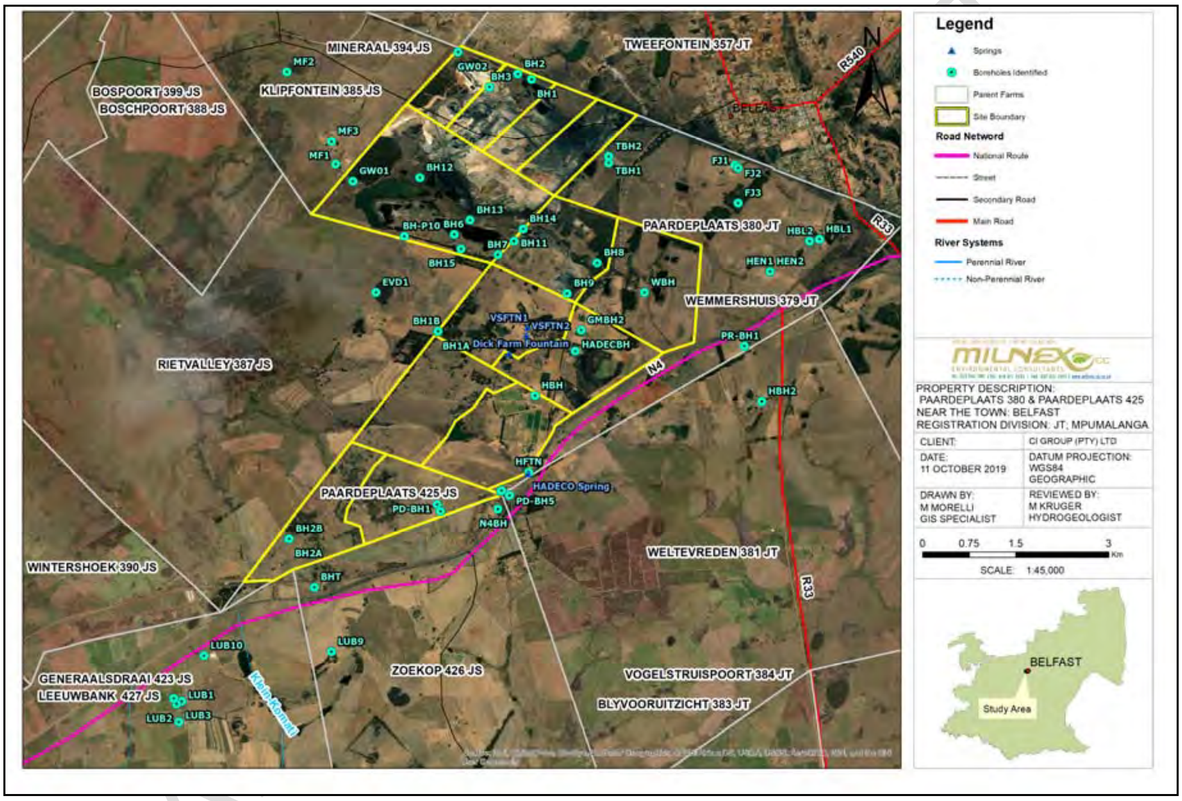

Figure 9.32: Borehole and Spring Locality Map.

The static groundwater levels ranged from 0.15 - 31.6 meters below ground level (mbgl). Field parameters were taken from each accessible borehole and included pH, Electrical Conductivity (EC) and Total Dissolved Solids (TDS). The pH recorded was neutral, however elevated and non-compliant EC and TDS were detected in BH13 (**Table 9.34**).

Four (4) springs were visited during the hydrocensus (**Table 9.35**). VSFN 2 was dry, while the HADECO Spring, VSFTN1 and Dick Farm Fountain were flowing.

Table 9.34: Hydrocensus Borehole Field Parameters.

BH ID	KNOWN YIELD	PUMP TYPE	POWERED BY	RESERVOIR	VOLUME OF WATER ABSTRACTED (l/day)	WATER USED FOR	DEPTH (m)	SWL (mbgl)	PH	EC (mS/m)	TDS (mg/l)
GW01	-	None	N/A	N/A	N/A	Monitoring	13.1	9.29	6.28	10.2	18.8
GW02	-	None	N/A	N/A	N/A	Monitoring	24.5	10.14	6.52	58	312
BH1	-	None	N/A	N/A	N/A	Monitoring	31	3.85	7.25	41.5	275
BH2	-	None	N/A	N/A	N/A	Monitoring	6.05	5.56	7.17	54.8	417
BH3	Destroyed										
BH6	-	None	N/A	N/A	N/A	Monitoring	Inaccessible due to Bees	-	-	-	-
BH7	Could not locate										
BH8	-	None	N/A	N/A	N/A	Monitoring	23.95	3.81	7.21	62.5	468
BH9	Could not locate										
BH11	-	None	N/A	N/A	N/A	Monitoring	-	-	-	-	-
BH12	-	None	N/A	N/A	N/A	Monitoring	4.86	3.18	7.41	76.9	544
BH13	-	None	N/A	N/A	N/A	Monitoring	31		6.81	214	1803
BH14	-	None	N/A	N/A	N/A	Monitoring	31	0.15	6.54	58.4	412
BH15	-	None	N/A	N/A	N/A	Monitoring	32	16.92	7.21	26.5	166
BH1A	-	None	N/A	N/A	N/A	Monitoring	8		7.24	66.8	494
BH1B	-	None	N/A	N/A	N/A	Monitoring	16	13.86	-	-	-
BH2A	-	None	N/A	N/A	N/A	Monitoring	-	-	-	-	-
BH2B	-	-	-	-	-	-	-	-	6.98	88.9	652

BH ID	KNOWN YIELD	PUMP TYPE	POWERED BY	RESERVOIR	VOLUME OF WATER ABSTRACTED (l/day)	WATER USED FOR	DEPTH (m)	SWL (mbgl)	PH	EC (mS/m)	TDS (mg/l)
BH-P10	800 l/h	None	N/A	N/A	N/A	Monitoring	54 (information plate)	Could not access	-	-	-
GMBH2	1000 l/h	0.37 kW Submersible	Electricity	5 Kl JoJo	5000	Drinking and domestic	56	31.6	6.39	23.2	158
HADECBH	Unknown	Submersible	electricity	Three 5 Kl JoJo tanks	5000	Drinking and domestic	-	-	6.94	64.7	418
HFTN	Unknown	None	N/A	N/A	N/A	-	88	18.1	7.73	84.6	585
HFTN	2000 l/h	Submersible	electricity	Three 5 Kl JoJo tanks	5000	Drinking and domestic	20	1.2	7.45	78.5	554
HBH	2500 l/h	Submersible	electricity	Three 5 Kl JoJo tanks	15000	Drinking and domestic	67	15.03	7.88	88.4	605
HBH2	3800 l/h	Submersible	Electricity	Two 5 Kl JoJo tanks	10000	Drinking and domestic	100	26.3	7.44	74.9	576
HBL1	No access										
HBL2	No access										
HEN1	No access										
HEN2	No access										
LUB1	1000 l/h	Submersible	Electricity	5 kl JoJo	5000	Drinking and general farming requirements	45	22.9	7.05	48.2	303

BH ID	KNOWN YIELD	PUMP TYPE	POWERED BY	RESERVOIR	VOLUME OF WATER ABSTRACTED (l/day)	WATER USED FOR	DEPTH (m)	SWL (mbgl)	PH	EC (mS/m)	TDS (mg/l)
LUB2	2000 l/h	Submersible	Electricity	2 X 5 Kl JoJo tanks	5000	Drinking and general farming requirements	45	16.19	7.17	44.5	275
LUB3	1000 l/h	Wind	Wind	Cement dam	5000	Stock watering and domestic	Could not access, wind pump	-	7.43	64.2	423
LUB9	1000 l/h	Wind	Wind	Cement dam	5000	Stock watering and domestic	Could not access, wind pump	-	7.28	66.1	428
LUB	1300 l/h	Wind	Wind	Cement dam	5000	Stock watering and domestic	Unknown	-	7.33	72.8	509
LUB	2000 l/h	Solar	Sun	2 X 5 kL JoJo Tanks	5000	Stock watering and domestic	Unknown	-	7.31	71.6	498
MF1	No access										
MF2	No access										
MF3	No access										
N4BH	Unknown	Submersible	Electrical	-	5000	Domestic and stock watering	Borehole sealed, no access	-	7.95	19.34	138.1

BH ID	KNOWN YIELD	PUMP TYPE	POWERED BY	RESERVOIR	VOLUME OF WATER ABSTRACTED (l/day)	WATER USED FOR	DEPTH (m)	SWL (mbgl)	PH	EC (mS/m)	TDS (mg/l)
BHT	2800 l/h	Submersible	Electricity	2 X 5000 l JoJo Tanks	10000	Domestic	Unknown	-	7.73	81.8	686
PD-BH1	No access, borehole locked										
PD-BH2	500 l/h	Hand pump	Hand	-	2000	Drinking and domestic	Unknown	-	6.87	77.4	528
PD-BH3	500 l/h	Hand pump	Hand	-	2000	Drinking and domestic	Unknown		6.68	74.3	518
PD-BH4	500 l/h	Hand pump	Hand	-	2000	Drinking and domestic	27	15.19	6.58	79.8	542
PD-BH5	1000 l/h	Wind	Wind	-	2000	Drinking and domestic	22	6.4	6.54	79.5	531
PR-BH1	No access										
TBH1	500 l/h	Wind	Wind	2 X 5 Kl JoJo tanks	10 000	Stock watering and domestic	Unknown	-	7.23	88.9	705
TBH2	500 l/h	Wind	Wind	2 X 5 Kl JoJo Tanks	10 000	Stock watering and domestic	Unknown	-	7.41	86.4	689
WBH	Unknown	Submersible	Electricity	2 X 5 Kl JoJo tanks	10 000 a week	Domestic and stock watering	45	0.89	7.81	178.7	1239
FJ1	No access, gate was locked. Owner did not answer phone calls										
FJ2	No access										

BH ID	KNOWN YIELD	PUMP TYPE	POWERED BY	RESERVOIR	VOLUME OF WATER ABSTRACTED (l/day)	WATER USED FOR	DEPTH (m)	SWL (mbgl)	PH	EC (mS/m)	TDS (mg/l)
FJ3	No access										
EVD1	-	-	-	-	8 000	Domestic and stock watering	No Access, owner not available	-	-	-	-
Values in RED exceeding the South African National Standards (SANS) 241-1:2015 Drinking Water Quality Guidelines.											

Table 9.35: Hydrocensus Spring Details.

SPRING ID	COORDINATES (WGS, 1984)		YIELD	COMMENTS	pH	EC (mS/m)	TDS (mg/l)
	LATITUDE	LATITUDE					
HADECO Spring	-25.74637	30.00227	Flowing, yield unknown	Spring still running. Clear and odourless	7.25	44.3	287
VSFTN1	-25.72515	30.00223	Flowing, yield unknown	Spring still running. Clear and odourless	6.85	65.7	408
VSFTN2	-25.72632	30.00208	Dry	-	-	-	-
Dick Farm Fountain	-25.72891	29.99957	Flowing, yield unknown	Clear and odourless	7.18	21.8	118

9.10.3 Water Quality

Water quality monitoring data, obtained during April 2019 (Golder, May 2019) and December 2020 (Golder, 2021) was made available for the mining area and includes:

- Monitoring boreholes in the Glisa Section: BH1, BH2, BH8, BH12, BH14, BH15, GW01; and GW02;
- Monitoring boreholes in the Paardeplaats Section: BH 1B, BH 2A; and BH 2B;
- Springs outside the mine boundaries: Hadeco Spring and SV Dam 2 (Dick Farm Fountain);
- Surface water monitoring points both within the Glisa Section and outside of the mining right area: Gijima Dam, Blue Gum Dam, Siding Dam, Wash Bay, Portion 24 Evaporation Dam, Belfast Dam, Lewis Dam Wall, Lewis Dam Upstream, Poach Dam, West WQ point on Mahim Dam Wall, Northern WQ point on Mahim Dam, Water Treatment Plant Discharge, Water Monitoring Point 1, Water Monitoring Point 2, Water Monitoring Point 3, Water Monitoring Point 4, and Skilferlaagtespruit;
- Surface water monitoring points both within the Paardeplaats Section and outside of the mining right area: MP6, MP8, SV Dam 1 (Wilkie Farm Dam), and SV Dam 3 (Hadeco Dam);
- Mine Voids: Block C Main Void, Upstream from Block C Main Void; and Downstream from Block C Main Void;
- Wetlands: Wetland in old Mine Area, Wetland 1 of Poach Dam, Wetland 2 of Poach Dam, Wetland at BH 1, and Small Wetland created from the overflow of the dam on western side; and
- Rivers and Decant Points: Decant Point, River Division 1, River Division 2, and Downstream Stream Channel below Mahim Dam Wall.

The impact of these monitoring points was determined by means of graphically presenting sulphate and EC concentrations as well as classification my means of Piper and Expanded Durov Diagrams. Impacted monitoring points indicated sulphate and EC concentrations above the ambient sample concentrations, however below the recommended limits. Dirty monitoring points indicated sulphate and/or EC concentrations above the recommended limits.

A Piper Diagram represents the chemistry of a water sample graphically. It is a tri-linear diagram that implements major cations (calcium, magnesium, sodium and potassium) and anions (chloride, sulphate and bicarbonate) to reveal the chemistry of water samples which is then used to characterise different types of water. The Expanded Durov Diagram is a graphic representation similar to the Piper Diagram. The central plotting area is a square rather than a diamond, but the principal difference is that in the Expanded Durov Diagram the percentages of the individual ions are calculated as total ions (Cation + Anions), whereas in the Piper Diagram the percentages of cations and anions are plotted separately. The nine blocks in the main square of the Expanded

Durov Diagram represent the hydrochemical facies which are used to distinguish one water type from another.

9.10.3.1 Boreholes

The borehole details are presented in **Table 9.36**. The quality results, as per the Golder (2021) report, for groundwater samples collected, indicated that BH1, BH2 and BH14 are impacted by the mining activities.

Table 9.36: Groundwater Sample Details – 2020 (Golder, 2021).

BOREHOLE ID	COORDINATES (WGS, 1984)		COMMENTS	IMPACTED BY MINING ACTIVITIES
	LATITUDE	LONGITUDE		
Glisa Monitoring Sites				
BH 1	-25.68907	30.00286	Clear	**Impacted**
BH 2	-25.68831	30.00085	Clear	**Impacted**
BH 6	-25.711641	29.991607	Bees are inside borehole	Unknown
BH 7	-25.714614	29.997962	Sampling is cancelled due to safety issues with accessibility	Unknown
BH 8	-25.715782	30.012369	Clear	No
BH 9	-25.720231	30.007997	Could not locate borehole	Unknown
BH12	-25.70397	29.98667	Clear	No
BH13	-25.71163	30.00607	No access. Borehole located in wetland	Unknown
BH14	-25.71326	29.99855	Clear. Borehole overflowing	**Impacted**
BH15	-25.71378	29.99261	Clear	No
GW01	-25.70388	29.97692	Collapsed/blocked since Feb 2020. Last monitoring done Jan 2020	No
GW02	-25.68515	29.99219	Clear	No
Paardeplaats Monitoring Sites				
BH 1A	-25.72576	29.989220	Blocked	Unknown
BH 1B	-25.72572	29.98929	Clear	No
BH 2A	-25.75587	29.96758	Clear	No
BH 2B	-25.75583	29.96768	Clear	No

*Groundwater Sample Collected (Golder, 2021)

The Piper and Expanded Durov Diagrams, based on the water quality obtained during the 2019 hydrocensus, are presented in **Figure 9.33**.

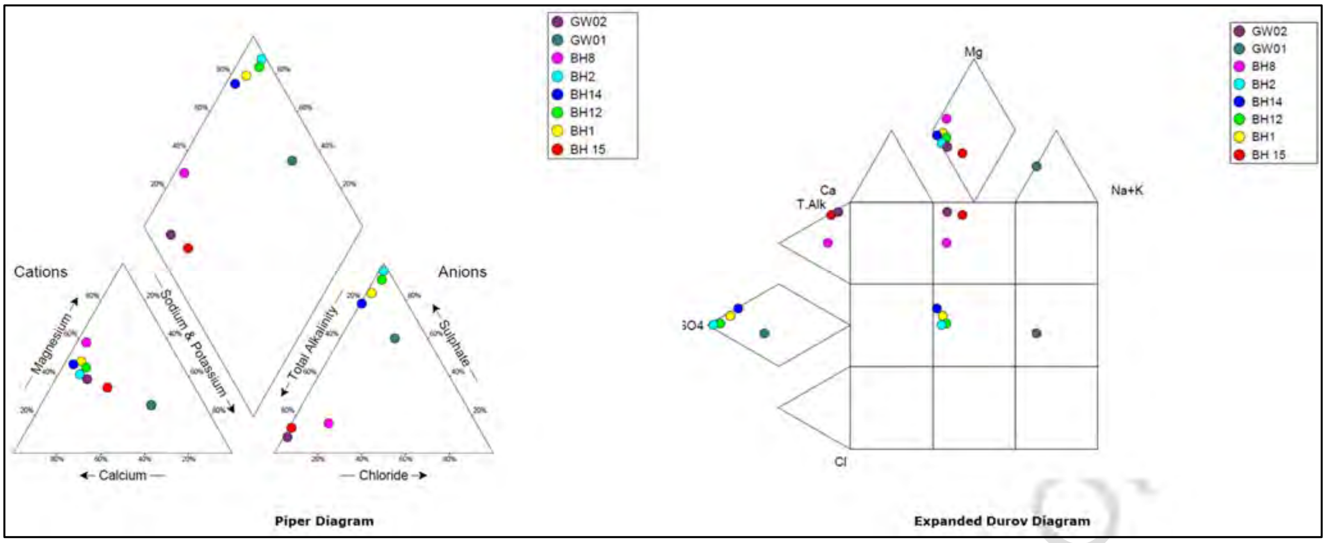

Figure 9.33: Piper and Extended Durov Diagrams for Boreholes (April 2019).

The groundwater samples collected from GW02, BH8 and BH15 represent recently recharged groundwater rich in calcium and/or magnesium and bicarbonate, whilst groundwater samples from BH1, BH2, BH12 and BH14 represent water influenced by mining activities. The groundwater sample collected from GW01 represents water that has been in contact with a source rich in sodium, or sodium chloride dominated water that resides in sodium-rich host rock/material. The groundwater from the monitoring boreholes in the Paardeplaats Section were characterised by three different signatures: sodium and bicarbonate (BH1B), calcium and/or sodium and bicarbonate (BH2A), and calcium and/or magnesium and bicarbonate (BH2B) (Golder, 2021).

Monitoring well BH2 (downstream of the Blue Gum Dam) showed acidic pH levels that were non-compliant with the IWUL limit (Golder, 2021). Some acidic pH levels and elevated calcium, magnesium and sulphate concentrations were also noted in BH1 during the monitoring period as well. Additionally, sulphate concentrations were detected above the IWUL limit in BH14 (downstream of Portion 24) and were noted to be slightly elevated (although within the IWUL limit) in BH12 (downstream of Old Block B). These exceedances, together with slightly elevated manganese concentrations (not regulated in the IWUL), are indicative of mining related impacts on the groundwater in these areas (Golder, 2021).

Concentrations of zinc were detected above the IWUL limit in all the Paardeplaats Section monitoring boreholes and mean iron concentrations were detected above the IWUL limit in BH1B and BH2B. Mean manganese concentrations were detected above the IWUL limit in BH2B (situated at a distance and not downstream from current mining activity) (Golder, 2021). Sulphate concentrations in these boreholes are still low and less than 2 mg/l. No mining related impacts were thus discernible.

9.10.3.2 Springs

Two spring samples were collected during the 2020 monitoring campaign (Golder, 2021) and are presented in **Table 9.37**.

Table 9.37: Spring Sample Details – 2020 (Golder, 2021).

BOREHOLE ID	COORDINATES (WGS, 1984)		COMMENTS	IMPACTED BY MINING ACTIVITIES
	LATITUDE	LONGITUDE		
Hadeco Spring	-25.74637	30.00227	Clear	No
Dick Farm Fountain	-25.72891	29.99957	Clear	No

The EC and sulphate concentrations were below the WUL limits, indicating that the springs are not influenced by mining activities. According to the Piper and Expanded Durov Diagrams, as presented in **Figure 9.34**, the samples represent clean water rich in calcium and/or magnesium.

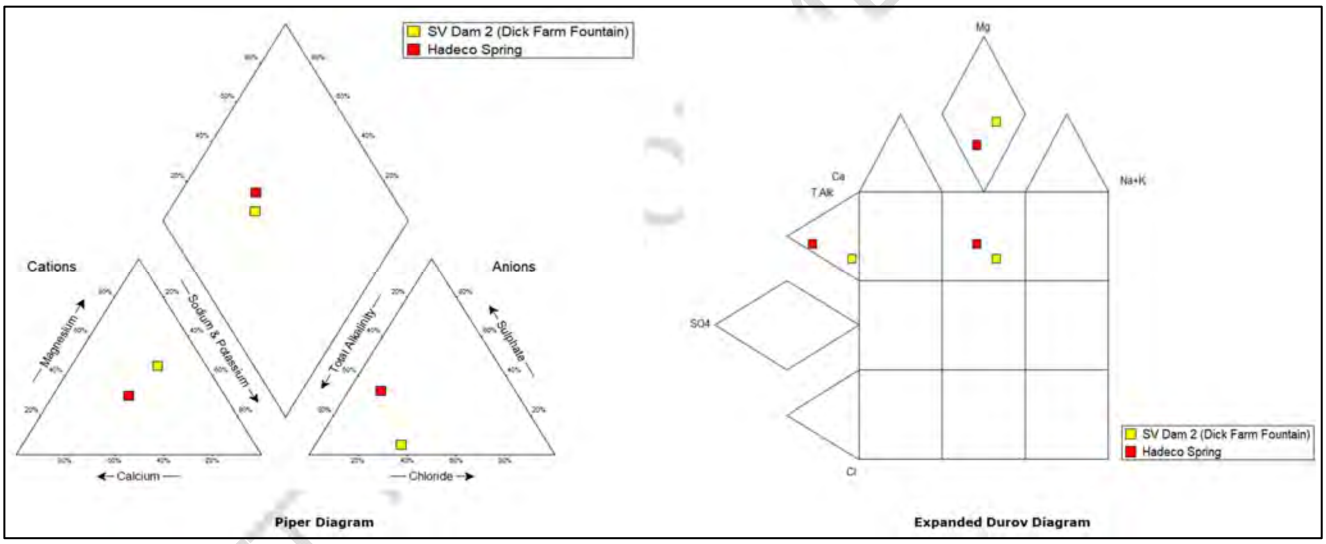

Figure 9.34: Piper and Extended Durov Diagrams for Springs (April 2019).

9.10.3.3 Surface Water

Twenty-eight (28) surface water samples were collected during the 2020 monitoring campaign as presented in **Table 9.38**.

Table 9.38: Surface Sample Details – 2020 (Golder, 2021).

SURFACE WATER ID	COORDINATES (WGS, 1984)		COMMENTS	IMPACTED BY MINING ACTIVITIES
	LATITUDE	LONGITUDE		
Glisa Surface Water Receiving Environment Sites				
Upstream from Block C Main Void	-25.71491	29.99668	Dry Jul - Dec 2020	Dirty
Downstream from Block C Main	-25.71115	30.00086	Dry Jul - Dec 2020	Dirty
Belfast Dam	-25.67125	30.01384	Clear	No
Lewis Dam Wall	-25.68102	30.02233	Clear	No
Lewis Dam – Upstream (GS 4)	-25.69585	30.02494	Clear	No
Poach Dam	-25.68328	30.01024	Clear	No
West WQ point on Mahim dam Wall	-25.70650	29.97705	Clear	Dirty
Northern WQ point on Mahim Dam	-25.70292	29.98384	Clear	Dirty
Downstream channel below Mahim dam wall	-25.70644	29.97524	Dark brown. Co-ordinates unknown	**Impacted**
Water treatment plant discharge	-25.70592	29.97601	Not discharging Jul - Dec 2020	Dirty
River Division 1	-25.71097	30.00082	Light brown with floating rust.	Dirty
River Division 2	-25.75878	30.98968	Light brown with floating rust.	Dirty
Water monitoring Point 1	-25.70337	30.01105	Clear	Dirty
Water monitoring Point 2	-25.70357	30.00893	Dry Jun - Sep 2020	Dirty
Water monitoring Point 3	-25.70482	30.01211	Clear	No
Water monitoring Point 4	-25.70228	30.01424	Dry Jun - Dec 2020	No
Skilferlaagte Spruit	-25.70295	29.91935	Clear	**Impacted**
Glisa Process Water Sites				
Decant point	-25.70400	29.98906	Light grey	Dirty
Gijima Dam (formerly Portion 5 Suppression Dam)	-25.70700	30.00800	Clear	Dirty
Block C Main Void	-25.71275	29.99739	Clear	Dirty
Blue Gum dam	-25.68972	30.00350	Clear	Dirty
Siding Dam	-25.70275	30.06275	Light grey	**Impacted**
Wash bay	-25.69936	30.01265	Light grey	Dirty

SURFACE WATER ID	COORDINATES (WGS, 1984)		COMMENTS	IMPACTED BY MINING ACTIVITIES
	LATITUDE	LONGITUDE		
Portion 24 Evaporation Dam	-25.71110	30.00199	Clear	Dirty
Paardeplaats Surface Water Receiving Environment Sites				
MP 6	-25.70606	29.97367	Dry May – Dec 2020	No
MP8	-25.71245	29.98384	Dry Apr – Dec 2020	No
SV Dam 1 (Wilkie Farm Dam)	-25.71806	30.01441	Clear	**Impacted**
SV Dam 3 (Hadeco Dam)	-25.74174	29.99106	Clear	No

The Glisa surface water receiving environment sites samples collected from Upstream from Block C Main Void, Downstream from Block C Main Void, West WQ point on Mahim dam Wall, Northern WQ point on Mahim Dam, Water treatment plant discharge, River Division 1, River Diversion 2, Water Monitoring Point 1 and Water Monitoring Point 2 are considered dirty due to the non-compliance of EC and sulphate concentrations. Downstream Channel below Mahim Dam Wall and Skilferlaagte Spruit are impacted by the mining activities due to the non-compliance of sulphate concentrations (Golder, 2021).

The Glisa process water sites samples collected from the Decant Point, Gijima Dam, Block C Main Void, Blue Gum Dam, Wash Bay and Portion 24 Evaporation Dam are considered dirty due to the non-compliance of EC and sulphate concentrations. The samples collected from Siding Dam are impacted by the mining activities due to the non-compliance of sulphate concentrations (Golder, 2021).

The Paardeplaats surface water receiving environment sites samples collected from Wilkie Farm Dam are impacted by the mining activities due to the non-compliance of sulphate concentrations.

According to the Piper and Expanded Durov Diagrams, as presented in **Figure 9.35**, Water Monitoring Point 3, Lewis Dam Wall, Lewis Dam Upstream and Belfast Dam samples represent relatively clean water. Water samples collected from Siding Dam, Portion 24 Evaporation Dam, Blue Gum Dam and Water Monitoring Point 1 represent water that has been in contact with a source of sulphate contamination. The following samples represent water that has undergone sulphate and sodium-chloride mixing or contamination: Skilferlaagte Spruit (before confluence), Downstream Channel below Dam Wall, Northern and Western WQ Points on Mahim Dam, SV Dam 1, SV Dam 3, Water Monitoring Point 4, River Division 1, River Diversion 2, Decant Point and Gijima Dam. Samples collected from the Wash Bay and Poach Dam represent water that has undergone sodium ion exchange (contamination effects from a source rich in sodium). The water sample collected from MP6 represent stagnant water that has reached the end of the geohydrological cycle (deserts, salty pans, etc.).

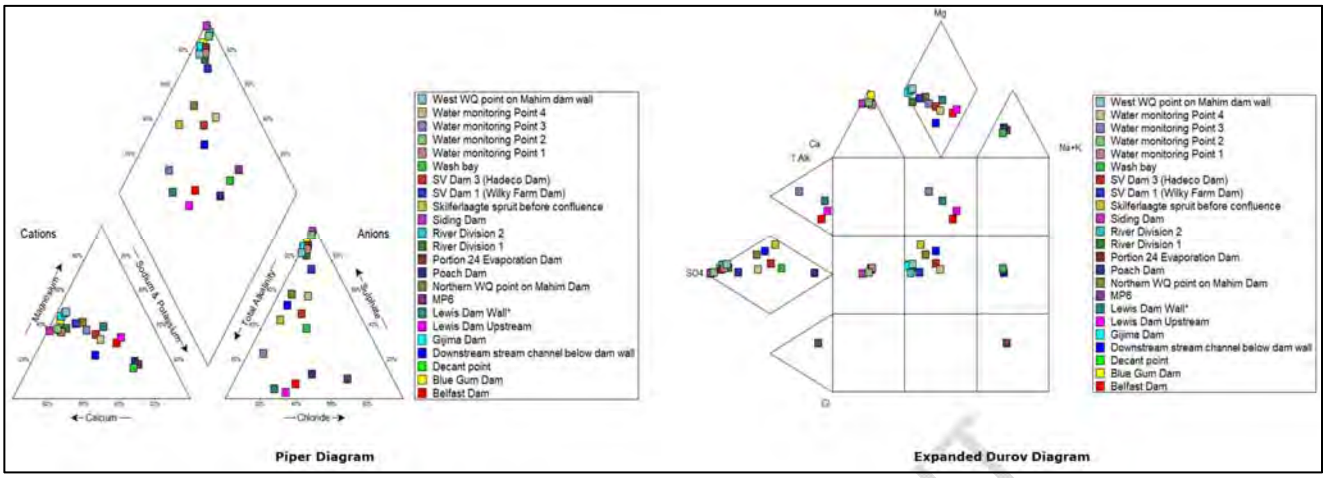

Figure 9.35: Piper and Extended Durov Diagrams for Surface Water (April 2019).

9.10.3.4 Wetlands

Five (5) wetland water samples were collected during the 2020 monitoring campaign. The sample details are presented in **Table 9.39**. Samples collected from the wetland in the old mine area (Siding Wetland), Wetland 2 (Poach Dam) and Wetland (BH1) are impacted by the mining activities based on the exceedance of sulphate concentrations. The small wetland area created from the overflow for the dam on western side are considered dirty due to exceedance of EC and sulphate concentrations. The wetlands were dry during most of 2020.

Table 9.39: Wetland Sample Details – 2020 (Golder, 2021).

BOREHOLE ID	COORDINATES (WGS, 1984)		COMMENTS	IMPACTED BY MINING ACTIVITIES
	LATITUDE	LONGITUDE		
Siding Wetland (Wetland in old mine area)	-25.70545	30.05993	Dry Jun-Dec 2020	**Impacted**
Wetland 1 of Poach Dam	-25.68873	30.00308	Dry Mar-Dec 2020	No
Wetland 2 of Poach Dam	-25.68651	29.99760	Dry Mar-Dec 2020	**Impacted**
Wetland at BH 1	-25.68888	30.00298	Dry Jun-Dec 2020	**Impacted**
Small wetland created from the overflow of the dam on western side	-25.70799	29.97663	Dry Aug -Dec 2020	Dirty

According to the Piper and Expanded Durov Diagrams (**Figure 9.36**) the water samples collected from the wetlands represent water that has been in contact with a source of sulphate contamination from mining activities.

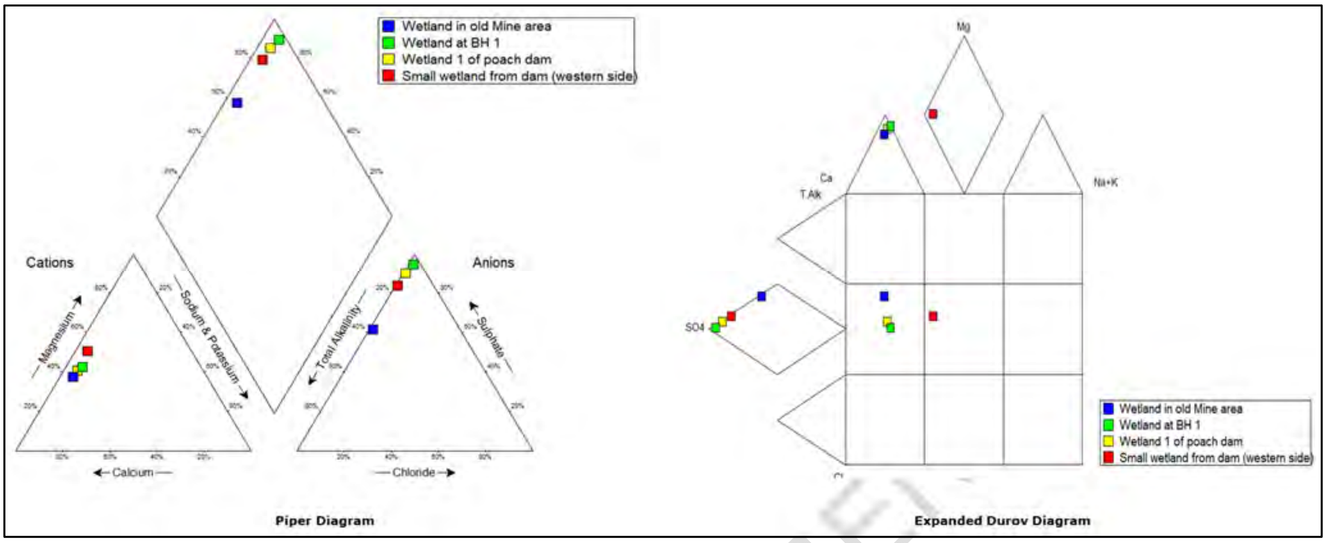

Figure 9.36: Piper and Extended Durov Diagrams for Wetlands (April 2019).

9.11 Heritage

In 2012, a total of 32 heritage sites (PP 1 – PP 32) including 21 heritage structures, 7 cemeteries, 3 areas with historical mining shafts, and one possible rock art site were identified within the Paardeplaats Section of the Integrated Paardeplaats Section. In 2020 an additional 13 heritage sites (PP 33 – PP 45) were identified within the Paardeplaats Section and Portion 24 of the Integrated Paardeplaats Section. The detailed description of each heritage feature identified, including an updated description of the sites identified in 2012 to align with current conditions is presented in **Table 9.40** whilst the location of the sites is presented in **Figure 9.37**.

The Integrated Paardeplaats Section is primarily underlain by the Vryheid Formation of the Ecca Group (Karoo Supergroup). Quaternary superficial deposits are the youngest geological deposits formed during the most recent period of geological time (approximately 2.6 million years ago to the present). Most of the superficial deposits are unconsolidated sediments which may include stream, channel and floodplain deposits, beach sand, talus gravels and glacial drift sediments (Partridge *et al*, 2006). Quaternary fossil assemblages are generally rare and low in diversity and occur over a wide-ranging geographic area.

Table 9.40: Heritage Sites Identified within the Integrated Paardeplaats Section.

SITE NUMBER AND TYPE	2012 DESCRIPTION	2021 DESCRIPTION
PP 1 - Demolished Historic Farmstead	A farmstead with its associated buildings was identified at this location. The main house and other buildings were still intact and were occupied until recently before the property was sold to Exxaro.	The structures that were identified in 2012 have been demolished. Only the ruins of the foundations remain. The site is overgrown and abandoned.
PP 2 - Burial Ground	A cluster of 4 informal graves was identified at this location. The graves are overgrown with vegetation, but it was evident that the graves had been cleared regularly as the vegetation was not overwhelming. The headstone inscriptions date the graves from the late 1960/1970s and all the names on the graves are of the Mtweni family.	The site was found to be overgrown vegetation.
PP 3 - Burial Ground	2 informal graves were identified at this location. The graves are crudely fenced and are not maintained so are overgrown with grass and other vegetation. The graves belong to the Maseko family, who apparently reside in the farmworker's houses located behind the farmstead (PP 1). Such graves are treated as being of 60 years or older unless evidence is obtained to the contrary.	The site consists of 3 graves located near the pit of the mine, 2 of the graves belong to the Maseko family whilst the other grave belongs to an unknown individual. NBC has appointed a service provider to relocate these graves and the process is currently in the permit application phase.
PP 4 - Burial Ground	An informal cemetery with ±81 graves was identified at this location. The cemetery is not fenced and is located in the open veld. Some of the graves had been cleaned recently, but most of them are overgrown with grass and other vegetation.	±80 - 90 graves appear to be buried at the site. The cemetery is overgrown with vegetation and is not fenced.

SITE NUMBER AND TYPE	2012 DESCRIPTION	2021 DESCRIPTION
PP 5 - Burial Ground	An informal cemetery with ±40 graves was identified at this location. The cemetery is not fenced and is located amongst a plantation of blue gum trees. Most of the graves are overgrown with grass and other vegetation.	It seems that more graves are present with ±40 – 50 noted currently. The site is located next to a blue gum plantation and is overgrown with vegetation.
PP 6 - Historic Homesteads and Structures with the Possible Risk for Unmarked Graves	The remains of an old cattle kraal were identified at this location. The age of the kraal is not known. 3 families had used parts of the old kraal structure to build their own homesteads and were working on the farm. Past experience has shown that in some cases stillborn babies and infants were frequently buried along the sides, or underneath, the parents' dwelling. No direct information with regards to the presence (or not) of such graves is currently available.	The cattle kraal was still identified during the current fieldwork; however sections of its walls have collapsed. A number of dwellings are still located at the site and appear to have increased since 2012. No additional information regarding the presence (or not) of such graves is currently available.
PP 7 - Demolished Historic Structures	A large storeroom or shed was identified at this location. It has an external electricity system, cement floor and is still in use. A small, square sandstone-built structure is situated next to the larger storeroom. It has a dirt floor and does not have any water or electrical systems. The age of these buildings is not known.	The structures that were identified in 2012 have been demolished. Only the remains of the foundations remain.
PP 8 - Demolished Historic Farmstead	The Remains Of A Farmhouse And Its Associated Buildings Were Identified At This Location. A Wrought Iron Fireplace Was Still *In Situ*, Which Could Date The Building Between The 1910 – 1930s (Edwardian Period). The house had an internal electrical system which was a later addition. A water reservoir is situated approximately 30 m from the	The structures that were identified in 2012 have all been demolished. Only the remains of the structures and foundations remain.

SITE NUMBER AND TYPE	2012 DESCRIPTION	2021 DESCRIPTION
	main house. The age of this farmstead and its associated buildings is not known; however, it is highly likely that they are 60 years or older and they could be the original buildings for the Hadeco company.	
PP 9 - Demolished Historic Structure	The remains of a small, square structure were identified at this location. The function and age of this structure is unknown.	The remains of the same square structure were identified during the 2021 fieldwork; however the condition of the structure has deteriorated significantly since2012.
PP 10 - Single Grave	1 informal grave was identified at this location. The grave is situated approximately 40 m from a farmstead (PP 11). The grave is not maintained and is overgrown with grass and other vegetation. The age of the grave is not known.	The general area of where the grave was identified in 2012 was walked through by the fieldwork team, yet despite an intensive walkthrough, no surface features as observed in 2012 could be found. Several single stones, that could possibly be grave markers, were however found.
PP 11 - Historic Farmstead and Structures with the Possible Risk for Unmarked Graves	A farmstead with its associated buildings was identified at this location. The farmstead consists of two brick-built houses, located next to each other inside a fenced area. Both houses also have internal electrical and plumbing systems and are still occupied. Another brick-built house is situated on the farmstead and is occupied by the farm labourers and their families. It has external electrical and plumbing systems. 2 ruined silos were observed but were not in use. The remains of 2 rondawel workers' dwellings were also identified and may be associated with the single grave (PP 10). The age of this farmstead and its associated buildings was not known. Past experience has shown that in some cases stillborn babies and infants were	The farmstead was visited during the 2020 fieldwork. The main farmhouse appears to be a bit dilapidated from the building that was recorded in 2012. However, all the other structures are still intact and appear to be in a similar condition as in 2012. The site is currently occupied by the Joubert family. No additional information regarding the presence (or not) of such graves is currently available.

SITE NUMBER AND TYPE	2012 DESCRIPTION	2021 DESCRIPTION
	frequently buried along the sides, or underneath, the parents' dwelling. No direct information with regards to the presence (or not) of such graves is currently available.	
PP 12 - Historic Coal Mine Shaft	An abandoned coal mine shaft was identified at this location. The shaft measures approximately 2 x 5 m and extends approximately 25 m into the side of the hill. A second tunnel/shaft extended from the main shaft and its roof had collapsed at the end of this shaft/tunnel. Most of the shaft is flooded with water. Wooden supports to keep the roof of the shaft from collapsing are still in place. A ventilation hole had been dug in the roof which is visible on the surface of the rock outcrop. The age of this abandoned mine is not known, however it is likely that it dates to over 100 years.	The entrance to the shaft is currently covered by dense vegetation. As a result, it was not possible to access the shaft and assess its interior.
PP 13 - Historic Coal Mine Shaft	An abandoned mine shaft was identified at this location. The shaft measures approximately 2 x 5 m and extends approximately 25 m into the side of the hill. Most of the shaft is flooded with water. Wooden supports to keep the roof of the shaft from collapsing are still in place. The age of this abandoned mine is not known, however it is likely that it dates to over 100 years. A coal spoil heap is also still present close to the entrance of the shaft.	The shaft appears to be in the same condition as when it was identified in 2012.
PP 14 - Possible Rock Art Site	A possible rock art site was identified at this location. The position of the panel is situated on the southern side of an exposed rock bank which formed a slight overhang. Two	During the 2020 site visit, the southern panel was studied, however no evidence of rock art can currently be seen with the naked eye.

SITE NUMBER AND TYPE	2012 DESCRIPTION	2021 DESCRIPTION
	extremely faded figures were identified. These figures were red in colour but could not be clearly identified. The figures measure approximately 20 cm in size. No archaeological deposit was identified at the foot of the rock face. The rock face is also deteriorating.	
PP 15 - Historic Homesteads and Structures with the Possible Risk for Unmarked Graves	The remains of a mud-brick homestead together with a stone-walled cattle kraal were identified at this location. Two lower grinding stones were also identified with the remains of the structures. Past experience has shown that in some cases stillborn babies and infants were frequently buried along the sides, or underneath, the parents' dwelling. No direct information with regards to the presence (or not) of such graves is currently available.	Sections of the stone-packed kraal were identified. It would appear that sections of the kraal's walls have collapsed since 2012. The remains of the mudbrick homestead could not be seen. No additional information regarding the presence (or not) of such graves is currently available.
PP 16 - Historic Homestead with Graves and the Possible Risk for Unmarked Graves	The remains of a mud-brick homestead with a stone-walled cattle kraal were identified at this location. A lower grinding stone was also identified with the remains of the structures. Several modern metal artefacts such as wire, corrugated iron and cans were found scattered around the site. The ruin of a stone-walled cattle kraal was also noted with 2 informal graves identified next to the kraal. The graves have no headstones, and their age could not be determined. Past experience has shown that in some cases stillborn babies and infants were frequently buried along the sides, or underneath, the parents' dwelling. No	Sections of the stone-packed kraal were identified but it would appear that sections of the kraal's walls have collapsed. The remains of the mudbrick homestead could not be seen. The two stone packed graves were identified on-site. No additional information regarding the presence (or not) of unknown infant graves is currently available.

SITE NUMBER AND TYPE	2012 DESCRIPTION	2021 DESCRIPTION
	direct information with regards to the presence (or not) of such graves is currently available.	
PP 17 - Historic Coal Mine Shaft	An abandoned coal mine shaft was identified at this location. The shaft measures approximately 2 x 4 m and extends approximately 15 m into the side of the hill. Most of the shaft is flooded with water. The age of this abandoned mine is not known, however it is likely that it dates to over 100 years.	The mine shaft appears to be relatively intact and in a similar condition as when it was recorded in 2012. The shaft is still flooded with water.
PP 18 - Animal Drinking Trough	An old animal drinking trough was identified at this location. No other structures or features are associated with the trough. The age of the trough is not known.	The trough appears to be in the same condition as when it was recorded in 2012. The site is overgrown with vegetation and it would appear that the trough is not currently used.
PP 19 - Demolished Historic Structure	A ruined stone-walled cattle kraal was identified at this location. Most of the sandstone blocks used in the walls of the kraal have been robbed (used somewhere else) and the original kraal is in a very dilapidated state.	During the recent site visit undertaken in 2021, the kraal could not be identified due to the fact that the site, and its surroundings, has been used for the construction of the Phumulani village. A sign placed near the site reads as follows: "Phumulani Agri-Village Belfast Coal Mine Relocated Community". The kraal was most likely demolished during the construction.
PP 20 - Reservoir with Associated Structures	A brick and cement dam was identified at this location. A square brick-built building is situated next to the cement dam. The age of this building is not known.	No evidence for the structures that were recorded in 2012 could be observed during the recent fieldwork. It would appear that the structures were most likely demolished during the construction of the Phumulani Agri-village. A newer steel reservoir is located close to the original position of the cement dam.

SITE NUMBER AND TYPE	2012 DESCRIPTION	2021 DESCRIPTION
PP 21 - Historic Homesteads and Structures with the Possible Risk for Unmarked Graves	The remains of a mud-brick homestead were identified at this location. A further circular structure was also observed. A lower grinding stone was also identified with the remains of the structures. Several modern metal artefacts such as wire, corrugated iron and cans were found scattered around the site. Past experience has shown that in some cases stillborn babies and infants were frequently buried along the sides, or underneath, the parents' dwelling. No direct information with regards to the presence (or not) of such graves is currently available.	No remains of a mud-brick homestead were identified at this location. The site is overgrown with grassy vegetation. No other cultural material including remains of foundations of a grinding stone was observed at the site. The site has been disturbed by illegal dumping activities. No additional information regarding the presence (or not) of such graves is currently available.
PP 23 - Historic Homesteads and Structures with the Possible Risk for Unmarked Graves	The remains of a mud-brick homestead were identified at this location. Several modern metal artefacts such as wire, corrugated iron and cans were found scattered around the site. Past experience has shown that in some cases stillborn babies and infants were frequently buried along the sides, or underneath, the parents' dwelling. No direct information with regards to the presence (or not) of such graves is currently available.	A small section of the remains of the foundation of the mud-brick homestead could be identified. The outlines of the structure were barely visible underneath the grassy vegetation. No other cultural material including remains were observed at the site. No additional information regarding the presence (or not) of such graves is currently available.
PP 23 - Demolished Historic Structure (before 2012)	The remains of an old sandstone building were identified at this location. Most of the remains of the building had been removed and only the sandstone blocks which formed the foundations of the building are left. These remains are most probably parts of an old farmhouse, which were broken down and removed from this site in	The scattered remains of an old sandstone building were identified at this location. Most of the remains of the building had been removed and only the sandstone blocks which formed the foundations of the building were left. The site is overgrown.

SITE NUMBER AND TYPE	2012 DESCRIPTION	2021 DESCRIPTION
	the past. The exact function and age of this structure are not known.	
PP 24 - Sunbury Railway Station	The ruined remains of the Sunbury Railway Station were identified at this location. The structure is constructed of red brick that was plastered and painted. The structure is in ruins and is overgrown with vegetation. The age of the station is not known.	The collapsed remains of the building associated with the Sunbury Railway Station building were identified. A newer brick structure, the Sunbury Substation, was also identified at the site.
PP 25 - Historic Homesteads and Structures with the Possible Risk for Unmarked Graves	The remains of farm labourer quarters were identified at this location. The structure is brick-built and plastered. A warm water system (donkey) is situated next to the bathroom of the building. A midden was also identified approximately 20 m from the structure. The remains of a cattle or pig shed were also identified and a brick and cement drinking trough was identified near the remains of the cattle/pig shed. Past experience has shown that in some cases stillborn babies and infants were frequently buried along the sides, or underneath, the parents' dwelling. No direct information with regards to the presence (or not) of such graves is currently available.	The remains of collapsed dwellings were observed. A single intact animal drinking trough was also found near the houses. The site is overgrown, and no remains of the shed were identified. No additional information regarding the presence (or not) of such graves is currently available.
PP 26 - Historic Homesteads and Structures with the Possible Risk for Unmarked Graves	The remains of a mud-brick homestead were identified at this location. Several modern metal artefacts such as wire, corrugated iron and cans were found scattered around the site. Past experience has shown that in some cases stillborn babies and infants were frequently buried along the sides, or underneath, the parents' dwelling. No	The site was found to consist of the remains of a barely visible foundation of a mudbrick house. The site was found to be very overgrown. No additional information regarding the presence (or not) of such graves is currently available.

SITE NUMBER AND TYPE	2012 DESCRIPTION	2021 DESCRIPTION
	direct information with regards to the presence (or not) of such graves is currently available.	
PP 27 - Historic Structure	The remains of a sandstone building were identified at this location. The structure was most probably a shed or a storeroom. The remains of a stone-walled kraal were identified next to the sandstone structure. Most of the walling for the kraal has been removed and only some sandstone blocks from the foundations are left.	The site was found to consist of a collapsed sandstone building and wall. The site is abandoned and poorly preserved. This said, the site appears to be in a similar condition as what was recorded in 2012.
PP 28 - Burial Ground	A small informal cemetery with 8 graves was identified at this location. The cemetery is fenced and is situated in the open veld. 1 grave dates from the early 1960s and belongs to the Skhosana family. Most of the graves are overgrown with grass and other vegetation. No grave goods were found with these graves.	All 8 graves were observed during the site visit undertaken recently. 1 of the graves contained a headstone, which is in a poor state of preservation and has fallen over. The graves are overgrown but clearly visible.
PP 29 - Historic Homesteads and Structures with the Possible Risk for Unmarked Graves	The remains of an extended mud-brick settlement were identified at this location. The remains of this mud-brick settlement consist of at least nine different homesteads or structures that formed part of the larger settlement. Most of the structures are ruined and were very difficult to identify. Several modern metal artefacts such as wire, corrugated iron and cans were found scattered around the site. Past experience has shown that in some cases stillborn babies and infants were frequently buried along the sides, or underneath, the parents' dwelling. No direct	The site was found to consist of the foundation remains of several mudbrick homesteads spread across the site. Only the raised foundations are visible on the surface. The site is overgrown. No other cultural remains were found. No additional information regarding the presence (or not) of such graves is currently available.

SITE NUMBER AND TYPE	2012 DESCRIPTION	2021 DESCRIPTION
	information with regards to the presence (or not) of such graves is currently available.	
PP 30 - Historic Farmstead	A farmstead with its associated buildings was identified at this location. The main house and other buildings are still intact and are still being occupied. The main house has been extended over the years and several extensions are visible and are all done in the same architectural style as the original building. According to the owner, Mr. Wilkie, the house is more than a hundred years old. The house has many different features and a detailed study by a heritage architect would be necessary to document them all. A second, more modern, house is situated opposite the original old house. According to the owner, Mr.Wilkie, this house is more than 60 years old. The house has internal electrical and plumbing systems. A storeroom or shed with farm implements was also identified. It has an external electrical system. Another storeroom or shed is situated next to the first shed. This building is in a rather poor state and more recent brick and cement supports had been placed there to extend the life of the building.	The site was found to consist of the remains of an abandoned farmstead with several buildings and a stone kraal. It appears as if the site has been abandoned for some period as the site is overgrown with vegetation. The main house and other buildings are intact and are currently unoccupied. The main house has been extended over the years and several extensions are visible. Two storerooms or sheds were also identified. The buildings are built with sandstone blocks and mortar and are located next to each other. The roof of one of the sandstone buildings has collapsed. Since the farmstead appears to be unoccupied, access could not be gained through the locked gate and electric fence.
PP 31 - Burial Ground	An informal cemetery with approximately 39 graves was identified at this location. The cemetery is not fenced and is located in a ploughed and planted field. Some of the graves had been cleaned recently, but most of them are overgrown with grass and other vegetation. According to	The site was found to consist of a cemetery containing a total of approximately 40 graves located in an agricultural field. Many of the graves have stone-lined dressings whereas some graves have formal dressings and inscribed

SITE NUMBER AND TYPE	2012 DESCRIPTION	2021 DESCRIPTION
	local residents, the graves are farmworker graves. Some families still live on the farm and others live in the settlement of Siyathuthuka.	headstones. The graves are clearly visibly. The cemetery is not fenced.
PP 32 - Historic Homesteads and Structures with the Possible Risk for Unmarked Graves	The remains of another mud-brick homestead were identified at this location. The remains of the mud-brick homestead consist of the foundations of four square structures and a circular structure. The structures are all placed around a central Lapa area. Several modern metal artefacts such as wire, corrugated iron and cans were found scattered around the site. Past experience has shown that in some cases stillborn babies and infants were frequently buried along the sides, or underneath, the parents' dwelling. No direct information with regards to the presence (or not) of such graves is currently available.	The site was found to consist of the remains of a mudbrick homestead, with only some of the foundations visible on site. The site is overgrown with vegetation. No additional information regarding the presence (or not) of such graves is currently available.
PP 33 - Historic Structure	-	The site consists of the stone foundation of a structure located approximately 25 m north of the old mine shaft at site PP 13. This suggests that the structure can in all likelihood be associated with the old mine shaft. The structure is rectangular in shape and consists of low stone foundations. No other cultural material was identified on-site.
PP 34 - Demolished Structure	-	The site consists of the demolished ruins of a multi-roomed brick house. The site is located approximately 100 m north of PP 7. A building is depicted in proximity to this site on the Second Edition of QDS 2530CA (Belfast)

SITE NUMBER AND TYPE	2012 DESCRIPTION	2021 DESCRIPTION
		Topographical Map that was compiled in 1989. This building is not depicted on the First Edition of this sheet that was surveyed in 1969. From this information it seems evident that the building at site PP 34 was built between 1969 - 1989. The building at site PP 34 is therefore younger than 60 years.
PP 35 - Contemporary Farmstead	-	The site consists of 2 brick buildings with tiled roofs. Structures. A third smaller brick building is located in the western corner of the property. A fourth building with a collapsed roof, most likely used as an outside storeroom, is located in the southern corner of the property. The property is surrounded by a fence and is currently occupied. The site is located approximately 90 m north-west of PP 8. A building is depicted in proximity to this site on the Second Edition of QDS 2530CA (Belfast) Topographical Map that was compiled in 1989. This building is not depicted on the First Edition of this sheet that was surveyed in 1969. From this information it seems evident that the buildings at site PP 35 were built between 1969 - 1989. These buildings are therefore younger than 60 years.
PP 36 - Historic Coal Mine Shaft	-	An abandoned coal mine shaft was identified here. The shaft measures approximately 2 x 2 m. It is located approximately 90 m south-west of the shaft at site PP 17. Because of the smaller shaft entrance, it was not possible

SITE NUMBER AND TYPE	2012 DESCRIPTION	2021 DESCRIPTION
		to get a clear view of the interior of the shaft. The age of this abandoned mine is not known but it is likely quite old.
PP 37 - Single Grave	-	1 grave was identified near the recorded positions of the farmhouse at PP 11 and the grave identified at site PP 10. The grave is located approximately 35 m northwest of PP 10. The grave at site PP 37 was pointed out by the farmworkers. Its surface is marked with an iron rod that was placed at the head of the grave. No other cultural remains were identified at the grave site.
PP 38 - Reservoir with Associated Structures	-	The site consists of a collapsed reservoir associated with a single brick building. Both the reservoir and brick building are younger than 60 years.
PP 39 - Reservoir with Associated Structures	-	The site consists of a circular reservoir associated with two brick buildings. Both the reservoir and brick buildings are younger than 60 years.
PP 40 - Historic Homestead with the Possible Risk for Unmarked Graves	-	The site consists of the stone foundations of a rectangular structure. The structure is located approximately 252 m north-west of the mudbrick homestead at site PP 26 and approximately 180 m west of the stone structure at site PP 27. It is most likely that the structure was a dwelling and can likely be associated with sites PP 26 and PP 27. Past experience has shown that in some cases stillborn babies and infants were frequently buried along the sides, or underneath, the parents' dwelling. No direct

SITE NUMBER AND TYPE	2012 DESCRIPTION	2021 DESCRIPTION
		information with regards to the presence (or not) of such graves is currently available.
PP 41 - Structure	-	The remains of a small, square structure were identified at this location. The structure was built with stone and cement and measures approximately 4 x 4 m in size. It has no roof and has only one entrance with no windows. The function and age of this structure are unknown. A section of one wall has broken away.
PP 42 - Animal Drinking Trough	-	An old animal drinking trough was identified at this location. The trough is constructed with blocks and cement and is plastered. The trough measures approximately 5 x 1 m and is approximately 0.75 m high. No other structures or features are associated with the trough. The age of the trough is not known.
PP 43 - Demolished Structure	-	The site consists of the remains of a demolished brick and plaster structure. The collapsed walls and foundations of the structure were found on site. A building is depicted in proximity to this site on the Second Edition of QDS 2530CA (Belfast) Topographical Map that was compiled in 1989. This building is not depicted on the First Edition of this sheet that was surveyed in 1969. From this information it seems evident that the building at site PP 43 was built between 1969 - 1989. The building at site PP 43 is therefore younger than 60 years.

SITE NUMBER AND TYPE	2012 DESCRIPTION	2021 DESCRIPTION
PP 44 - Reservoirs with Associated Structures	-	The site consists of 2 circular cement reservoirs. 3 delipidated brick buildings, with no roofs or windows, were also identified at the site. The site is believed to be younger than 60 years.
PP 45 - Demolished Structure	-	The site consists of the remains of a demolished multi-roomed structure. A building is depicted in proximity to this site on the Second Edition of QDS 2530CA (Belfast) Topographical Map that was compiled in 1989. This building is not depicted on the First Edition of this sheet that was surveyed in 1969. From this information it seems evident that the building at site PP 45 was built between 1969 - 1989. The building at site PP 45 is therefore younger than 60 years.

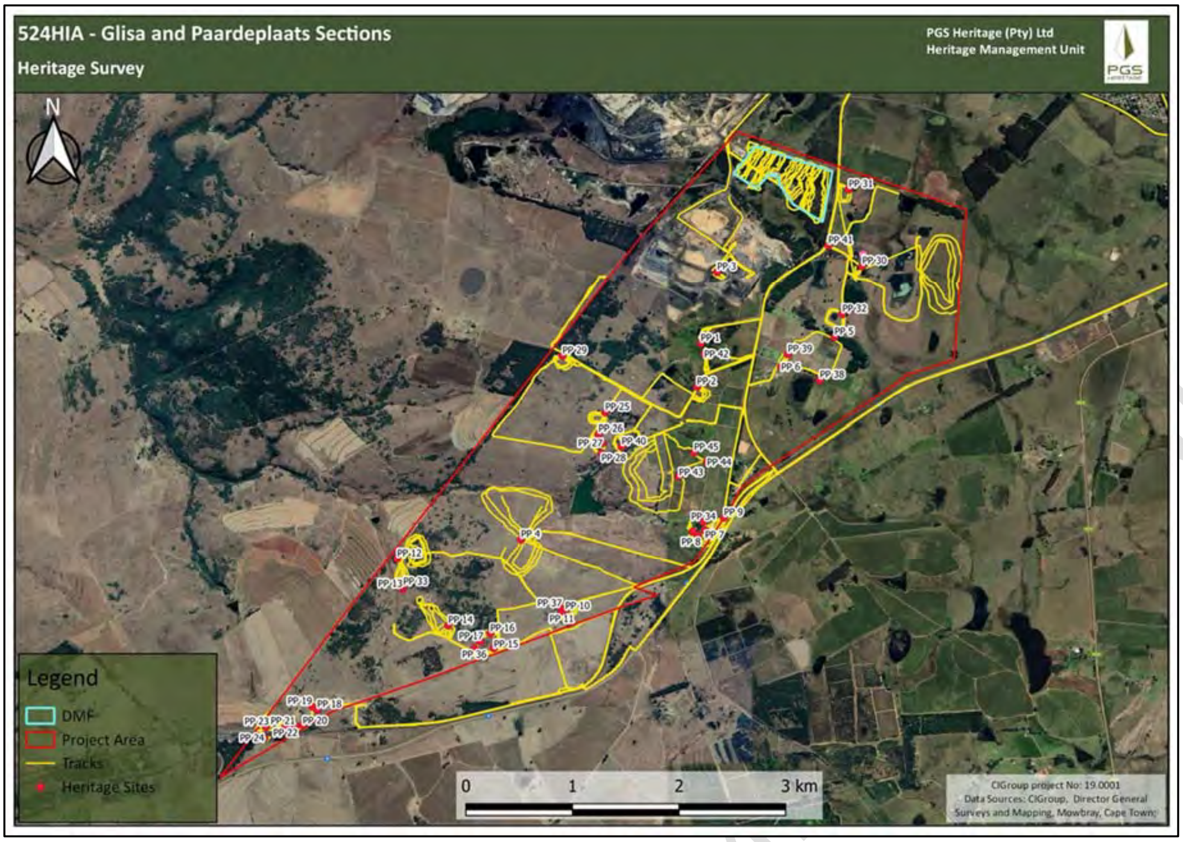

Figure 9.37: Identified Heritage Features within the Integrated Paardeplaats Section.

9.12 Socio-Economic Environment

9.12.1 Regional Context

The Integrated Paardeplaats Section is located in the eMakhazeni LM which forms part of the Nkangala DM in Mpumalanga Province of South Africa. Mpumalanga lies in eastern South Africa, north of KwaZulu-Natal and bordering Swaziland and Mozambique. It constitutes 6.5% of South Africa's land area. In the north it borders on Limpopo, to the west Gauteng, to the southwest the Free State and to the south KwaZulu-Natal. The capital is Mbombela. Mpumalanga Province is divided into three DMs, which are further subdivided into 17 LMs.

The Nkangala DM is one of the three DMs in Mpumalanga. Local municipalities forming part of the Nkangala DM are Delmas, Dr JS Moroka, Emalahleni, eMakhazeni, Steve Tshwete, and Thembisile, as well as the Mdala District Management Area. The district is approximately 17,000 square kilometre (km^2) and consists of about 165 towns and villages, with Emalahleni and Middelburg being the primary towns. The Nkangala DM has a population of approximately 1.1 million people, which constitutes almost a third of Mpumalanga's population. The Nkangala DM is at the economic hub of Mpumalanga and is rich in minerals and natural resources.

9.12.2 Local context

9.12.2.1 Demographics

According to the 2011 census, Mpumalanga recorded a population size of 4 039 939, ranking it sixth out of the nine provinces, of which, 90.65% are Black Africa, 7.51% are White, 0.91% are Coloured, 0.69% are Indian or Asian and the remaining 0.24% are other (**Figure 9.38**) (Stats SA, 2018\1). In 2011 census, the dominant home language in the eMakhazeni LM was SiSwati (28.35%), followed by IsiZulu (21.77%), isiNdebele (18.75%), and Afrikaans (10.66%).

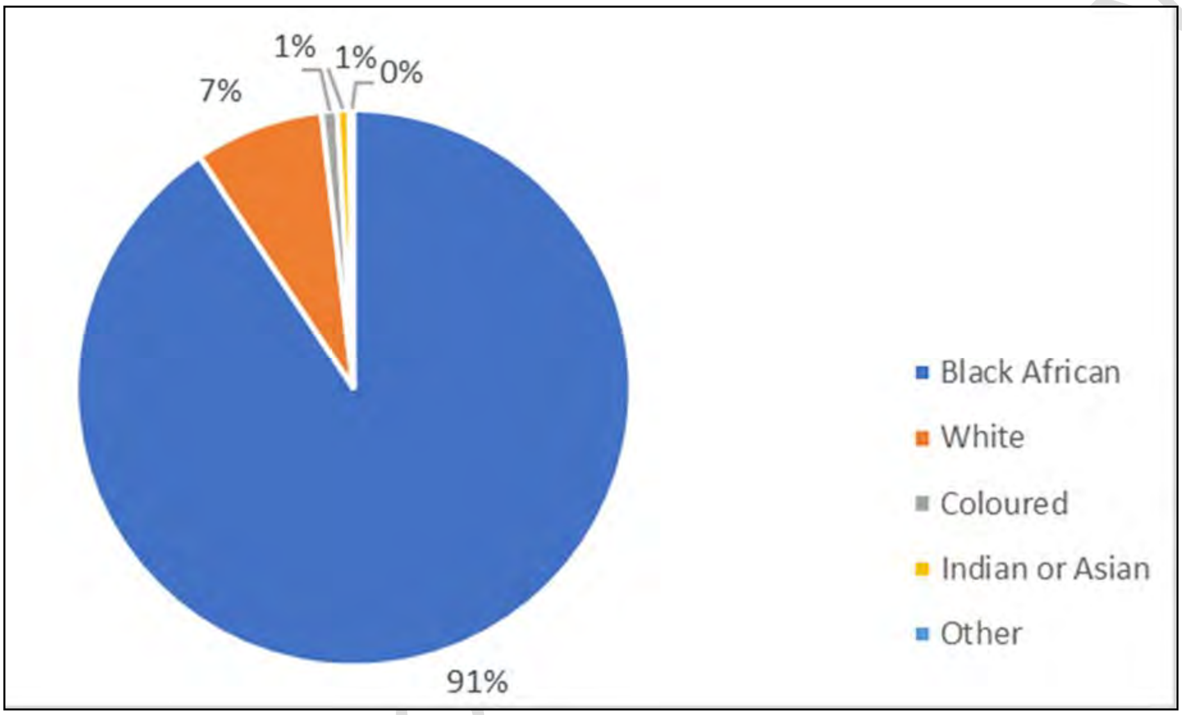

Figure 9.38: Population Groups (Stats SA, 2011).

The eMakhazeni LM is at the heart of the Mpumalanga province and is bordered by the Greater Groblersdal, Thaba-Chweu, Steve Tshwete, Albert Luthuli, and Mbombela Local Municipalities. The municipality is strategically located between the Pretoria/Johannesburg complex in Gauteng and Nelspruit in Mpumalanga and is situated on the N4 Maputo corridor. The dominant economic activity in the area is farming (IDP, 2020). Farming occupies the largest part of the physical area. There are a number of small towns in the area that serve as service centres for the agricultural sector, namely:

- eMakhazeni (Belfast) and Siyathuthuka;
- Dullstroom and Sakhelwe;
- Entokozweni (Machadodorp) and Emthonjeni;
- Waterval-Boven and Emgwenya.

The district's economy is dominated by electricity, manufacturing, and mining. Community services, trade, finance, transport, agriculture, and construction are also important sectors. Nkangala's Integrated Development Plan (IDP) states that the district has extensive mineral deposits, including chrome and coal.

The majority of the population is men with 51.4% (**Figure 9.39**). The most spoken language in the eMakhazeni LM is isiZulu (35.7%), followed by IsiNdebele (25.1%) and Afrikaans (15.7%).

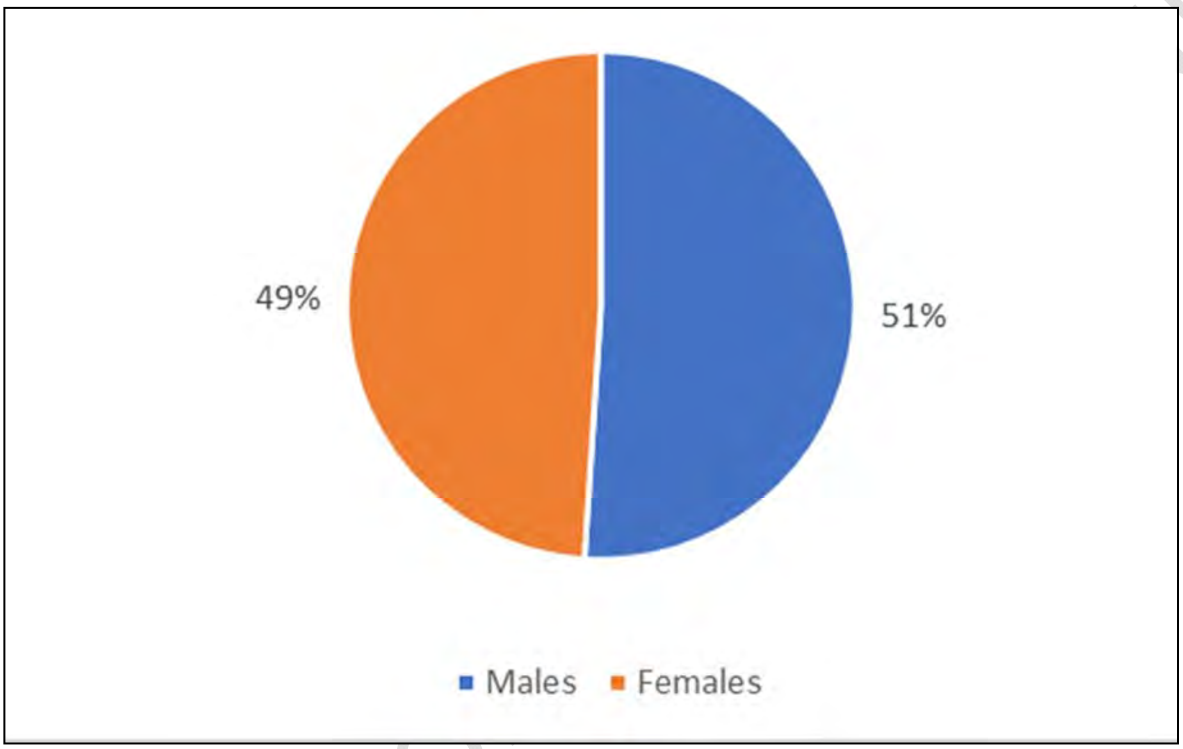

Figure 9.39: Sex (Stats SA, 2011).

9.12.2.2 Education

Education is a major challenge in the area as about 30% of children in the area of school-going age do not have access to quality education (IPD, 2020). This is due to the rural nature of the area. The majority of schools are farm schools which are multi-graded, and that lack quality infrastructure and adequate human resources. The majority of primary schools are on the NSNP (National Schools Nutrition Programme) and the municipality welcomes the proposal of the Department of Education to extend the programme to high schools. There is only one tertiary education facility in the area, namely a FET College at Emgwenya. **Table 9.41** gives a summary of the number and type of schools in the eMakhazeni LM (IDP, 2020).

Table 9.41: Summary of schools in the eMakhazeni Local Municipality.

TYPE OF SCHOOL	NUMBER
Primary Schools (Farms)	7
Primary Schools (Farms)	13
Secondary Schools	5
Secondary Schools (Farms)	4
Private Schools	4
Schools for learners with special education needs	4
FET	1
Total	**35**

9.12.2.3 Employment

The main industry of employment in Mpumalanga as well as in the eMakhazeni LM is Manufacturing, Community, social and personal services and Wholesale and retail trade. The Community, social and personal services sector includes public administration and defence activities, education and health and social work. Other large employment sectors in the Emakhazeni LM are Wholesale and retail trade and Manufacturing. The pattern of overall unemployment rate in eMakhazeni has changed as compared to 2001 where the LM wase at 30% and in 2011, it was at 25.92 percent. Employment opportunities are favourable in the municipality, particularly for males, about 80% of males and 66% females were employed in 2011.

Figure 9.40 shows employment status for the population in the economically active group (15 to 65 years old) and further indicate that there has been a reduction in the percentage of unemployed in the district between 2001 and 2011 for both males and females. The decline is similar for males and females, although employment remains higher for males than for females.

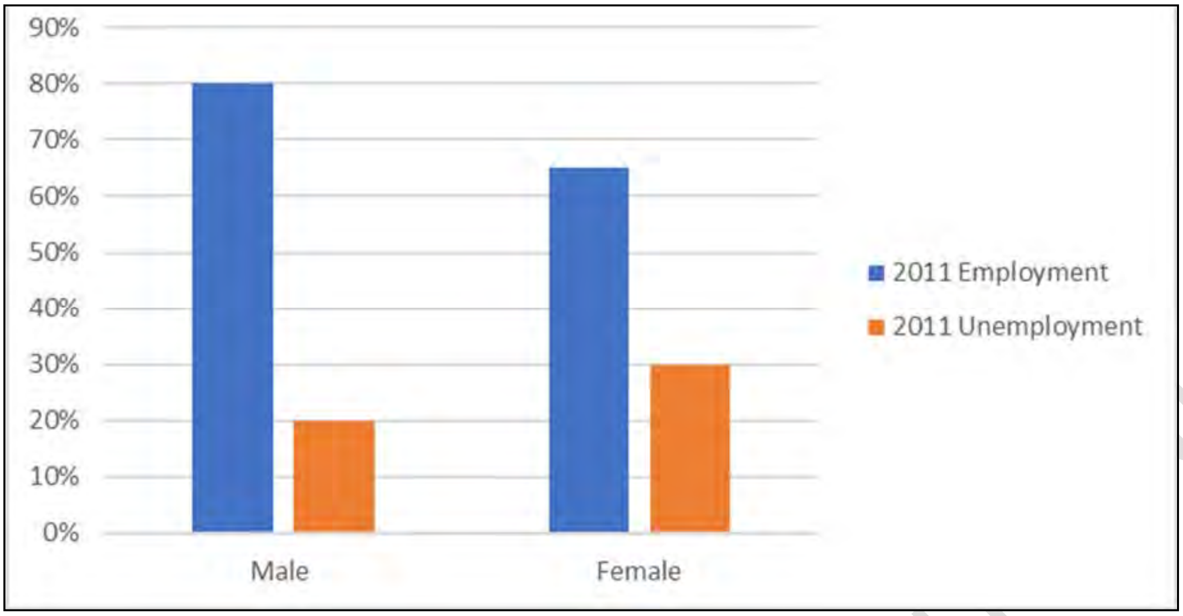

Figure 9.40: Employment status (StatsSA 2011).

9.13 Description of Current Land Uses

The Integrated Paardeplaats Section is situated approximately 5 km South of the town of eMakhazeni (Belfast). The closest settlement to the Sections is the Siyathuthuka Township, approximately 1 km North of the Integrated Paardeplaats Section. The site is located within an area that consists of three main land uses, i.e. active mining areas, rehabilitated areas, and agricultural areas. Farming is the second largest land use occurring within the greater area. The MR areas are surrounded by farms to the east, west, and south. Farms within the area are predominantly used for monocultures such as maize as well as grazing land for cattle and sheep. Within the Paardeplaats Section this trend is also observable as it is dominated by maize farming and grazing land for cattle, sheep, blesbok, and springbok. The Paardeplaats Section also contains irrigated land used by Hadeco for their highly specialised cold climate bulb operation.

9.14 Description of Specific Environmental Features and Infrastructure on Site

There are isolated farmsteads that are comprised of farm buildings including residential buildings and storage facilities in the Paardeplaats Section. Some of these farmsteads need to be relocated as mining progresses. NBC are in the process of developing and executing a Resettlement Action Plan (RAP) with selected farmsteads as a separate process to the environmental authorisation process.

9.15 Environmental and Current Land Use

Figure 9.41 presents the current land use map with important environmental features.

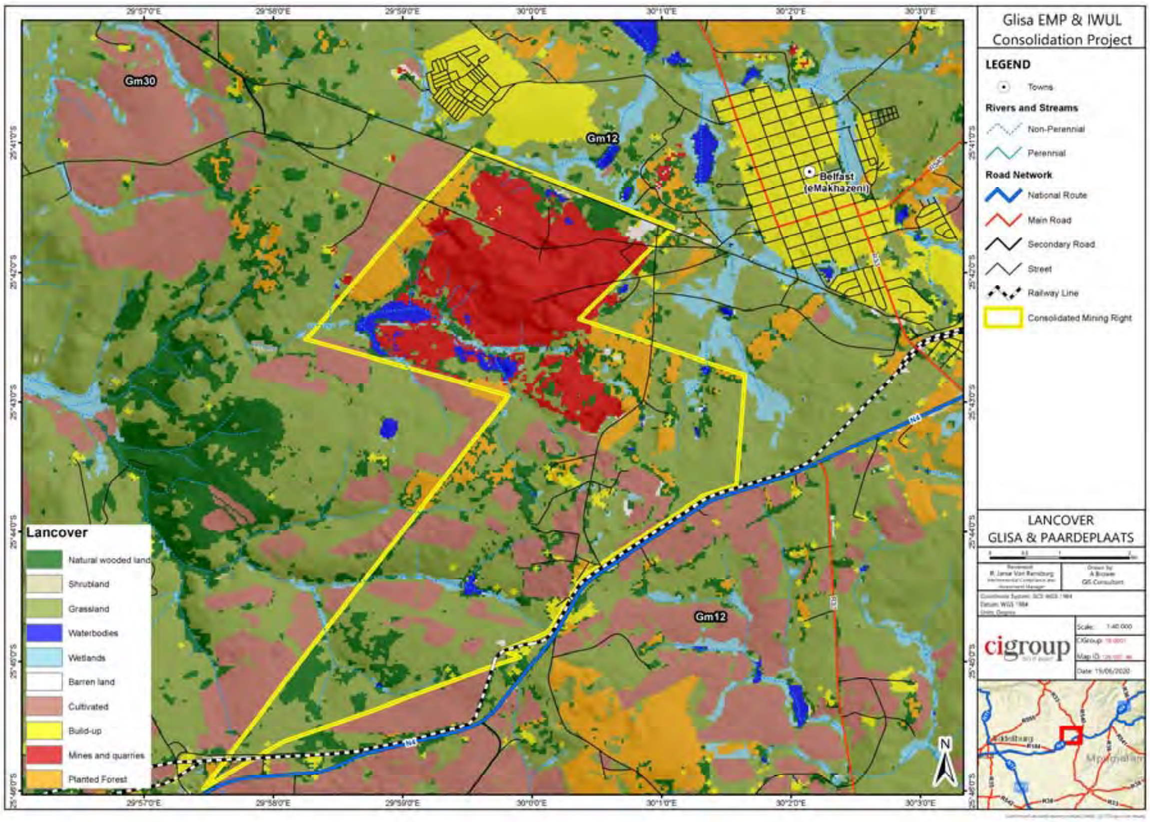

Figure 9.41: Land Uses within the Integrated Paardeplaats Section.

10 ASSESSMENT AND EVALUATION OF ENVIRONMENTAL IMPACTS

10.1 Summary of Impacts Identified by Specialists

10.1.1 Climate Change

During an assessment in 2016 of South Africa's coal mining sectors' response to climate change adaption demands climate change adaptation has received limited attention compared to mitigation across all spatial levels. This is besides the documented adverse impacts of climate change in different sectors of societies including mining in general and coal mining specifically. Against this background, the 2016 assessment set three objectives:

- The first objective was to identify current and possible future climate change impacts that may affect selected coal mines in South Africa;

- The second objective was to establish the nature and extent to which these mines were ready to address and implement adaptation measures; and
- The last objective was to determine and document existing climate change adaptation practices in selected mines.

Employing the mixed methods approach, the research engaged five (5) coal mines located in the Mpumalanga, Free State and KwaZulu-Natal Provinces, gathering both qualitative and quantitative data which was analysed thematically. The 2016 assessment had three major findings:

- The first finding was that the climatic conditions in the research areas have been changing over the observed period. In general, rainfall has been declining and temperatures have been increasing, leading to increased cases of extreme fog, mist and heatwaves.
- The second finding was that there has been an increase in frequency and intensity of extreme weather events, most notably, floods and droughts. These changes in the climate and associated weather events have frequently affected mine operations particularly at the production sub-chain of the coal mining value chain.
- The third major finding was that despite this evidence of adverse impact of climate change on the production sub-chain of the South African coal mining value chain, adaption responses in all the studied mines showed reactive adaptation to extreme events instead of proactive adaptation planning and implementation.

South Africa depends on coal-derived energy, electricity in particular, and the coal mines are implicitly exposed and vulnerable to the adverse impacts of climate change. Reducing this exposure and vulnerability dictates the urgent need to implement anticipatory adaptation measures in all the sub-chains of the coal mining value chain.

Coal is the world's most abundant and widely distributed fossil fuel source and will remain so well into the future. At present approximately 23% of primary global energy needs are met by coal and 40% of electricity is generated from coal. About 70% of world steel production depends on coal feedstock. The combustion of coal is the largest contributor to the human-made increase of Carbon Dioxide (CO_2) in the atmosphere. Electric generation using coal burning produces approximately twice the greenhouse gasses per kilowatt compared to generation using natural gas.

Coal mining releases methane, a potent greenhouse gas. Methane (CH_4) is the naturally occurring product of the decay of organic matter as coal deposits are formed with increasing depths of burial, rising temperatures, and rising pressure over geological time. A portion of the methane produced is absorbed by the coal and later released from the coal seam (and surrounding disturbed strata) during the mining process. Methane accounts for 10.55% of greenhouse-gas emissions created through human activity. According to the Intergovernmental Panel on Climate Change (IPCC), methane has a global warming potential 21 times greater than that of carbon dioxide over a 100-year timeline. The process of mining can release pockets of methane, and these gases may pose a threat to coal miners, as well as being a source of air pollution. This is due to the relaxation of pressure and fracturing of the strata during mining activity, which gives rise to safety concerns for the coal miners if not managed properly. The build-up of pressure in the strata can lead to explosions during (or after) the mining process if prevention methods, such as "methane draining", are not taken.

In 2008 James E. Hansen and Pushker Kharecha published a peer-reviewed scientific study analysing the effect of a coal phase-out on atmospheric CO_2 levels. Their baseline mitigation scenario was a phase-out of global coal emissions by 2050. Under the Business as Usual scenario, atmospheric CO_2 peaks at 563 parts per million (ppm) in the year 2100. Under the four coal phase-out scenarios, atmospheric CO_2 peaks at 422–446 ppm between 2045 and 2060 and declines thereafter.

Climate change is unlikely to have a major direct impact on the mining industry, for which regulations and management strategies are already in place to manage factors such as water usage, water conservation and demand strategies and environmental issues relating to rehabilitation and the provision of rehabilitation guarantees. While a lack of access to water may affect some mining projects, most mining processes do not generally require potable water. Where high-quality water is required, some mines are already installing water treatment units.

Changes in the frequency and intensity of storm events have the potential to impact on mining operations (e.g. tailing dams, sediment and erosion control); however, these impacts can normally be addressed as part of the mine's storm water management plan.

The highest risk to the mining industry from climate change is most likely to come from meeting growing community concerns over environmental issues. This is likely to increase the difficulty in obtaining approvals for mining projects (particularly for coal). Additional constraints on mining may also affect the economic viability of individual mines, leading to flow-on effects to communities, through job losses and a decline in regional revenue. Work to develop clean coal technologies may ameliorate this risk to some extent; however, the actual process of mining is likely to face increasing community pressure.

10.1.2 Air Quality

10.1.2.1 Construction Phase

Typical activities associated with the construction phase include site clearing, removal of topsoil and vegetation, construction of the DMF and associated infrastructure, and general transportation and hauling of material.

10.1.2.2 Operational Phase

The following activities during the operational phases are identified as possible fugitive emission sources and may impact on the ambient air quality at the relevant environmental sensitive receivers:

- Dust from material handling.
- Wind erosion from DMF.

Total Suspended Particles (TSP) is the amount of particulate matter in the air that we breathe. Particulate Matter (PM) is the collective name for fine solid or liquid particles added to the atmosphere by processes at the earth's surface, and includes dust, smoke, pollen and soil particles (Kemp, 1998). PM has been linked to a range of serious respiratory and cardiovascular health problems. PM can principally be characterised as discrete particles spanning several orders of magnitude in size, with inhalable particles falling into the following general size fractions (USEPA, 1996):

- TSP, generally defined as all particles with a diameter less than or equal to 100 microns;
- PM 10, generally defined as all particles equal to and less than 10 microns in aerodynamic diameter; particles larger than this are generally not deposited in the lung;
- PM 2.5, also known as fine fraction particles, generally defined as those particles with an aerodynamic diameter of 2.5 microns or less;
- PM 10-2.5, also known as coarse fraction particles, generally defined as those particles with an aerodynamic diameter greater than 2.5 microns, but equal to or less than a nominal 10 microns; and
- Ultra-fine particles, generally defined as those less than 0.1 microns.

Guidelines provide a basis for protecting public health from adverse effects of air pollution and for eliminating, or reducing to a minimum, those contaminants of air that are known or likely to be hazardous to human health and well-being (WHO, 2000). Once the guidelines are adopted as standards, they become legally enforceable. The South African Bureau of Standards (SABS), in collaboration with Department of Forestry, Fisheries and Environment (DFFE), established ambient air quality standards (South African National Standard (SANS) 1929:2011) for gravimetric dust fallout as indicated in **Table 10.1**.

Table 10.1: SANS 1929:2011 Limits for PM 10.

AVERAGE PERIOD	CONCENTRATION (µg/m³)	FREQUENCY OF EXCEEDANCES
24 hours	75	4
1 year	40	0

Increasing reliance has been placed on estimates from models as the primary basis for environmental and health impact assessments. Dispersion models compute ambient concentrations as a function of source configurations, and meteorological characteristics, providing a tool to calculate the spatial and temporal patterns in the ground level concentrations arising from the emissions of emissions sources. For the purpose of this assessment, the regulatory model of the US.EPA, AERMET/AERMOD dispersion model suite was chosen for use. AERMET uses both surface and upper air data, and also has a terrain pre-processor (AERMAP) for including a large topography into the model. Input data required for the AERMOD model include:

- Source emissions and type data;
- Meteorological data (pre-processed by the AERMET model);
- Terrain data; and
- The receptor grids.

AERMOD requires two specific input files generated by the AERMET pre-processor. AERMET is designed to be run as a three-stage processor and operates on three types of data (upper air data, on-site measurements, and the national meteorological database). Use was made of the WRF AERMET ready weather data prepared with MMIF for the period 1 January 2018 to 31 December 2020.

AERMOD is able to model point, area, volume, pit and line sources. Wind erosion sources such as stockpiles and unpaved roads were modelled as area sources whilst material transfer points and crushing and screening were modelled as volume sources. Emission factors are quantified using the Australian National Pollutant Inventory (NPI) which is an improvement on the US Environmental Protection Agency (US.EPA) AP-42 document of Air Pollution Emission Factors for Australian conditions, for fugitive dust deriving from material handling, on-site roads, milling and crushing operations, drilling and blasting, and wind erosion from exposed surfaces. The NPI emission factors which were utilised as inputs for the model are presented in **Table 10.2** and include an Emission Factor Rating (EFR) code as developed by the US EPA and the European Environmental Agency.

The calculated source emissions rates generated by the model are presented in **Table 10.3**.

Table 10.2: NPI Emission Factors.

ACTIVITY	TSP	PM 10	UNITS	RATING
Excavators Shovels Front-end Loaders	0.025	0.012	kg/t	Unrated
Wind Erosion	0.4	0.2	kg/ha/h	Unrated

Table 10.3: Calculated Source Emission Rates Summary.

ACTIVITY	UNIT	UNMITIGATED		PROPOSED MITIGATION	MITIGATED	
		TSP	PM 10		TSP	PM 10
Material handling – discard	g/s	4.19E-01	2.01E-01	Water sprays (50% reduction)	2.10E-01	1.01E-01
Wind erosion	$g/s/m^2$	1.11E-05	5.56E-06	Revegetation (90% reduction)	1.11E-06	5.56E-07

The pollutant dispersion was setup for a modelled domain of 5 km (north-south) by 5 km (east-west) with the centre of the proposed DMF in the centre of the modelling domain. Modelling was undertaken for two proposed operational phase scenarios:

- Unmitigated – Material handled dry; and
- Mitigated – Identified mitigation measures (i.e., water sprayers and revegetation) applied.

Dispersion modelling was undertaken to determine 2nd highest daily and annual average Ground Level Concentrations (GLCs) for PM 10. Total daily dust fallout rates (TSP) were also simulated. These averaging periods are selected to draw comparisons between PM 10 predicted concentrations/deposition with relevant air quality guidelines and dust fallout limits, respectively. Isopleths plots were generated, to visually display the interpolated values from the concentrations predicted by the model for each of the receptor grid points. Plots reflecting daily averaging periods contain only the 2nd highest predicted GLC for the daily concentration, over the entire period for which simulations were undertaken. It is therefore possible that even though a high hourly or daily average concentration is predicted at certain locations, this may only be true for one day during the modelling period.

Isopleth plots which visually show the predicted GLC of TSP are presented in **Figure 10.1 – Figure 10.4** for the unmitigated and mitigated scenarios. In both the unmitigated and mitigated scenarios, it is not predicted that any sensitive receptors (**Figure 9.5**) will be exposed to dust fallout exceeding the monthly dust fallout residential limit of 600 milligrams per square metre per day ($mg/m^2/day$) (**Table 10.4**). The predicted annual dust fallout for the unmitigated and mitigated scenarios are also not predicted to exceed the annual limit of 300 $mg/m^2/day$ at any of the sensitive receptor locations (**Table 10.4**).

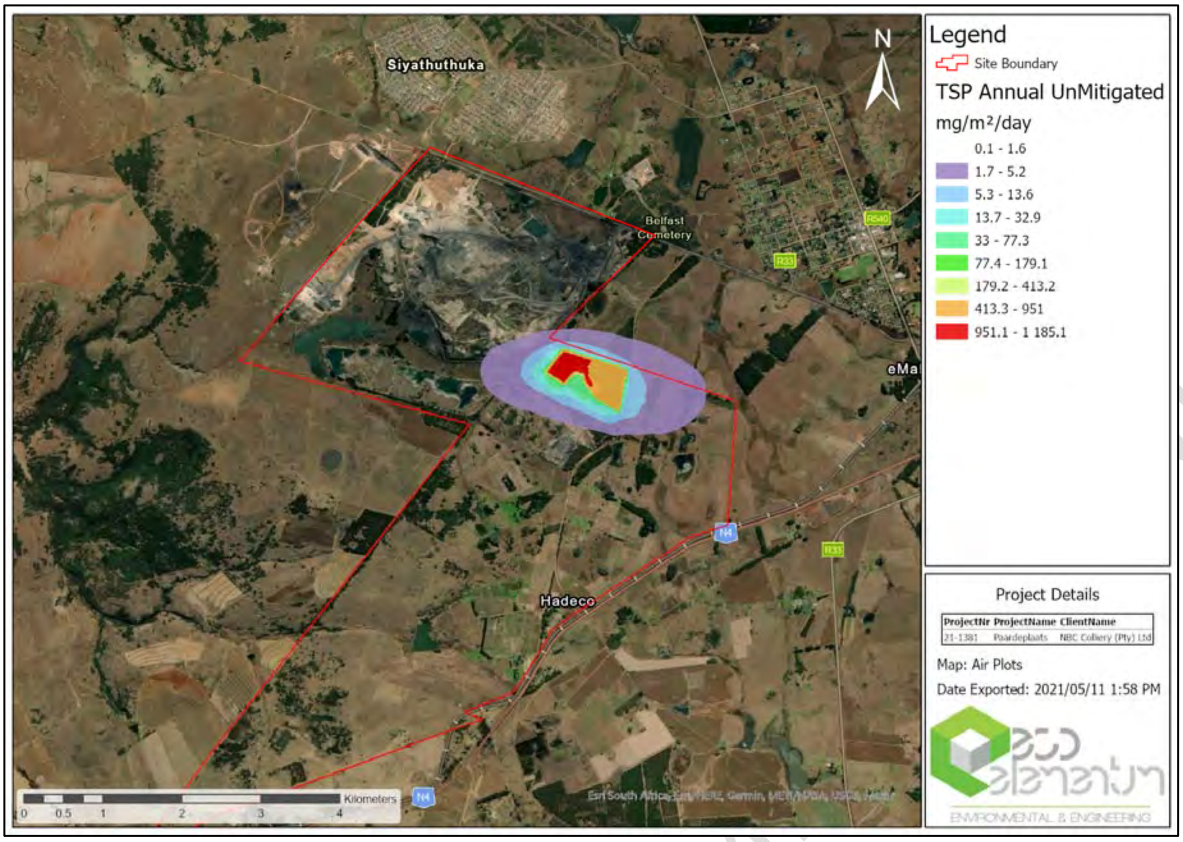

Figure 10.1: Predicted Average Annual TSP Deposition (Unmitigated).

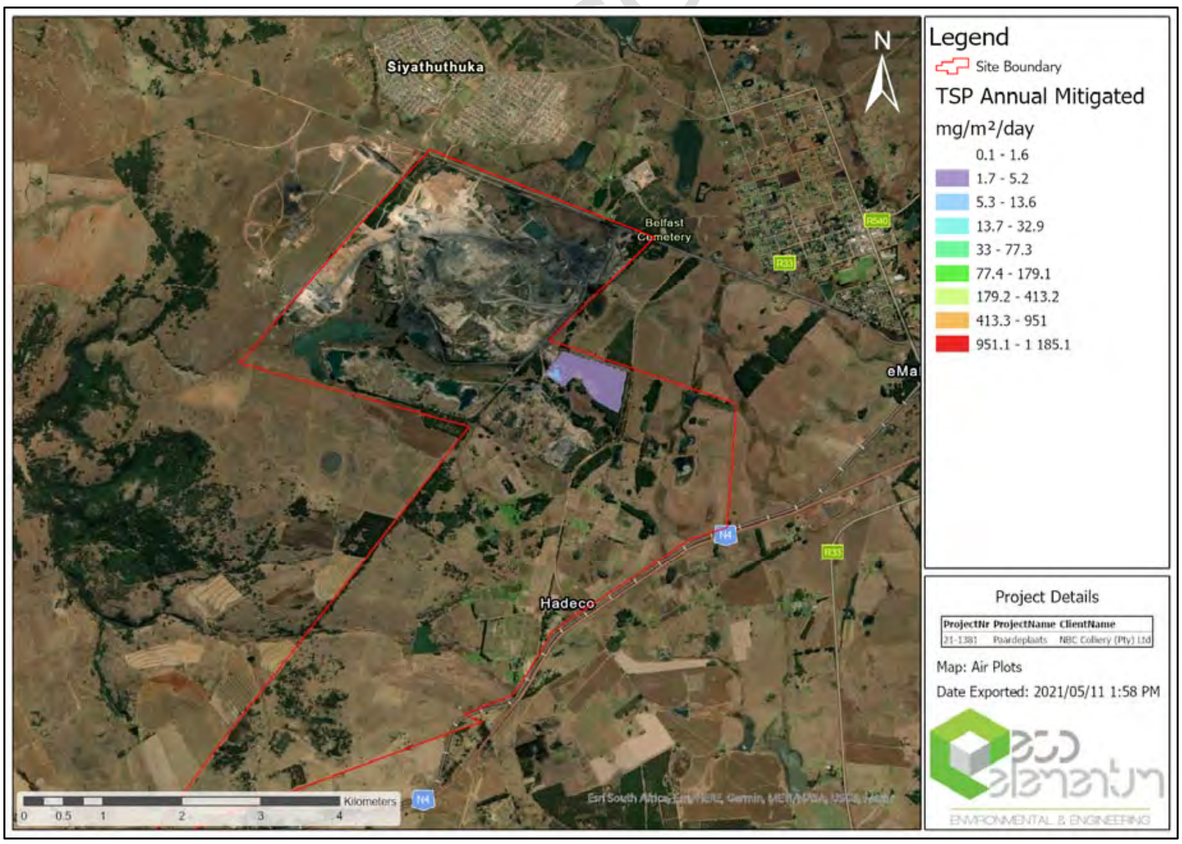

Figure 10.2: Predicted Average Annual TSP Deposition (Mitigated).

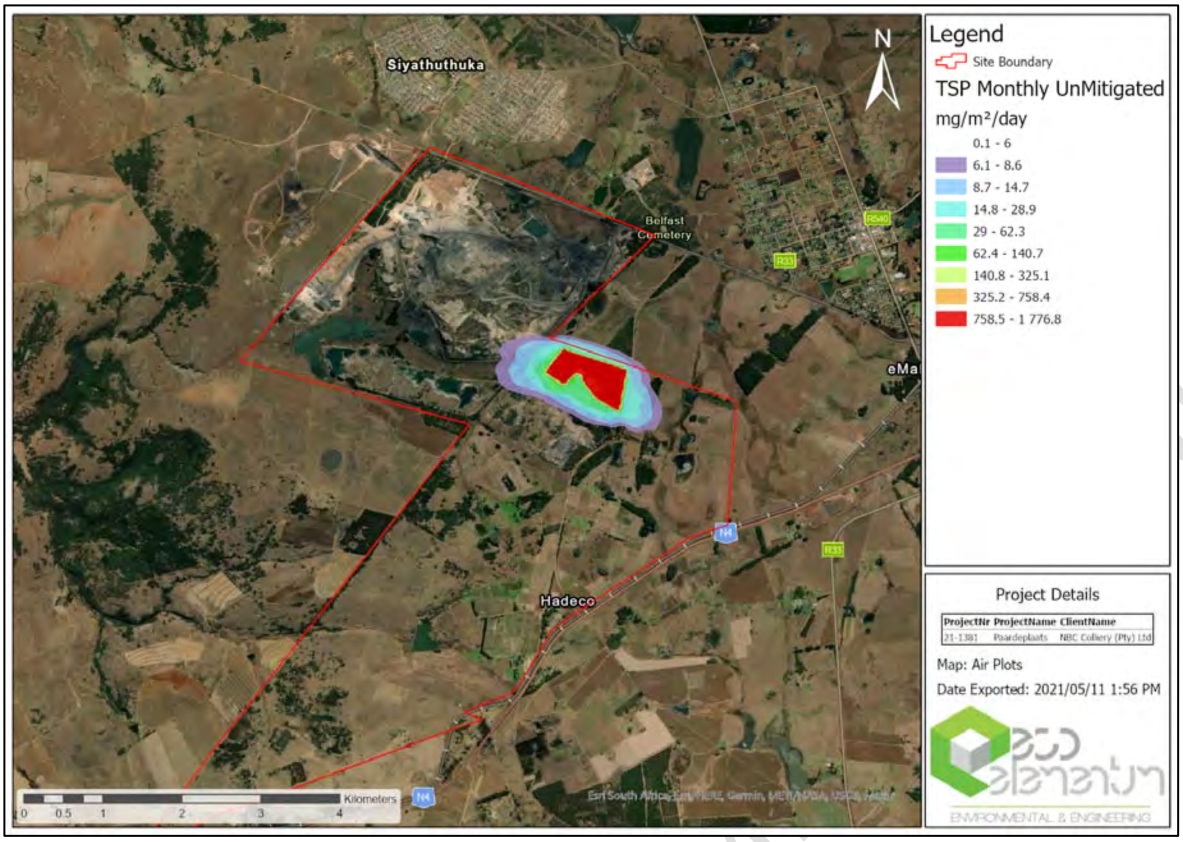

Figure 10.3: Predicted Highest Monthly TSP Deposition (Unmitigated).

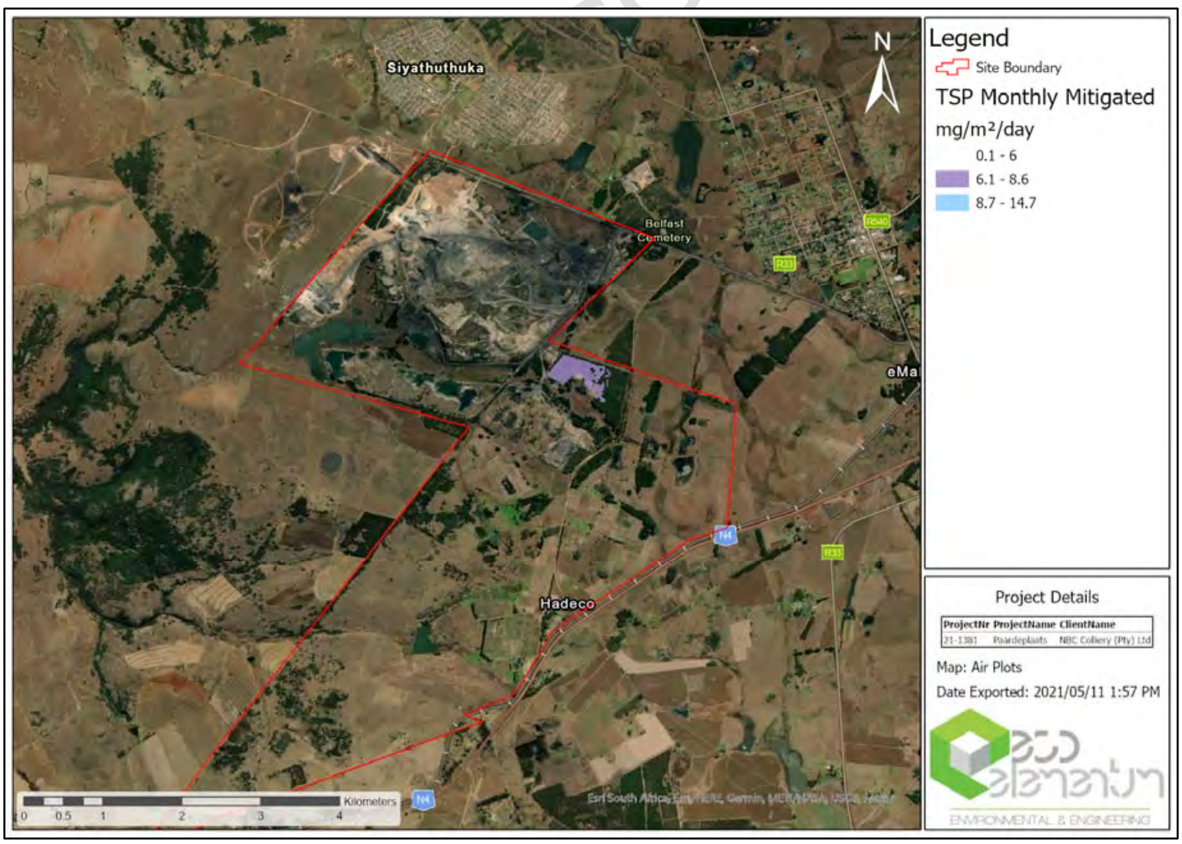

Figure 10.4: Predicted Highest Monthly TSP Deposition (Mitigated).

Table 10.4: TSP Deposition Rates at Sensitive Receptor Locations.

RECEPTOR	TSP HIGHEST MONTHLY (mg/m²/day)		TSP ANNUAL AVERAGE (mg/m²/day)	
	UNMITIGATED	MITIGATED	UNMITIGATED	MITIGATED
1	0.07	0.00	0.02	0.00
2	0.09	0.00	0.02	0.00
3	0.11	0.00	0.03	0.00
4	0.13	0.00	0.03	0.00
5	0.15	0.00	0.04	0.00
6	0.19	0.00	0.06	0.00
7	0.20	0.00	0.06	0.00
8	0.21	0.00	0.07	0.00
9	0.08	0.00	0.03	0.00
10	0.10	0.00	0.04	0.00
11	0.14	0.00	0.07	0.00
12	0.28	0.00	0.11	0.00
13	0.42	0.00	0.19	0.00
14	0.58	0.00	0.30	0.00
15	0.51	0.00	0.26	0.00
16	0.35	0.00	0.23	0.00
17	0.32	0.00	0.20	0.00
18	0.35	0.00	0.19	0.00
19	0.35	0.00	0.17	0.00
20	0.24	0.00	0.12	0.00
21	0.42	0.00	0.18	0.00
22	0.49	0.00	0.21	0.00
23	0.53	0.00	0.22	0.00
24	0.65	0.00	0.25	0.00
25	0.63	0.00	0.21	0.00
26	0.31	0.00	0.09	0.00
27	0.47	0.00	0.13	0.00
28	0.50	0.00	0.13	0.00
29	0.08	0.00	0.02	0.00
30	0.11	0.00	0.03	0.00
31	0.11	0.00	0.03	0.00
32	0.05	0.00	0.02	0.00
33	0.06	0.00	0.02	0.00
34	0.05	0.00	0.01	0.00
35	0.01	0.00	0.00	0.00
36	0.01	0.00	0.00	0.00
37	0.01	0.00	0.00	0.00

RECEPTOR	TSP HIGHEST MONTHLY (mg/m²/day)		TSP ANNUAL AVERAGE (mg/m²/day)	
	UNMITIGATED	MITIGATED	UNMITIGATED	MITIGATED
38	0.01	0.00	0.00	0.00
39	0.01	0.00	0.00	0.00
40	0.01	0.00	0.00	0.00
41	0.01	0.00	0.00	0.00
42	0.01	0.00	0.00	0.00
43	0.01	0.00	0.00	0.00
44	0.01	0.00	0.00	0.00
45	0.01	0.00	0.00	0.00
46	0.01	0.00	0.01	0.00
47	0.01	0.00	0.01	0.00
48	0.01	0.00	0.01	0.00
49	0.01	0.00	0.01	0.00
50	0.01	0.00	0.00	0.00
51	0.04	0.00	0.01	0.00
52	0.06	0.00	0.01	0.00
53	0.02	0.00	0.01	0.00

Figure 10.5 – Figure 10.6 present the predicted GLC for PM 10 for the unmitigated scenario. PM 10 isopleth plots for the mitigated scenario are not provided because the mitigated concentrations are so low that they do not reflect visually at the level of modelling. The annual average PM 10 limit of 40 micrograms per cubic metre (µg/m³) is not predicted to be exceeded at any of the identified sensitive receptors (**Figure 9.5**) for both the mitigated and unmitigated scenario (**Table 10.5**). For the unmitigated and mitigated daily PM 10 concentrations (2nd highest levels within a 24-hour period) it is not predicted to be higher than the 75 micrograms per cubic metre (µg/m³) limit for any of the identified sensitive receptors (**Table 10.5**).

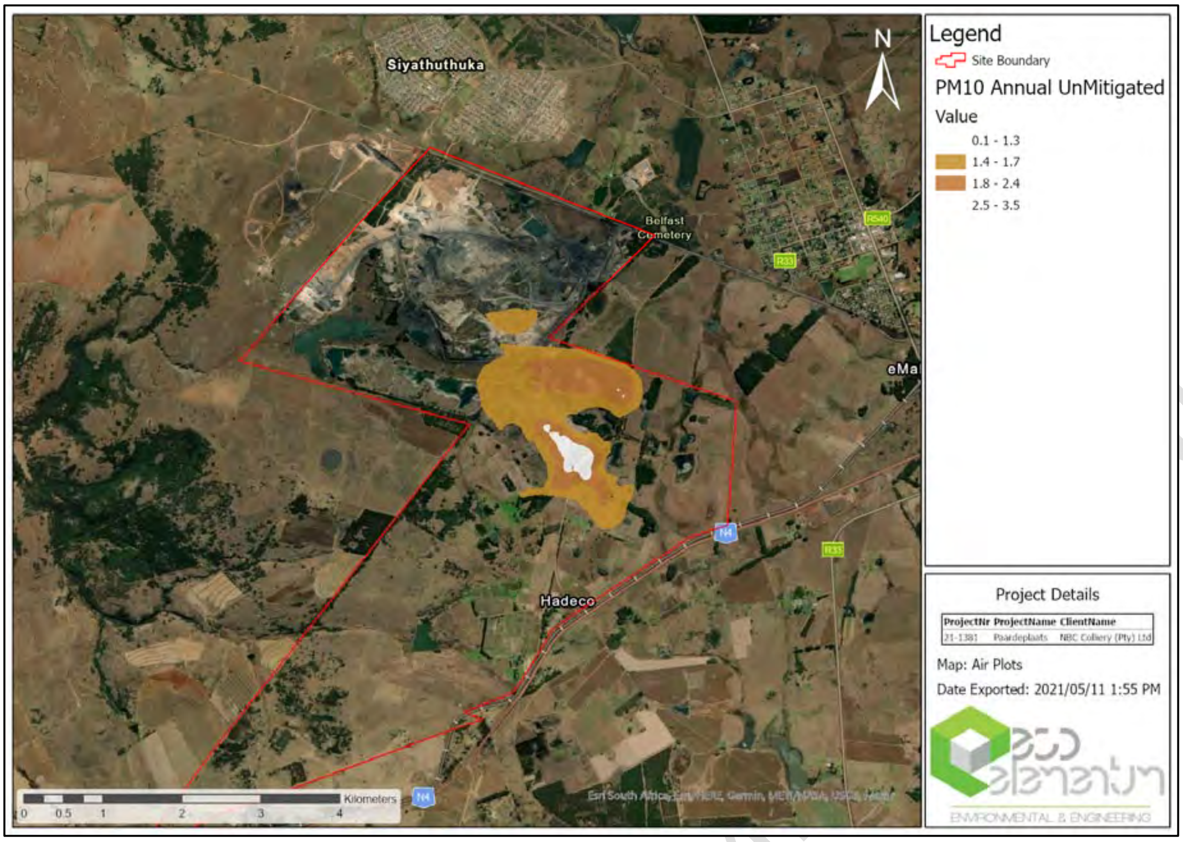

Figure 10.5: Predicted Average Annual PM 10 Concentrations (Unmitigated).

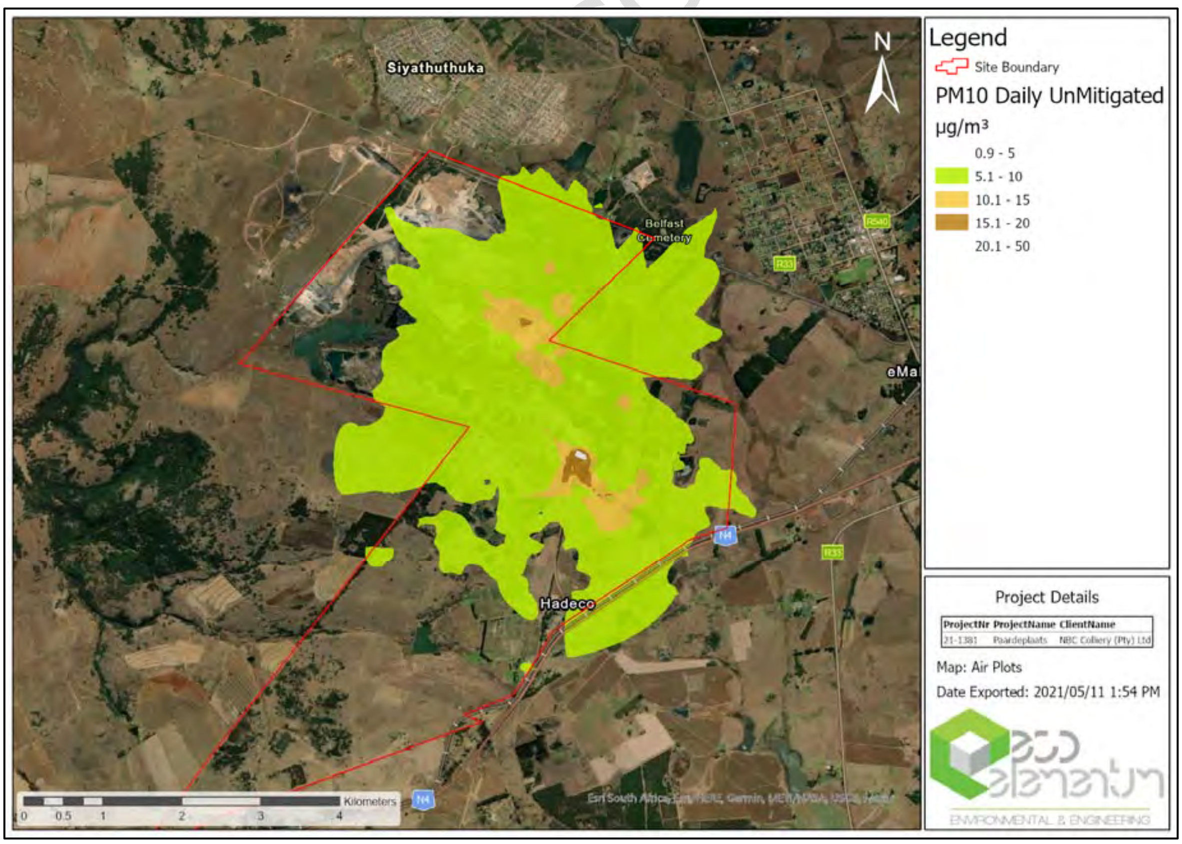

Figure 10.6: Predicted 2nd Highest Daily PM 10 Concentrations (Unmitigated).

Table 10.5: PM 10 Concentrations at Sensitive Receptor Locations.

RECEPTOR	PM 10 2ND HIGHEST DAILY (ug/m³)		PM 10 ANNUAL AVERAGE (ug/m³)	
	UNMITIGATED	MITIGATED	UNMITIGATED	MITIGATED
1	2.26	0.23	0.17	0.02
2	2.52	0.25	0.20	0.02
3	2.51	0.25	0.21	0.02
4	2.77	0.28	0.24	0.02
5	2.89	0.29	0.26	0.03
6	4.12	0.41	0.27	0.03
7	4.55	0.46	0.26	0.03
8	3.95	0.40	0.23	0.02
9	2.81	0.28	0.08	0.01
10	3.17	0.32	0.08	0.01
11	3.27	0.33	0.08	0.01
12	4.20	0.42	0.08	0.01
13	4.11	0.41	0.09	0.01
14	3.42	0.34	0.11	0.01
15	2.95	0.30	0.09	0.01
16	2.18	0.22	0.07	0.01
17	2.18	0.22	0.06	0.01
18	2.19	0.22	0.06	0.01
19	1.58	0.16	0.04	0.00
20	1.05	0.11	0.03	0.00
21	0.84	0.08	0.05	0.00
22	0.82	0.08	0.05	0.01
23	0.96	0.10	0.06	0.01
24	1.19	0.12	0.07	0.01
25	2.29	0.23	0.16	0.02
26	2.69	0.27	0.20	0.02
27	1.73	0.17	0.10	0.01
28	3.81	0.38	0.24	0.02
29	2.42	0.24	0.14	0.01
30	4.81	0.48	0.54	0.05
31	4.56	0.46	0.53	0.05
32	5.07	0.51	0.51	0.05
33	4.85	0.49	0.52	0.05

RECEPTOR	PM 10 2ND HIGHEST DAILY (ug/m³)		PM 10 ANNUAL AVERAGE (ug/m³)	
	UNMITIGATED	MITIGATED	UNMITIGATED	MITIGATED
34	2.25	0.22	0.14	0.01
35	2.55	0.25	0.23	0.02
36	2.00	0.20	0.14	0.01
37	1.43	0.14	0.13	0.01
38	1.60	0.16	0.14	0.01
39	1.61	0.16	0.13	0.01
40	2.23	0.22	0.18	0.02
41	2.21	0.22	0.19	0.02
42	2.11	0.21	0.20	0.02
43	2.15	0.21	0.20	0.02
44	2.20	0.22	0.20	0.02
45	2.20	0.22	0.19	0.02
46	2.77	0.28	0.24	0.02
47	2.45	0.25	0.24	0.02
48	2.71	0.27	0.25	0.03
49	2.63	0.26	0.23	0.02
50	1.81	0.18	0.18	0.02
51	2.26	0.23	0.22	0.02
52	1.84	0.18	0.17	0.02
53	1.45	0.14	0.08	0.01

10.1.2.3 Decommissioning, Closure and Rehabilitation Phase

Typical activities associated with the decommissioning, closure and rehabilitation phase include the rehabilitation of exposed areas including the spreading of soil, revegetation and profiling/contouring.

10.1.2.4 Cumulative Impacts

The Integrated Paardeplaats Section is surrounded by other mining operations. These mining operations will also generate fugitive dust and particulate matter emissions. The Integrated Paardeplaats Section will contribute to the cumulative air quality impacts of the region.

The impacts of projects are often assessed by comparing the post-project situation to a pre-existing baseline. Where projects can be considered in isolation this provides a good method of assessing a project's impact. However, in areas where baselines have already been affected, or where future development will continue to add to the impacts in an area or region, it is appropriate to consider the cumulative effects of development. This is similar to the concept of shifting baselines, which describes how the environmental baseline at a point in time may represent a significant change from the original state of the system. Cumulative impacts refer to the incremental effect of several projects that may have an individually minor, but collectively significant, impact on air quality.

Cumulative impact can be defined as:

- Two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts, and
- The change in the environment which results from the incremental impact of the project when added to other closely related past, present, or reasonably foreseeable future projects, and can result from individually minor, but collectively significant, projects taking place over a period of time.

10.1.2.4.1 Project Site Localised Cumulative Impacts

These are the cumulative impacts that result from mining operations in the immediate vicinity of the project site. Project site localised cumulative impacts include the cumulative effects from operations that are close enough to potentially cause additive effects on the environment or sensitive receivers. These include mainly dust deposition. From this air impact assessment conducted for the proposed project the modelling indicates the cumulative pollution plume emanating from this site as a combination of activities and shows that the impacts will be mainly localised around and in the vicinity of the operations.

10.1.2.4.2 Regional Cumulative Impacts

Regional cumulative impacts include the project's contribution to impacts that are caused by mining operations throughout the region. Each mining operation in itself may not represent a substantial impact, however the cumulative effect on air quality in the region may warrant consideration. The coal mining sector in South Africa is growing steadily as the requirement for electricity also grows and therefore this project will also contribute to the larger regional impact that will be experienced.

10.1.2.4.3 Global Cumulative Impacts

The only impact from the project that is potentially global is the generation of potential greenhouse gas emissions. However, the level of emissions from the project represents a very minor and insignificant contribution at this scale.

the overall impact on the air quality as a result of the project would not be cumulatively considerable and would be less than significant if the sound implementation of mitigation measures identified reducing emissions are implemented. If emissions are kept below the relevant threshold levels by ensuring the management and mitigation measures prescribed are adhered to there is no significant cumulative impacts expected as the air quality impacts would be limited to the site level.

10.1.3 Soils

The impacts of opencast mining on the soil resource, and the availability of that resource for agriculture, are usually long-lasting and severe. Even when soils are stockpiled then replaced, there are usually problems such as compaction, acidification, impeded drainage, and insufficient soil depth after rehabilitation, all of which are likely to lower the prevailing land capability class.

The anticipated impacts on the soil, land use and land capability of the Integrated Paardeplaats Section include the following:

- Loss of soil fertility;
- Soil erosion;
- Soil compaction;
- Chemical pollution;
- Change in natural landscape; and
- Reduction of agricultural potential.

10.1.4 Terrestrial Biodiversity

A sensitivity analysis was undertaken and considered all of the desktop data (Mpumalanga C-Plan, Threatened Ecosystems, IBAs and the NPAES), as well as the field data gathered during the site visits. The outcome of this analysis depicts sensitivity ranging from low - high. High sensitivity was assigned to the Rocky Outcrops and Wetland habitats as they provide habitat for SCC and their irreplaceability as unique biodiversity features. Various habitats within the Integrated Paardeplaats Section sustain a high diversity of faunal and floral SCC. The drainage and wetland systems are associated with a high ecological sensitivity as they provide refugia and habitat for numerous faunal SCC, promote movement of faunal species and act as corridors and also provide vital ecosystem services. Areas with moderate sensitivity included those that were considered in a natural state with minor anthropogenic disturbances and presence of SCC such as the intact grasslands and moderate rocky slopes. Low sensitivity was assigned to the transformed areas as they have been previously heavily degraded and are proliferated with AIPs. **Figure 10.7** illustrates the areas of concern confined to the Integrated Paardeplaats Section.

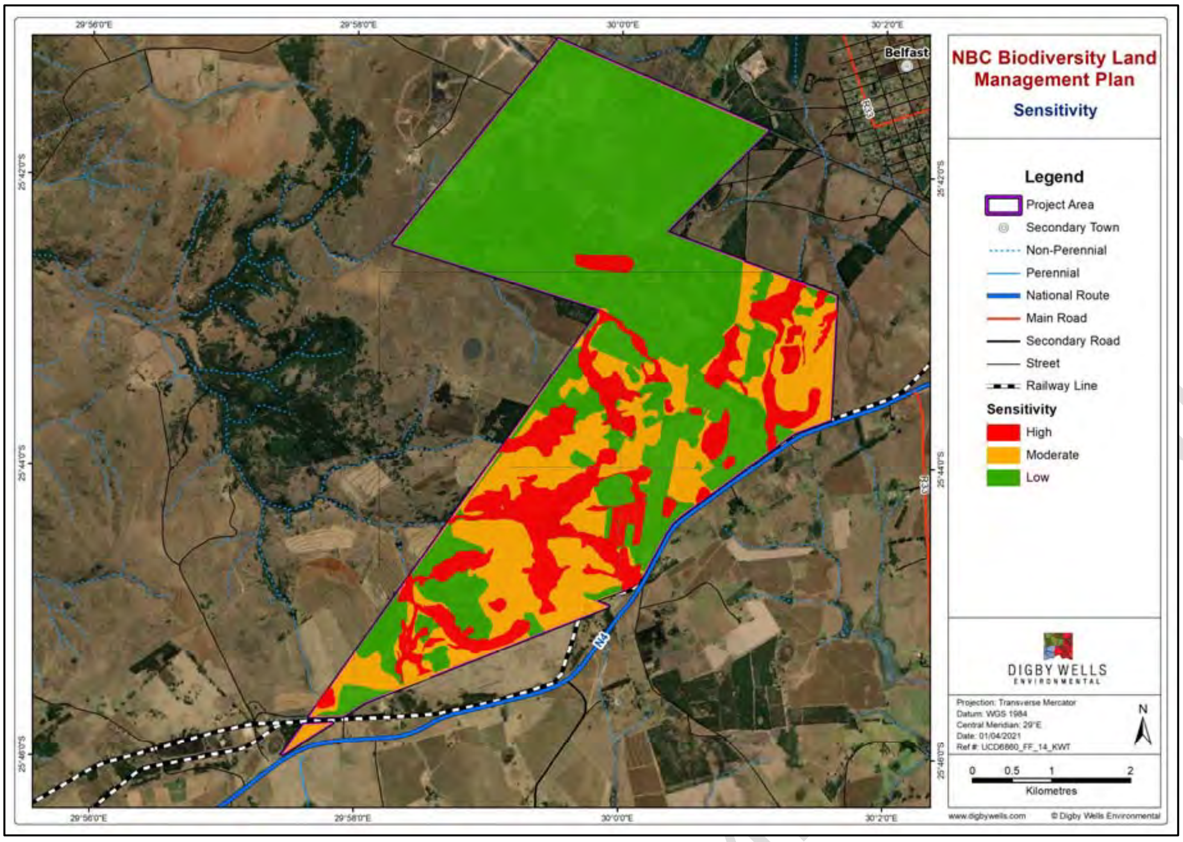

Figure 10.7: Sensitive Areas Associated with the Integrated Paardeplaats Section.

It is recommended that areas of high sensitivity be actively conserved throughout the LoM of the Integrated Paardeplaats Section, as well as after decommissioning and closure. These areas should not be cleared or impacted in any way by construction activities. Areas of moderate sensitivity should be avoided as far as possible, and ideally conserved along with areas of high sensitivity. Mining activities and associated infrastructure should proceed with caution in these areas. Areas of low sensitivity are recommended for construction activities, however, should any SCC occur, the area is to be avoided. If this cannot be done, the appropriate permits should be obtained for their removal.

10.1.4.1 Construction Phase

Activities during the construction phase that may have potential impacts on the vegetation communities, biodiversity and ecosystem function are listed in **Table 10.6**.

Table 10.6: Construction Phase Interactions and Impacts of Activity.

INTERACTION	IMPACT
Vegetation clearing	• Removal of all vegetation within the development footprint, permits the loss of vegetation communities (including floral SCC), biodiversity and ecosystem services; and • Soil compaction, increased runoff and soil erosion.
Diesel storage	• Potential spillage of hydrocarbons (diesel/fuel) thus contaminating the soil and groundwater.
Access and road constructions	• Removal of vegetation, AIP proliferation and faunal casualties; • Increased vehicle movement; and • Increased dust, compaction and sedimentation.
Rock blasting	• Increased dust dispersal, faunal casualties and vegetation removal; and • Changes to the landscape, causing ponding and undulating topographies.
Stockpiles and dumping	• Vegetation removal, dust pollution, soil erosion, compaction, sedimentation and AIP proliferation.

10.1.4.2 Operational Phase

Activities during the operational phase that may have potential impacts on the vegetation communities, biodiversity and ecosystem function are listed in **Table 10.7**.

Table 10.7: Operational Phase Interactions and Impacts of Activity.

INTERACTION	IMPACT
Diesel storage and fuelling of diesel on site	• Potential spillage of hydrocarbon thus contaminating the soil, ground water and surrounding areas.
Coal Transportation: vehicle, and heavy machinery movement	• Removal of soil and vegetation, increased faunal casualties (road kill); and • Increased erosion and sedimentation decreasing vegetation cover.
Open-pit establishment	• Removal of vegetation, habitats and increased soil erosion and compaction.
Stockpiles, rock blasting and dumping	• Destruction of vegetation and habitat, dust pollution, soil erosion and AIP proliferation; • Increased vehicle movement in the area, increasing soil compaction, and runoff potential; and • Unexpected changes in the topography and overall habitats.

10.1.4.3 Decommissioning, Closure and Rehabilitation Phase

Activities during the decommissioning phase that may have potential impacts on the vegetation communities, biodiversity and ecosystem function are listed in **Table 10.8**.

Table 10.8: Decommissioning, Closure and Rehabilitation Phase Interactions and Impacts of Activity.

INTERACTION	IMPACT
Demolition, and removal of infrastructure – once mining activities have been concluded infrastructure will be demolished in preparation for the final land rehabilitation	• Disturbance of soils, and subsequent erosion by wind, and water; • Increased vehicle movement in the area, increasing soil erosion and habitat destruction; • Potential spillage of hydrocarbons such as oils, fuels, and grease, thus contamination of the surrounding grounds; • AIP proliferation; and • Unexpected changes in topography and landscape.
Movement of vehicles, and heavy machinery	• Compaction of soil; • Increased runoff potential; and • Increased erosion, and consequently sedimentation potential.
Rehabilitation – re-vegetation and profiling of the land.	• Exposure of soils, and subsequent compaction, erosion, and sedimentation; • Soil compaction, and increased runoff potential due to vehicle movement during rehabilitation programs; • Loss of organic material, and vegetation cover; and • Potential spillage of hydrocarbons such as oils, fuels, and grease, thus contamination of soil.
Post-closure monitoring and rehabilitation	• Minimal negative impacts on the environment; and • Environmental Management Plan.

10.1.4.4 Cumulative Impacts

It is necessary to consider the impacts that the future development will have from a wide-ranging perspective, by considering land-use and transformation of the natural habitat in surrounding areas. Cumulative impacts are assessed by considering past, present and anticipated changes to the biodiversity. Albeit the Eastern Highveld Grassland vegetation type is assigned an Endangered conservation status, large portions of this vegetation type are under threat due to expanding mining operations. The cumulative loss of the vegetation type as well as the SCC within it should be considered proactively.

The further removal of habitat/vegetation types to allow construction/mining will bring about a reduction of natural areas, and the increase of the edge effect. The impacts on the ecology of the area will be significant. It is expected that there will be great losses of vegetation and flora along with associated faunal habitat. The primary impacts will be fragmentation and edge effects with a reduction in movement of remaining naturally occurring wildlife and isolation of pockets of vegetation.

Secondary cumulative impacts will include increased accessibility to the site and the resulting increase in development and resource dependence. Ideally, a strategic environmental plan for the area should be developed and adhered to. This should include the conservation of important areas as well as the provision of corridors for faunal movement.

10.1.5 Freshwater Ecosystems

All wetlands located within the direct footprint of the proposed opencast pit will be permanently destroyed by mining. This will result in the loss of 86.74 ha of wetlands consisting predominantly of hillslope seepage wetlands (**Table 10.9** and **Figure 10.8**). Wetland systems affected include the upper reaches of tributaries draining into the Glisa Section of the NBC Consolidation area, as well as wetland systems draining westwards and forming part of the upper Steelpoort River catchment. Should mining proceed as per the LoM plan, the loss of wetland habitat cannot be successfully mitigated, and it is likely that offsets will need to be considered. Such offsets will have to be implemented in a phased approach based on surrounding land uses and planned developments.

Table 10.9: HGM Units and Their Extents to be Directly Lost as a Result of the Proposed LoM Plan.

NAME	HGM_UNIT	PES	ECOSERVICE	EIS	AREA (ha)	HECTARE EQUIVALENT
HGM 45	Hillslope seep	D	Intermediate	Moderate	3.21	1.926
HGM 46	Unchannelled valley bottom	D	Moderately high	High	0.68	0.408
HGM 47	Hillslope seep	C	Intermediate	High	19.54	13.678
HGM 48	Unchannelled valley bottom	C	Moderately high	High	1.4	0.98
HGM 27	Hillslope seep	D	Intermediate	Moderate	1.2	0.72
HGM 26	Hillslope seep	C	Intermediate	High	1.39	0.973
HGM 25	Unchannelled valley bottom	C	Intermediate	High	0.47	0.329
HGM 51	Channelled valley bottom	D	Intermediate	High	0.22	0.132
HGM 50	Unchannelled valley bottom	C	Moderately high	High	1.76	1.232
HGM 49	Channelled valley bottom	C	Intermediate	High	2.98	2.086
HGM 72	Hillslope seep	D	Intermediate	Moderate	0.1	0.06
HGM 44	Pan	D	Intermediate	Moderate	1.74	1.044

NAME	HGM_UNIT	PES	ECOSERVICE	EIS	AREA (ha)	HECTARE EQUIVALENT
HGM 39	Wet patch	-	-	-	1.04	0.624
HGM 54	Hillslope seep	B	Intermediate	High	6.27	5.016
HGM 55	Hillslope seep	B	Intermediate	High	9.29	7.432
HGM 63	Hillslope seep	D	Intermediate	Moderate	0.31	0.186
HGM 62	Channelled valley bottom	D	Intermediate	Moderate	0.97	0.582
HGM 60	Unchannelled valley bottom	B	Moderately high	High	0.11	0.088
HGM 59	Unchannelled valley bottom	B	Moderately high	High	0.05	0.04
HGM 56	Hillslope seep	B	Intermediate	High	15.41	12.328
HGM 58	Channelled valley bottom	C	Intermediate	Moderate	2.53	1.771
HGM 61	Hillslope seep	C	Intermediate	High	0.82	0.574
HGM 64	Hillslope seep	C	Intermediate	Moderate	4.17	2.919
HGM 67	Channelled valley bottom	C	Intermediate	Moderate	1.92	1.344
HGM 57	Hillslope seep	B	Intermediate	High	0.29	0.232
HGM 66	Hillslope seep	D	Intermediate	Moderate	0.69	0.414
HGM 69	Channelled valley bottom	D	Intermediate	Moderate	2.68	1.608
HGM 71	Hillslope seep	D	Intermediate	Moderate	3.72	2.232
HGM 70	Hillslope seep	C	Intermediate	Moderate	1.51	1.057
HGM 65	Hillslope seep	D	Intermediate	High	0.27	0.162
Total wetlands to be destroyed					**86.74***	**62.18**
Hillslope seeps					68.19	49.91
Channelled valley bottoms					11.3	7.52
Unchannelled valley bottoms					4.47	3.08
Depressions (or Pans)					1.74	1.04

*Calculations based on remaining wetlands on site as of 13-16 April 2021 field assessment and do not consider wetlands already destroyed as a result of mining activities, for full extent of wetlands lost on the Paardeplaats Section Refer to WCS, 2011. At the time of the April 2021 assessment, 5.5 hectares (3.85 hectare equivalents) of CBA wetland habitat had already been destroyed within the proposed LoM plan as a result of active mining. These calculations were not included in the table above and should be considered additionally for any offset strategies to be implemented.

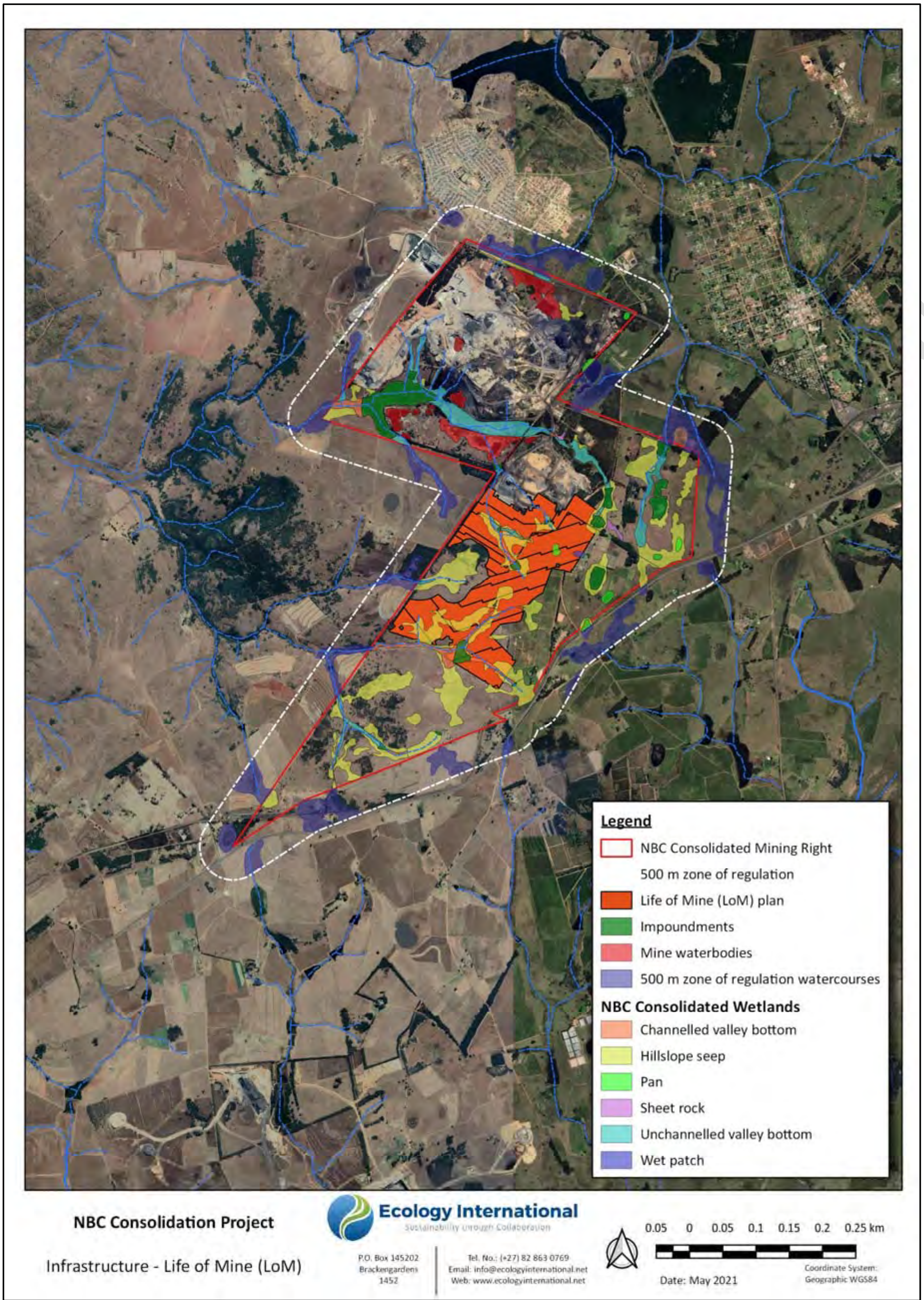

Figure 10.8: Proposed Life of Mine Plan and Identified Wetland HGM Units.

10.1.5.1.1 Buffer Zones and No-go Areas

Buffer zones associated with water resources have been shown to perform a wide range of functions and have been proposed as a standard measure to protect water resources and associated biodiversity on this basis. These functions can include (Macfarlane & Bredin, 2016):

- Maintaining basic aquatic processes;
- Reducing impacts on water resources from upstream activities and adjoining land uses;
- Providing habitat for aquatic and semi-aquatic species;
- Providing habitat for terrestrial species; and
- A range of ancillary societal benefits.

However, despite the range of functions potentially provided by buffer zones, buffer zones are unable to address all water resource-related problems. For example, buffers can do little to address impacts such as hydrological changes caused by stream flow reduction activities or changes in flow brought about by abstractions or upstream impoundments. Buffer zones are also not the appropriate tool for mitigating against point-source discharges (e.g., sewage outflows), which can be more effectively managed by targeting these areas through specific source-directed controls (Macfarlane & Bredin, 2016).

Within the context of the proposed activities, the determination of relevant buffer requirements by means of the approach of Macfarlane & Bredin (2016) was not deemed to be applicable. Instead, set-back distances for proposed activities are to be reflective of relevant legislation (Government Notice 704 of the National Water Act, Act 36 of 1998, as published in Government Gazette 20119).

A buffer of 100 m, in line with the 100 m zone of regulation triggered by GN 704 is regarded as sufficient for wetlands outside of the proposed opencast activities to limit impacts related to ancillary mining activities, however, for the proposed opencast mining activities, buffers are unlikely to be of value in terms of mitigating impacts to the watercourses present within the Integrated Paardeplaats Section. A hydropedological assessment and/or input from a geohydrological specialist will be necessary to determine appropriate distances to mitigate impacts to the associated hillslope seeps.

The range of potential impacts anticipated as a result of the proposed activities have been identified in line with the nature of the proposed activities, the proximity of these activities to the watercourses within the Integrated Paardeplaats Section, as well as according to the baseline conditions and sensitivities identified in **Section 9.7** and are described in detail in the sections that follow.

10.1.5.1.2 Construction Phase

Due to the nature of the proposed project the various potential impacts present with considerable overlap, with activities and impacts likely to continue for the lifespan of the project. Construction phase impacts are discussed under the operational phase impacts.

10.1.5.1.3 Operational Phase

The following potential impacts are anticipated in the construction and operational phase:

- Loss of wetland and aquatic habitat;
- Fragmentation of watercourses;
- Disturbance and degradation of wetland and aquatic habitat;
- Increased sediment transport and deposition in wetland and aquatic habitat;
- Water quality deterioration; and
- Impact on provincial freshwater conservation targets.

10.1.5.1.4 Decommissioning, Closure and Rehabilitation Phase

The following potential impacts are anticipated in the decommissioning, closure, rehabilitation and post-closure phase:

- Post-closure Phase Impacts
- Water quality deterioration;
- Increased surface runoff into wetland and aquatic habitat; and
- Invasive plant species encroachment.

10.1.5.1.5 Cumulative Impacts

The freshwater ecology of this area has historically been heavily impacted as a result of various cumulative impacts as a result of extensive mining activities in the area. In addition, other impacts to the freshwater resources present in the vicinity of the proposed project include agricultural cultivation and grazing activities. The proposed opencast activities have the potential to result in additional impacts to the wetland systems present including fragmentation of the systems, altered hydrology and terrain profiles, loss of biodiversity and altered vegetation structures.

10.1.6 Surface Water

10.1.6.1 Construction Phase

The mine is situated in the headwater of the catchments and no major build-up of flows is expected to happen. Drainage lines flowing into the mining area will however have to be diverted to prevent clean water from entering the mining area and increase the risk of flooding.

10.1.6.2 Operational Phase

There are no perennial streams on site, but increased pit depth of mining will increase the flow from surface water, wetlands, and groundwater into the mining areas.

10.1.6.3 Post Closure Phase

Decant will happen as presented in **Section 10.1.7**. This will impact on the surface water in the catchment where the decant happens. Containment and or treatment might be required by capturing decant water and pumping it back to the PCDs or WTP.

10.1.7 Groundwater

10.1.7.1 Geochemical Characterisation

Geochemical characterisation of eight lithological units and coal slurry (nine samples in total) was conducted by GCS in 2011 for the Glisa Section. In 2012, Aqua Earth Consulting collected six samples for the Paardeplaats Section for Acid Base Accounting (ABA). In 2021 a geochemical assessment on two coal discard samples from the CSWP was undertaken by Milnex cc. The overall objective of the geochemical assessment on the coal discard was as to determine the potential for acid rock drainage of the discard, and to perform a waste classification of the material to inform the DMF design.

Acid-Base Accounting (ABA) is a static test where the net potential of the rock to generate long-term acidic drainage when subjected to atmospheric (oxidising) conditions is determined. It is mostly applicable to pyrite containing rock excavated and disposed of during mining. The test obviously does not consider site-specific conditions or the timeframe for potential acidification. Rock not subjected to oxidising conditions at the mine e.g., water saturated rock, may not generate the predicted acidification.

The screening method as proposed by Price (1997) uses the Neutralisation Potential : Acid Potential (NP:AP) ratio to classify rock types in terms of their potential for acid generation (**Table 10.10**). This method was applied to the ABA classification.

Table 10.10: Screening Method Using the NP:AP Ratio (Price, 1997).

POTENTIAL FOR ACID GENERATION	NP:AP SCREENING CRITERIA	COMMENTS
Rock Type I Likely Acid Generating	< 1:1	Likely AMD generating.
Rock Type II Possibly Acid Generating	1:1 – 2:1	Possibly AMD generating if NP is insufficiently reactive or is depleted at a faster rate than sulphides.
Rock Type III Low Potential for Acid Generation	2:1 – 4:1	Not potentially AMD generating unless significant preferential exposure of sulphides along fracture planes, or extremely reactive sulphides in combination with insufficient reactive NP.
Rock Type IV No Potential for Acid Generation	>4:1	No further AMD testing required unless materials are to be used as a source of alkalinity.

<u>**GCS (2011)**</u>

In 2011, GCS took a total of 9 rock composite samples from the Glisa Section to obtain Acid Mine Drainage (AMD) potential values for the area. The results are presented in **Table 10.11**.

Table 10.11: ABA Results for the Glisa Section (GCS, 2011).

UNIT	LITHOLOGY	ROCK TYPE	COMMENTS
Topsoil Overburden	Soil & Highly Weathered Sandstone	Type III	No potential for acid generation.
Soft Overburden Lower	Highly Weathered Sandstone	Type III	No potential for acid generation.
Seam 4 Upper	Coal	Type I	Potentially acid generating.
Seam 4 Lower	Coal	Type I	Potentially acid generating.
Mudstone Above Seam 3	Mudstone	Type III	No potential for acid generation.
Seam 3	Coal	Type III	Potentially acid generating (variable).
Siltstone between Seam 3 & Seam 2 Upper	Siltstone	Type III	No potential for acid generation.
Seam 2	Coal	Type I	Potentially acid generating.
Slurry Dam	Fine By-Products	Type I	Potentially acid generating.

Aqua Earth (2012)

In 2012, Aqua Earth took a total of 6 samples from newly drilled boreholes drilled into several lithological units at the Paardeplaats Section. Only ABA analyses were conducted on the samples and the results thereof are presented in **Table 10.12**.

Table 10.12: ABA Results for the Paardeplaats Section (Aqua Earth, 2012).

UNIT	LITHOLOGY	TYPE	COMMENTS
Seam 4	Coal	Type II	Potentially acid generating (intermediate).
Roof of seam 5	Siltstone	Type III	No potential to be acid generating.
Seam 5	Coal	Type I	Likely acid generating.

These findings are similar to that found by GCS (2011).

Milnex (2021)

In 2021, Milnex took 2 composite discard material samples from the CSWP to determine the acid generating potential of material that will be deposited at the DMF. The results were screened as Rock Type I - IV. The results are presented in **Table 10.13**.

Table 10.13: ABA Results for the Composite Discard Samples (Milnex, 2021).

UNIT	LITHOLOGY	TYPE	COMMENTS
Composite discard 1	Coal discard	Type I	Likely acid generating.
Composite discard 2	Coal discard	Type I	Likely acid generating.

10.1.7.2 Discard Material Waste Classification

The waste classification was performed in terms of the NEM:WA National Norms and Standards for the Assessment of Waste for Landfill Disposal (GNR 635) which in turn guides the waste disposal options as prescribed in the NEM:WA National Norms and Standards for Disposal of Waste to Landfill (GNR 636). The following analyses were undertaken for the composite discard samples:

- An aqua regia (total) digestion of the sample followed by quantitative analysis by inductively coupled optical emission spectrometry (ICP-OES), and other methods, for the following:
    - ICP analysis for 15 elements (As, B, Ba, Cd, Co, Cr (total), Cu, Mn, Mo, Ni, Pb, Sb, Se, V, Zn); and
    - Additional analysis for mercury (Hg), hexavalent chromium (Cr VI), total fluoride (F) and total cyanide (CN).

- An aqueous extraction conducted in accordance with the prescribed leach testing procedure AS 4439.3 (1997) standard, which is analysed as follows:
  - ICP analysis for 16 elements (As, B, Ba, Cd, Co, Cr (total), Cu, Hg, Mn, Mo, Ni, Pb, Sb, Se, V, Zn); and
  - Total Dissolved Salt (TDS) concentration and specific anions and cations including Cr(VI), Cl, SO_4, NO_3 as N, F and CN (total).

The samples were not analysed for any of the prescribed organic contaminants, as the material is derived directly from the inorganic ore which is processed through crushing and separation and at no point during the processing is any organic compound added to the materials. The discard material can therefore reasonably be expected to only contain inorganic compounds and elements in either mineralogical or dissolved form.

The waste classification (GNR 635) involves the determination of a risk profile for the waste by following the prescribed testing and leach testing protocols. The results must be assessed against the threshold levels for Leachable (LCT) and Total Concentrations (TCT) which, in combination, determine the risk profile of the waste as set out below.

- Type 4 Waste: wastes with all determinant concentrations below the LCT0 and TCT0 values;
- Type 3 Waste: wastes with any determinant concentration above the LCT0 but below the LCT1 value and all determinant concentrations below the TCT1 values;
- Type 2 Waste; wastes with any determinant concentration above the LCT1 but below the LCT2 values, and all determinant concentrations below the TCT1 values;
- Type 1 Waste: wastes with any determinant concentration above the LCT2 but below the LCT3 values, or above the TCT1 but below the TCT2 values; and
- Type 0 Waste: wastes with any determinant concentration above the LCT3 or TCT2 values.

Table 10.14 lists the average LCT and TCT of inorganic determinants in the composite discard samples. The LCT and TCT threshold values prescribed in GNR 635 are also listed in **Table 10.14**. The threshold value columns are shaded and where the reported LCT and TCT concentration exceeds the threshold, the values are shaded correspondingly.

Table 10.14: Waste Classification for Inorganic Determinants (GNR 635).

DETERMINANT	TOTAL (AQUA-REGIA)	LEACHABLE (AQUEOUS EXTRACTION)	THRESHOLD LEVELS							WASTE TYPE
			TCT0	TCT1	TCT2	LCT0	LCT1	LCT2	LTC3	
	mg/kg	mg/l	mg/kg			mg/l				
General										
Total Dissolved Solids	N/A	146	N/A	N/A	N/A	1 000	12 500	25 000	100 000	Type 4
Moisture Content (%)	0.48	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Electrical Conductivity (uS/cm)	89	249	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P-Alkalinity as CaCO3	NR	<0.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
M-Alkalinity as CaCO3	NR	51	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
pH - Sample	8.37	7.36	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Metal-Ions										
As, Arsenic	**15.09**	<0.001	5.8	500	2 000	0.01	0.5	1	4	Type 3
B, Boron	36.95	0.069	150	15 000	60 000	0.5	25	50	200	Type 4
Ba, Barium	**100.7**	0.247	62.5	6 250	25 000	0.7	35	70	280	Type 3
Cd, Cadmium	<3.2	<0.001	7.5	260	1 040	0.003	0.15	0.3	1.2	Type 4
Co, Cobalt	10.86	<0.025	50	5 000	20 000	0.5	25	50	200	Type 4
Cr, Total, Chromium Total	46.01	<0.025	46 000	800 000	N/A	0.1	5	10	40	Type 4
Cr(VI), Chromium (VI)	<2	<0.05	6.5	500	2 000	0.05	2.5	5	20	Type 4
Cu, Copper	**18.95**	<0.01	16	19 500	78 000	2	100	200	800	Type 3
Hg, Mercury	**4.19**	0.001	0.93	160	640	0.006	0.3	0.6	2.4	Type 3
Mn, Manganese	252.5	0.033	1000	25 000	100 000	0.5	25	50	200	Type 4
Mo, Molybdenum	<6.4	<0.025	40	1 000	4 000	0.07	3.5	7	28	Type 4
Ni, Nickel	23.59	<0.025	91	10 600	42 400	0.07	3.5	7	28	Type 4

DETERMINANT	TOTAL (AQUA-REGIA)	LEACHABLE (AQUEOUS EXTRACTION)	THRESHOLD LEVELS							WASTE TYPE
			TCT0	TCT1	TCT2	LCT0	LCT1	LCT2	LTC3	
	mg/kg	mg/l	mg/kg			mg/l				
Pb, Lead	**78.15**	<0.001	20	1 900	7 600	0.01	0.5	1	4	Type 3
Sb, Antimony	<3.2	0.001	10	75	300	0.02	1	2	8	Type 4
Se, Selenium	<6.4	0.003	10	50	200	0.01	0.5	1	4	Type 4
V, Vanadium	30.85	<0.025	150	2 680	10 720	0.2	10	20	80	Type 4
Zn, Zinc	25.72	<0.025	240	160 000	640 000	5	250	500	2 000	Type 4
Anions										
Fluoride as F	1.46	0.07	100	10 000	40 000	1.5	75	150	600	Type 4
Chloride as Cl	N/A	<2	N/A	N/A	N/A	300	15 000	30 000	120 000	Type 4
Nitrate (NO3) as N	N/A	<0.5	N/A	N/A	N/A	11	550	1 100	4 400	Type 4
Sulphate as SO4	N/A	59.75	N/A	N/A	N/A	250	12 500	25 000	100 000	Type 4
Total Cyanide as CN	<1.55	<0.07	14	10 500	42 000	0.07	3.5	7	28	Type 4

In terms of the prescribed classification procedure, the composite discard sample is classified as a Type 3 waste, based on the solid concentration exceedance (TCT0) of arsenic, barium, copper, mercury and lead. No water leach constituent concentrations were exceeded. Based on this classification a landfill site, in this instance the DMF, designed to comply with the containment barrier requirements of a Class C landfill must be used for disposal of the discard material.

According to GNR 636, *"Type 3 Waste may only be disposed of at a Class C landfill designed in accordance with Section 3(1) and (2) of these Norms and Standards, or, subject to Section 3(4) of these Norms and Standards, may be disposed of at a landfill site designed in accordance with the requirements for a G:L:B+ landfill as specified in the Minimum Requirements for Waste Disposal by Landfill (DWAF MR, 1998)"*. The Class C containment barrier design, or liner, requirement is depicted in **Figure 10.9**.

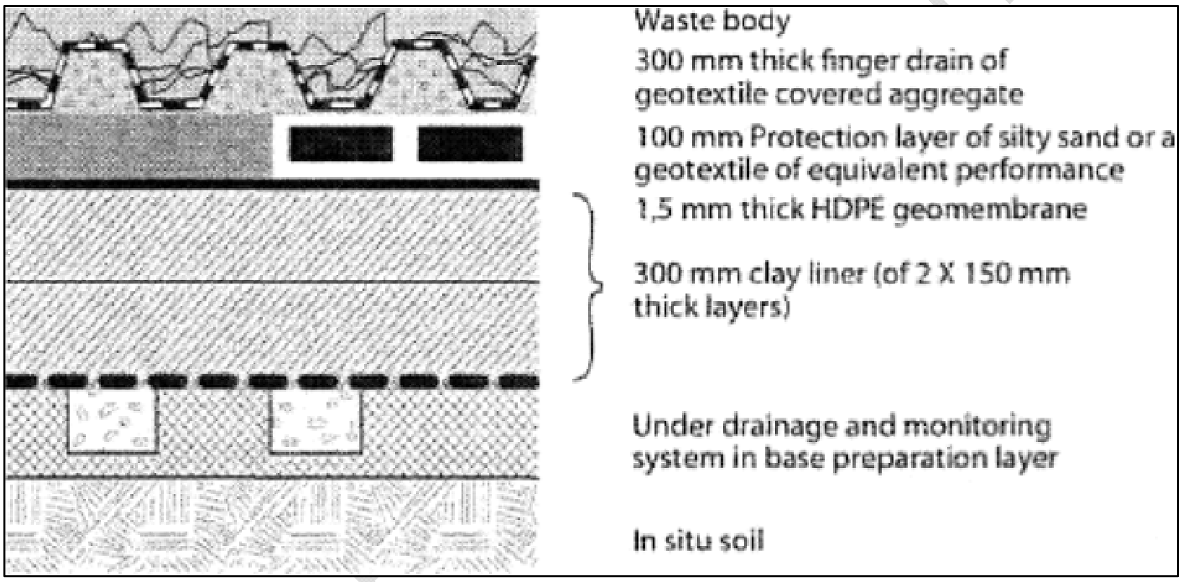

Figure 10.9: Class C landfill Containment Barrier Design(GNR 636).

Groundwater modelling was undertaken to determine the impacts of the Integrated Paardeplaats Section on the groundwater regime. The main objective of the model was to develop a steady state and transient flow and contaminant model which would include the following aspects:

- The operational and the post-closure phase;
- Impacts on groundwater levels and quality in the aquifer due to mining;
- Impact on potential groundwater and surface water receptors as a result of mining and the proposed DMF;
- Potential contaminant plumes that could emanate from the mining areas and the proposed DMF; and
- Assess the potential for mine water decant from the workings.

The numerical model for the Integrated Paardeplaats Section was constructed using GMS 10.3.8, a pre- and post- processing package for the modelling code MODFLOW. MODFLOW is a modular three-dimensional groundwater flow model developed by the United States Geological Survey (Harbaugh et al., 2000). MODFLOW uses 3D finite difference discretisation and flow codes to solve the governing equations of groundwater flow. MODFLOW NWT (Niswonger et al., 2011) was used in the simulation of the groundwater flow model. Both are widely used simulation codes and are well documented. MT3D-USGS is a 3D model for the simulation of advection, dispersion, and chemical reactions of dissolved constituents in groundwater systems. MT3D-USGS uses a modular structure similar to the structure utilised by MODFLOW and is used in conjunction with MODFLOW in a two-step flow and transport simulation. Heads are computed by MODFLOW during the flow simulation and utilised by MT3D-USGS as the flow field for the transport portion of the simulation.

The following limitations are true for the numerical groundwater model:

- The top of the aquifer is represented by the surface topography and used to construct a representative spatial extent;
- The model simulates the fractured rock environment as an equivalent porous medium, which is an overall simplification of the flow process;
- No inter-mine flow or impacts of other adjacent mining related activities were included.;
- No groundwater abstraction of external users was simulated;
- Recharge rates were assumed as constant throughout the simulated period; therefore, no wet-dry cycles are simulated;
- Detailed geology as well as faults and dykes were not included;
- Hydraulic conductivities for the aquifers were assumed to be isotropic. The model furthermore simulates the fractured rock environment as equivalent porous medium, which is an overall simplification of the flow process; and
- The extent of mining at the Glisa Section was assumed based on information provided by NBC.

The calibrated groundwater flow model was used as a basis for developing the contaminant transport model. Sulphate (SO_4) is considered to be a water-soluble oxidation product of Acid Rock Drainage/Neutral Mine Drainage (ARD/NMD) and is considered to be a representative indicator of the impact of coal mining on groundwater quality. SO_4 was thus used as input parameter.

The model was based on the following assumptions:

- Contaminant movement will mostly take place as a result of advection. This assumption was based on the calculation of the Peclet number (Pe) for the aquifer which indicated that advection is the main flow mechanism.

- Chemical reaction between rock and dissolved species were not taken into consideration during simulations. Therefore, a worst-case scenario was assumed.

Movement of contaminant particles involves advection, dispersion, and flux sources. Longitudinal dispersion was taken as 50 m, which is about a tenth of the maximum transport distance. Concentrations at different transport distances in the plume also take dilution from natural rainwater recharge and mixing into account (sources). While an effective porosity of 0.02 (2%) was assumed for model domain, a porosity of 0.1 (10%) was assumed for the backfilled pits.

An input concentration of 1,600 mg/l SO4 was used. The solute source was activated when the mining at the Integrated Paardeplaats Section commenced. The concentrations were kept as a constant source using the same footprint.

The DMF is proposed to be lined with a Class C liner. The discard material has the potential to produce ARD. In the absence of a geochemical source term for the discard, seepage concentrations from discard material in similar environments were used. For modelling purposes, an input concentration of 5,000 mg/l sulphate was used. The DMF source was activated in 2022. The concentrations were kept as a constant source using the same footprint, post closure.

The results from the contaminant transport model are considered to represent a first approximation of the impact on groundwater quality. Due to the nature of the simulations, the estimated concentrations will reflect expected conditions within an order of magnitude. It is advisable to recalibrate the flow model and transport model once more information regarding water qualities and new mining areas become available. The model outputs were for the contaminant plumes at 50- and 100-years post closure.

10.1.7.3 Construction Phase

During construction of the new mining block at the Paardeplaats Section and the DMF minimal additional impacts to the groundwater system are expected. The main activities that could impact on groundwater in this phase include the construction and clearing of footprint areas.

10.1.7.4 Operational Phase

10.1.7.4.1 Groundwater Level Drawdown

The mine floor elevation of the Integrated Paardeplaats Section is below the general groundwater level thus causing groundwater inflows into the opencast mining areas from the surrounding aquifers during operations. The mining areas require active dewatering to ensure a safe working environment. Pumping water that seeps into the mining areas to the surface will cause dewatering of the surrounding aquifers and an associated decrease in the groundwater level within the zone of influence of the dewatering cone.

The zone of influence of the dewatering cone depends on several factors including the depth of mining below the regional groundwater level, recharge from rainfall to the aquifers, the size of the mining area, and the aquifer transmissivity, amongst others. The 3D numerical groundwater flow model was used to simulate the development of the drawdown cone over time in the Integrated Paardeplaats Section. The simulated extent of drawdown extends 100 – 600 m from the active mining area (**Figure 10.10**).

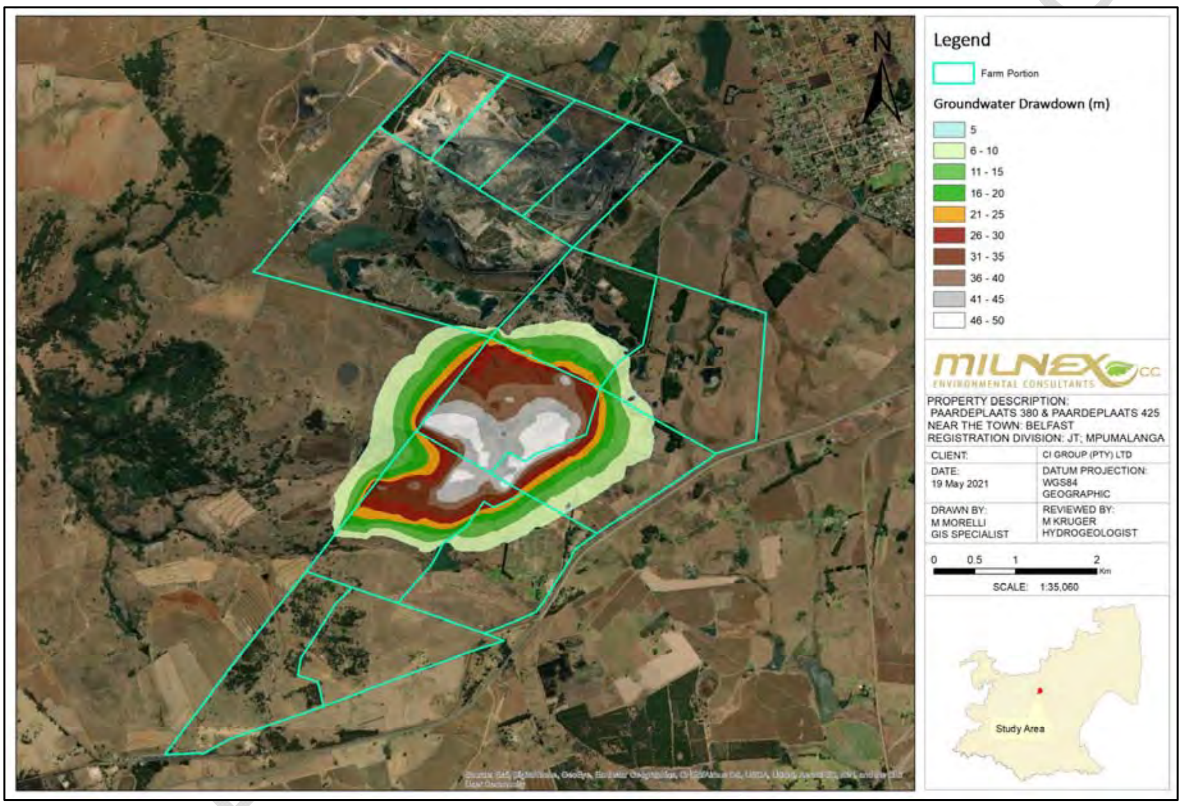

Figure 10.10: Simulated Groundwater Drawdown Year 15.

During the operational phase, it is expected that the main impact on the groundwater environment will be dewatering of the surrounding aquifer. Based on the modelling simulations, the following deductions can be made:

- The water levels could be lowered over a relatively large area around the opencast but recover once dewatering in the pits' ceases; and
- Boreholes GMBH2 and HBH are the only privately-owned boreholes likely to be impacted by the lowering of water levels as a result of mining activities at the Integrated Paardeplaats Section;

- It is expected that several boreholes and springs will be impacted by mining and that VSFTN1, VSFTN2 and Dick Farm Fountain springs will be mined out;
- Boreholes BH1B, HBH, BH15 and GMBH2 could potentially become affected in varying degrees by dewatering activities.

It is important that the boreholes that are to be mined out are comprehensively sealed and grouted before mining commences to prevent potential contamination to the underlying aquifer.

10.1.7.4.2 Mine Inflow Volumes

It was possible to calculate the inflow into the Paardeplaats section opencast for each mining cut, from the numerical model. The computed inflow into the opencast was calculated as shown in **Figure 10.11**, based on the mine schedules. Due to several assumptions that had to be made for this model, these numbers must be considered as order of magnitude only, and actual values could deviate considerably from these.

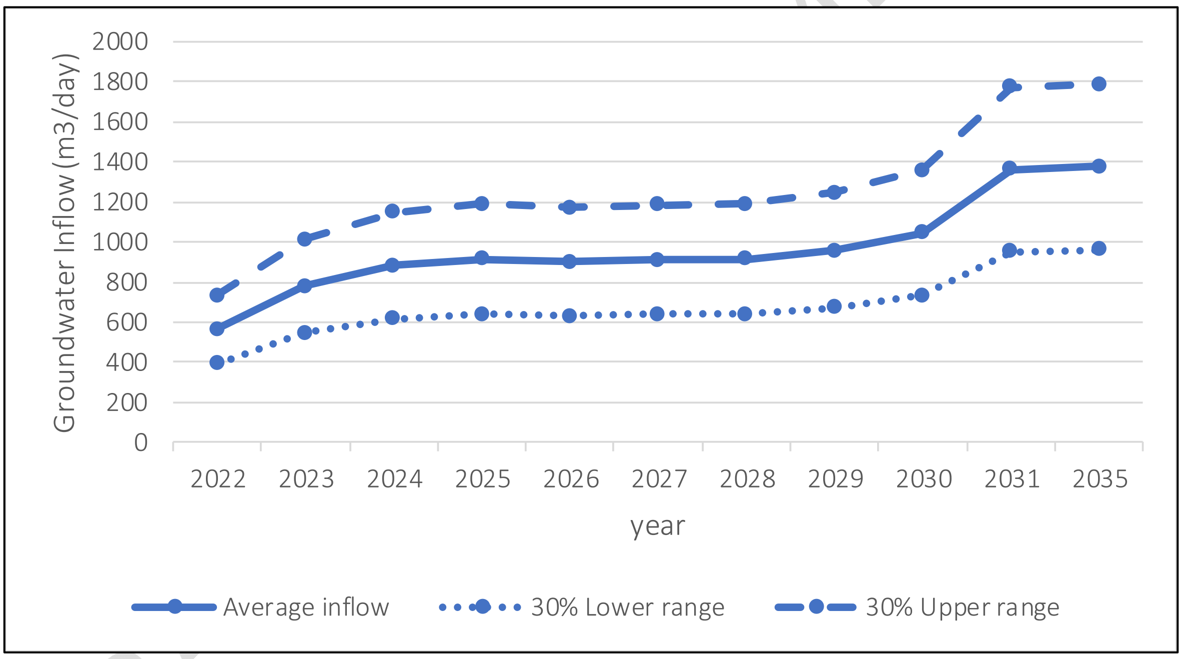

Figure 10.11: Simulated Groundwater Inflows into the Integrated Paardeplaats Section.

The inflows during year 1 is approximately 560 cubic metres per day (m^3/d), the inflow increases to approximately 1,400 m^3/d at the end of year 15.

It is also important to view these volumes for the water make of the mine in relation to natural evaporation. Evaporation will take place over the whole area of the opencasts, and will remove large amounts of water, particularly in the dry season. It must be cautioned that these calculations have been done using simplified assumptions of homogeneous aquifer conditions. The reality could deviate substantially from this and the model should thus be updated as more information becomes available.

10.1.7.4.3 Groundwater Quality (Contamination of the Surrounding Aquifers)

The life of mine for the mining at the Glisa Section has come to an end so for the purposes of pollution identification it was assumed that the opencasts at the Glisa Section are fully rehabilitated and flooded. This allows sufficient time for chemical reactions to take place in the mined-out areas, overburden dumps and other potential pollution sources to produce ARD/NMD conditions. Due to mine dewatering activities, groundwater flow directions will be directed towards the mining area at the Integrated Paardeplaats Section. Therefore, contamination will be contained within the mining area, and limited contamination will be able to migrate away from the mining area. Effective lining of the water balancing dam and pollution control dams should be ensured, thereby preventing contamination of the underlying aquifers.

Based on an assessment of monitoring results reviewed, it is clear that the sulphate (SO_4) levels have increased for the Glisa Section since 2007. pH levels remain stable with slight acidification noted for Portion 24. This is generally in line with the predicted contaminant plume movement as calculated by GCS in 2011 as well as the predicted plumes from the 2021 model undertaken by Milnex. The proposed DMF is likely to have an impact on the groundwater quality as well as the adjacent stream if unlined or if seepage leaks through the liner. Should the Class C liner remain intact for the life of the facility, then a minimal impact is expected.

10.1.7.5 Decommissioning, Closure and Rehabilitation Phases

During decommissioning phase it is assumed that active mining has stopped, and the opencasts will be rehabilitated. The surface contaminant sources (plant areas, dams, and stockpiles) have been decommissioned and no longer acts as a pollution source. It is assumed that a suitable cover will be constructed on the DMF to further reduce potential post closure impacts. Some of the post closure impacts could start manifesting in the decommissioning phase., therefore several mitigation measures should be implemented in the decommissioning phase, to ensure sufficient mitigation post closure.

10.1.7.6 Post Closure Phase

In the post closure phase, all the opencasts are deemed to be fully backfilled and vegetated. Water and oxygen will likely react with the backfilled material and as a result ARD/NMD could peak during this phase. The environmental impact significance is expected to be moderate to high if not mitigated.

10.1.7.6.1 Mine Water Decant

Decanting occurs when the mine water level in the rehabilitated and backfilled workings rebounds to a level above the topographic elevation, resulting in mine water discharging onto surface. Surface decanting refers to direct discharge of mine water to surface through backfilled material, voids, shafts, adits, boreholes and other direct paths. Decant takes place at the lowest topographic level that intersects the flow path and/or opencast. A summary of the decant levels and volume for the opencasts can be seen in **Table 10.15**. The decant volume and period to decant is based on a backfilled opencast with no final void and does not take evapotranspiration into account. Based on the available opencast floor elevations all the opencast floors will be partially flooded. The location of the decant positions can be seen in **Figure 10.12**.

The extent of the opencasts was interpreted from data submitted by NBC and were thought to represent the pit outlines. No Block C coal seam elevations were obtained from NBC, as such time to decant could not be estimated, but the decant volumes could nevertheless be determined. It is assumed that the old Block B, north Pit, Block A etc. will form one combined pit with no internal barrier pillars. It is also assumed that all underground workings have been mined out.

The old Block C area is already reported to be decanting for some time. It is likely that decant occurs as diffuse seepage across a large area near the decant position shown in **Figure 10.12**. Portion 24 backfilled pit is also thought be decanting on the western most boundary on the pit.

The Block C that was mined in 2019/2020 is also likely to decant near Mahim Dam. The Combined Glisa Blocks are likely to decant near the old Block B decant position.

At the Paardeplaats Section, decant will occur at the south western part of the pit in proximity to where lower seam 2 sub-outcrops. The lowest surface elevation based on the current mining extent is 1,818 mamsl, and this is the area where the coal seam 2 sub-outcrops. The No. 2 lower coal seam in the Paardeplaats Section ranges from 1,816 - 1,888 mamsl. The rehabilitated Paardeplaats Section opencast is thus likely to be largely unsaturated. The coal floor also dips towards the decant point in the south west. It is thus likely that the mine water quality emanating from the Paardeplaats Section will be significantly impacted by the mining activities. A final void in this Section could assist in reducing the post closure decant rate for the Section but should be verified once mining commences to ensure proper planning for closure could be achieved.

Table 10.15: Summary of the Estimated Decant Status of the Integrated Paardeplaats Section (Milnex, 2021).

	UNIT	PORTION 24	BLOCK C VOID	BLOCK C	COMBINED BLOCKS	PAARDEPLAATS	TOTAL
Surface area	m^2	615 765	694 332	389 978	3 800 311	3 558 069	9 058 455
Decant elevation	mamsl	1 852	1 841	1 849	1 842	1 813	
Total saturated backfill volume	m^3	2 134 880	2 854 277	No information	992 568	461 558	6 443 284
Mean annual rainfall	m/a	0.715	0.715	0.715	0.715	0.715	
Saturated Backfilled Void Volume							
20% Porosity	m^3	426 976	570 855	No information	198 514	92 312	1 288 657
30% Porosity	m^3	640 464	856 283	No information	297 770	138 467	1 932 985
50% Porosity	m^3	1 067 440	1 427 139	No information	496 284	230 779	3 221 642
Flooding/Decant Rate (Including Groundwater Inflow)							
10% Recharge	m^3/d	121	136	76	744	697	1 774
18% Recharge	m^3/d	217	245	138	1 340	1 255	3 194
22% Recharge	m^3/d	265	299	168	1 638	1 533	3 904
Time to Fill							
Most probable scenario	**Years**	**8**	**10**	**Unknown**	**1**	**1**	

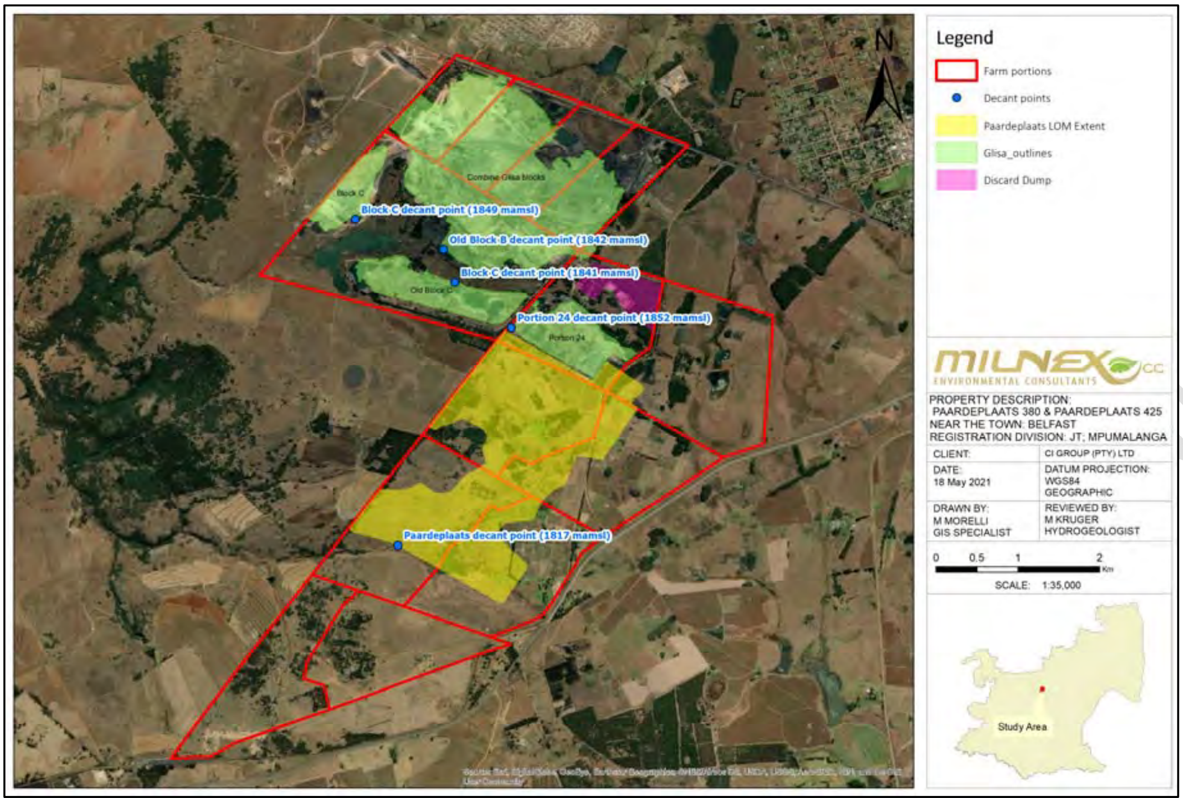

Figure 10.12: Location of Potential Decant Positions.

In general, it is expected that the rehabilitated and backfilled areas will only be partially flooded, due to the nature of the mine/coal floor elevation and topography. It is for this reason that certain mining areas are likely to start decanting sooner that others (as the void space to fill is less due to the decant position).

In the 2019 assessment, the decanting water quality was predicted not to become acidic but will contain a high salt content with SO_4 being the main constituent of concern. However based on the proposed mine plan for the Integrated Paardeplaats Section (NBC, 2021), this assumption that the water will not acidify may not be valid. Decant water will flow to surface water drainage channels and dams. Decant from the Glisa Section opencasts will flow towards the Mahim Dam, while at the Paardeplaats Section the decant will flow towards a tributary of the Steelpoort River. Based on the geochemical modelling (GCS, 2011a) decant is expected to continue from the operational phase into closure from the existing backfilled areas at the Glisa Section at SO_4 concentrations between 1,100 – 1,600 mg/l. SO_4 values could however reach 2,200 mg/l in the long term.

10.1.7.6.2 Groundwater Quality

Once the mining has ceased, Acid Rock Drainage (ARD), Neutral Mine Drainage (NMD), or Saline Drainage (SD) is still likely to form given the unsaturated conditions in the mining areas and contact of water and oxygen through natural process including rainfall. Therefore, groundwater contaminant plumes are likely to migrate from the mining areas once the water level in the rehabilitated pits have reached long term steady state conditions (i.e. each pit water level has reached the decant level). The contaminant plume emanating from the rehabilitated opencasts will have a cumulative impact on the groundwater quality as seen in the post mining simulations (**Figure 10.13** and **Figure 10.14**). The migration of contaminated water from the opencasts has been simulated for 50 and 100 years after closure (i.e. it is assumed that all opencasts have been rehabilitated and backfilled).

The contaminant plumes could migrate ±600 m down gradient of the rehabilitated Integrated Paardeplaats Section opencast areas in the weathered and fractured karoo aquifer 50 years post closure (after decant level has been reached). The plumes are likely to extend further 100 years post closure and could extend ±800 m from the Integrated Paardeplaats Section opencast areas. The contaminant plume emanating from the Glisa Section old Block C and Portion 24 migrate in a north and north westerly direction toward the Mahim stream. The contaminant plume migrating from Block C and the combined Glisa Section blocks (Block B, Block A north pit etc.) will move in a southern and south western direction, while the plume will also migrate from the northern part of the combined Glisa blocks (Block B, Block A north pit etc.) toward the north. For the Paardeplaats section mining area, the contaminant plume migrates in a westerly direction towards the unnamed tributary of the Steelpoort River.

The tributary feeding the Mahim Dam is likely to be impact by shallow contaminated seepage emanating from the Glisa Section rehabilitated opencast areas. Similarly, the non-perennial stream west of the Paardeplaats Section could also be impacted by shallow contaminated seepage emanating from the Integrated Paardeplaats Section rehabilitated opencast area. The stream located north of the Glisa Section draining into Belfast Dam could also be impacted by shallow contaminated seepage emanating from the Glisa Section combined block rehabilitated opencast area.

Several monitoring boreholes could be located within the long-term SO_4 contaminant plume. Boreholes GW01, GW02, BH1, BH2, BH12, BH10, BH15, BH6, BH13, BH11, BH14, BH1A and BH1B, identified during the 2019 hydrocensus, will likely be impacted by the potential SO_4 contaminant plume post-closure. Third party borehole MF1 could potentially be impacted by contaminants emanating from the Glisa Section Block C. No access was however allowed during the 2019 hydrocensus, as a result the status of the borehole is currently unknown.

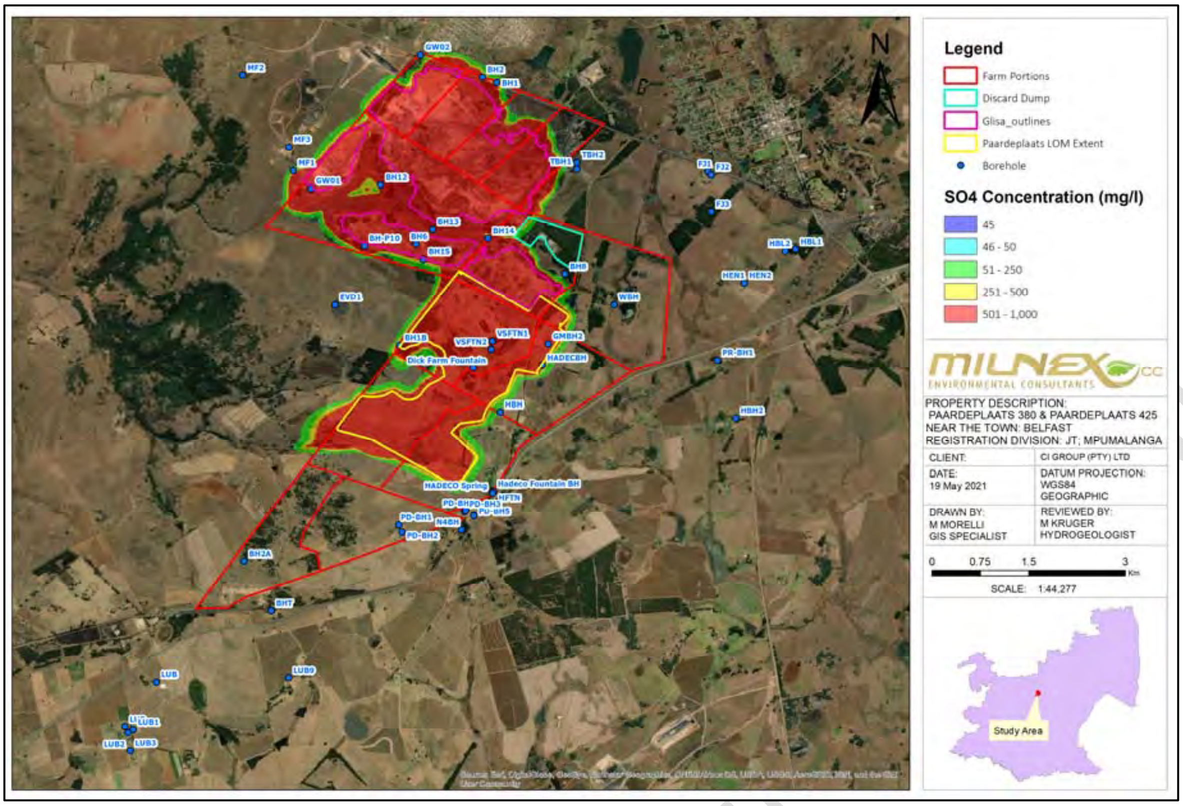

Figure 10.13: Simulated SO_4 Contaminant Plume – 50 Years Post Closure with No DMF Leakage.

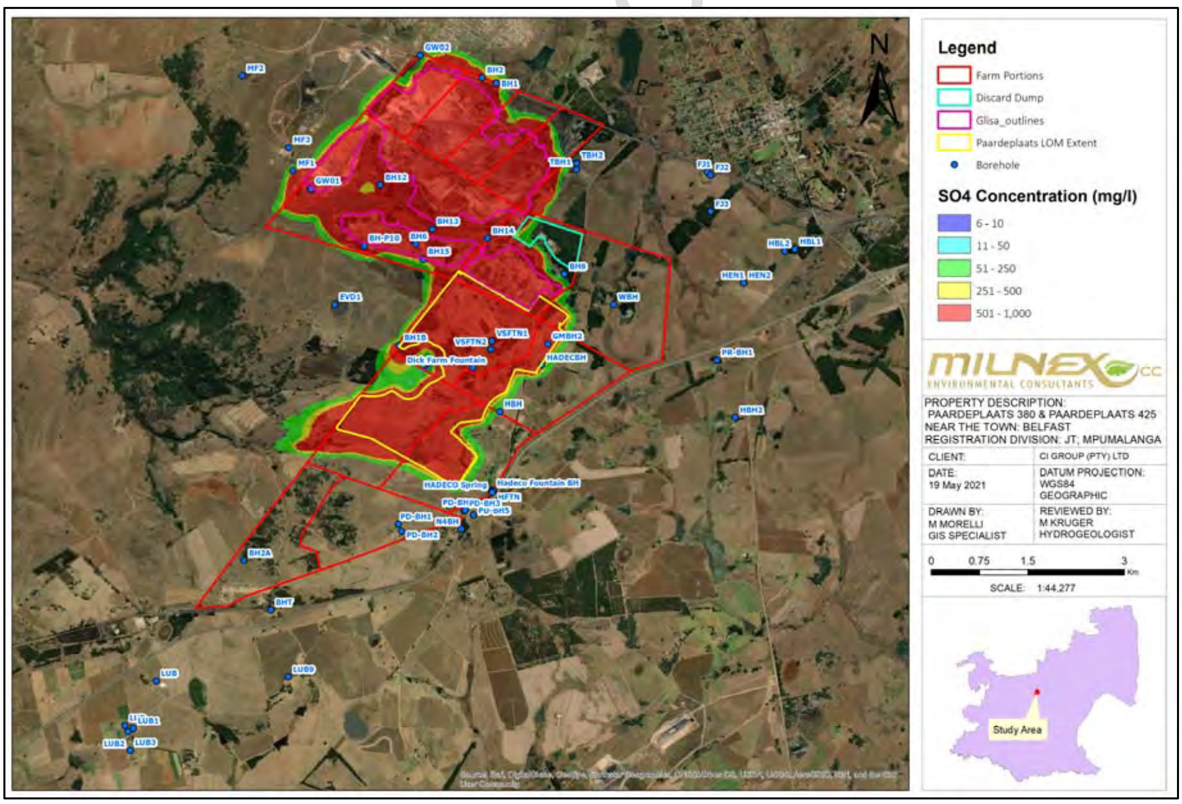

Figure 10.14: Simulated SO_4 Contaminant Plume – 100 Years Post Closure with No DMF Leakage.

The impact of the proposed DMF could be seen in **Figure 10.13** and **Figure 10.14**, if the liner and cover of the DMF stays intact then a minimal impact is expected. However, should the liner be compromised, then a contaminant plume with elevated sulphate concentrations of approximately 3,000 mg/l could impact on the adjacent stream and contribute to the salt load of the stream (**Figure 10.15** and **Figure 10.16**). From a spatial extent the impact of the DMF is overshadowed by the cumulative impacts of the rehabilitated opencast workings. In an unmitigated state the DMF would have a significant post closure impact on groundwater and seepage water quality.

The results must be viewed with caution as a layered homogeneous aquifer has been assumed. Heterogeneities in the aquifer are unknown and the effect of this cannot be predicted. Furthermore, no chemical interaction of the sulphate with the minerals in the surrounding bedrock has been assumed. As there may be some interaction and retardation of the plume, it is likely that this prediction will represent a worst-case scenario.

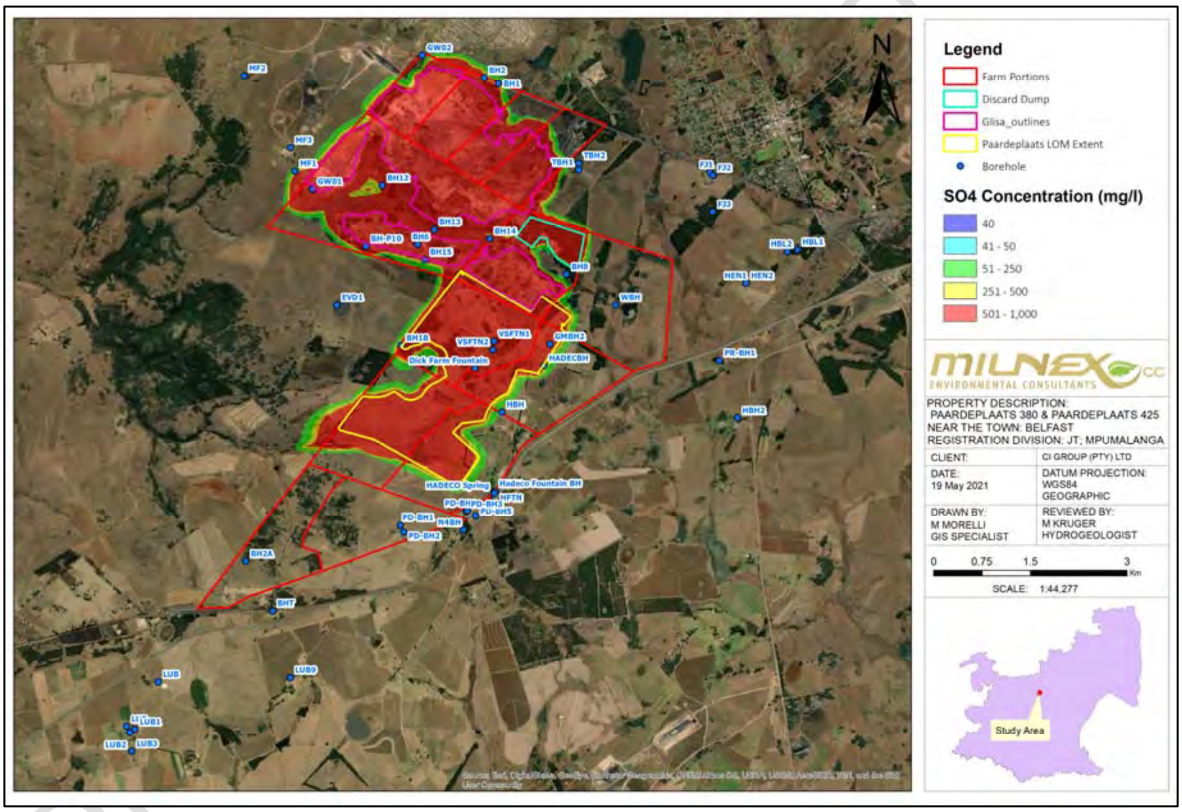

Figure 10.15: Simulated SO_4 Contaminant Plume – 50 Years Post Closure with DMF Leakage.

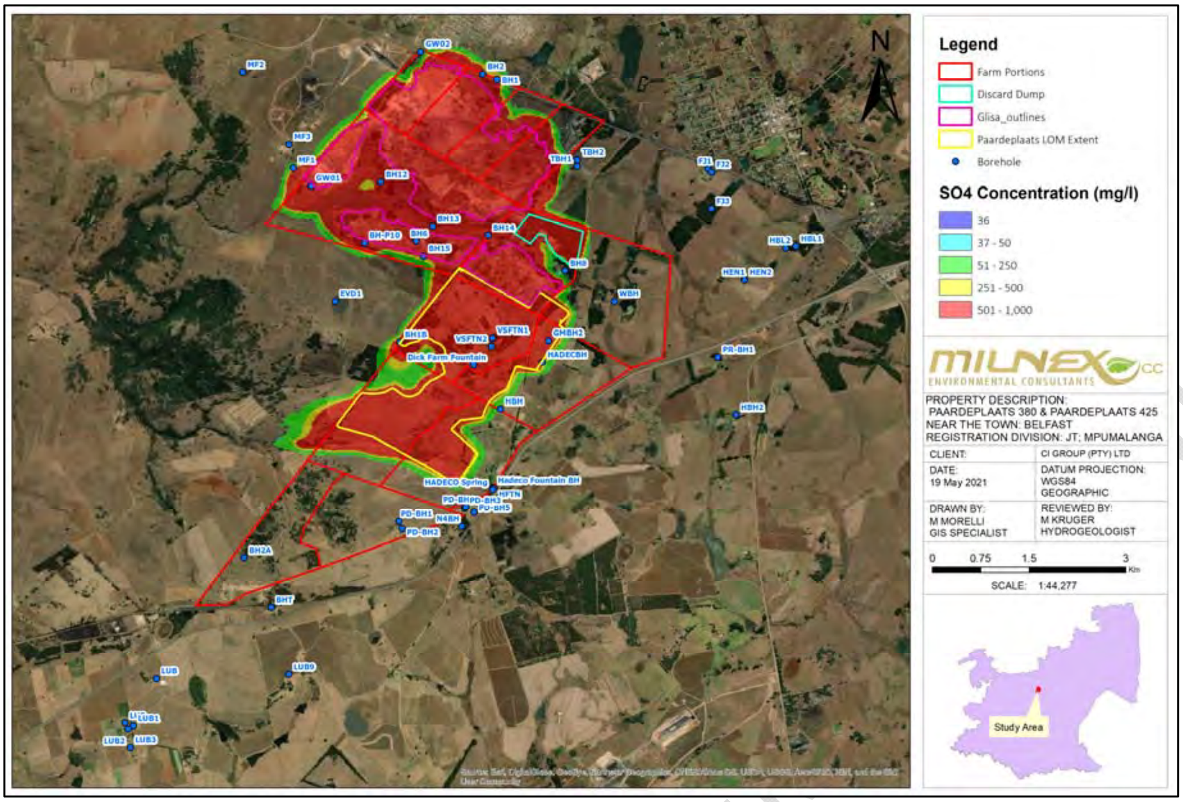

Figure 10.16: Simulated SO_4 Contaminant Plume – 100 Years Post Closure with DMF Leakage.

10.1.8 Heritage

The significance of heritage sites is based on five main criteria:

- Site integrity (i.e. primary vs. secondary context);
- Amount of deposit or range of features (e.g., stonewalling, stone tools and enclosures);
- Density of scatter (dispersed scatter):
  - Low - <10/50 m^2
  - Medium - 10-50/50 m^2
  - High - >50/50 m^2
- Uniqueness; and
- The potential to answer present research questions.

Site significance classification standards (**Table 10.16**) prescribed by the South African Heritage Resources Agency (SAHRA) (2006) and approved by the Association for Southern African Professional Archaeologists (ASAPA) for the Southern African Development Community (SADC) region, were used for the purpose of determining significance of heritage features within the Integrated Paardeplaats Section (**Table 10.17**).

Table 10.16: Site Significance Classification Standards as Prescribed by SAHRA.

FIELD RATING	GRADE	SIGNIFICANCE	RECOMMENDED MITIGATION
National Significance (NS)	Grade 1	-	Conservation; National site nomination.
Provincial Significance (PS)	Grade 2	-	Conservation; Provincial site nomination.
Local Significance (LS)	Grade 3A	High	Conservation; Mitigation not advised.
Local Significance (LS)	Grade 3B	High	Mitigation (part of site should be retained).
Generally Protected A (GP.A)	-	High/Medium	Mitigation before destruction.
Generally Protected B (GP.B)	-	Medium	Recording before destruction.
Generally Protected C (GP.C)	-	Low	Destruction.

Table 10.17: Significance of heritage features within the Integrated Paardeplaats Section.

SITE NUMBER AND TYPE	2012 SIGNIFICANCE AND FIELD RATING	2021 SIGNIFICANCE AND FIELD RATING
PP 1 - Demolished Historic Farmstead	High; LS (Grade 3B)	Low; GP.C
PP 2 - Burial Ground	High/Medium; GP.A	High/Medium; GP.A
PP 3 - Burial Ground	High/Medium; GP.A	High/Medium; GP.A
PP 4 - Burial Ground	High/Medium; GP.A	High/Medium; GP.A
PP 5 - Burial Ground	High/Medium; GP.A	High/Medium; GP.A
PP 6 - Historic Homesteads and Structures with the Possible Risk for Unmarked Graves	Low; GP.C	Medium; GP.B
PP 7 - Demolished Historic Structures	Medium; GP.B	Low; GP.C
PP 8 - Demolished Historic Farmstead	Medium; GP.B	Low; GP.C
PP 9 - Demolished Historic Structure	Medium; GP.B	Low; GP.C
PP 10 - Single Grave	High/Medium; GP.A	High/Medium; GP.A
PP 11 - Historic Farmstead and Structures with the Possible Risk for Unmarked Graves	Medium; GP.B	Medium; GP.B
PP 12 - Historic Coal Mine Shaft	Medium; GP.B	Medium; GP.B
PP 13 - Historic Coal Mine Shaft	High/Medium; GP.A	High/Medium; GP.A
PP 14 - Possible Rock Art Site	PS (Grade 2)	High/Medium; GP.A
PP 15 - Historic Homesteads and Structures with the Possible Risk for Unmarked Graves	Low; GP.C	Medium; GP.B
PP 16 - Historic Homestead with Graves and the Possible Risk for Unmarked Graves	High/Medium; GP.A	High/Medium; GP.A
PP 17 - Historic Coal Mine Shaft	High/Medium; GP.A	High/Medium; GP.A
PP 18 - Animal Drinking Trough	Low; GP.C	Low; GP.C
PP 19 - Demolished Historic Structure	Low; GP.C	Low; GP.C
PP 20 - Reservoir with Associated Structures	Low; GP.C	Low; GP.C
PP 21 - Historic Homesteads and Structures with the Possible Risk for Unmarked Graves	Low; GP.C	Medium; GP.B

SITE NUMBER AND TYPE	2012 SIGNIFICANCE AND FIELD RATING	2021 SIGNIFICANCE AND FIELD RATING
PP 22 - Historic Homesteads and Structures with the Possible Risk for Unmarked Graves	Low; GP.C	Medium; GP.B
PP 23 - Demolished Historic Structure (before 2012)	Low; GP.C	Low; GP.C
PP 24 - Sunbury Railway Station	Low; GP.C	Low; GP.C
PP 25 - Historic Homesteads and Structures with the Possible Risk for Unmarked Graves	Low; GP.C	Medium; GP.B
PP 26 - Historic Homesteads and Structures with the Possible Risk for Unmarked Graves	Low; GP.C	Medium; GP.B
PP 27 - Historic Structure	Medium; GP.B	Medium; GP.B
PP 28 - Burial Ground	High/Medium; GP.A	High/Medium; GP.A
PP 29 - Historic Homesteads and Structures with the Possible Risk for Unmarked Graves	Low; GP.C	Medium; GP.B
PP 30 - Historic Farmstead	Medium; GP.B	Medium; GP.B
PP 31 - Burial Ground	High/Medium; GP.A	High/Medium; GP.A
PP 32 - Historic Homesteads and Structures with the Possible Risk for Unmarked Graves	Low; GP.C	Medium; GP.B
PP 33 - Historic Structure	-	Medium; GP.B
PP 34 - Demolished Structure	-	Low; GP.C
PP 35 - Contemporary Farmstead	-	Low; GP.C
PP 36 - Historic Coal Mine Shaft	-	High/Medium; GP.A
PP 37 - Single Grave	-	High/Medium; GP.A
PP 38 - Reservoir with Associated Structures	-	Low; GP.C
PP 39 - Reservoir with Associated Structures	-	Low; GP.C
PP 40 - Historic Homestead with the Possible Risk for Unmarked Graves	-	Medium; GP.B
PP 41 - Structure	-	Low; GP.C
PP 42 - Animal Drinking Trough	-	Low; GP.C
PP 43 - Demolished Structure	-	Low; GP.C
PP 44 - Reservoirs with Associated Structures	-	Low; GP.C
PP 45 - Demolished Structure	-	Low; GP.C

No mitigation is required for heritage features assessed to have a low heritage significance. As a result, no mitigation is required for such sites (PP 1, PP 7, PP 8, PP 9, PP 18, PP 19, PP 20, PP 23, PP 24, PP 34, PP 35, PP 38, PP 39, PP 41, PP 42, PP 43, PP 44 and PP 45). Site mitigation measures would be required should any development footprints be proposed within 100 m of the identified burial grounds (PP 2, PP 3, PP 4, PP 5, PP 28 and PP 31) and graves (PP 10 and PP 37) or within 50 m of any other identified heritage sites that are of Medium Significance and higher (PP 6, PP 11, PP 15, PP 16, PP 21, PP 22, PP 25, PP 26, PP 27, PP 29, PP 30, PP 32, PP 33 and PP 40). General site mitigation measures are also required for the Possible Rock Art Site (PP 14) and sites comprising Historic Coal Mine Shafts (PP 12, PP 13, PP 17 and PP 36). These general mitigation measures must be implemented as soon as possible and are not dependent on the expansion of development footprint areas.

Furthermore, of the 45 heritage features identified, only 5 are located within 1,000 m of the proposed DMF footprint area, namely:

- Site PP 31 (Burial Ground) – 158 m east of the proposed DMF;
- Site PP 41 (Structure) – 199 m south by south-east of the proposed DMF;
- Site PP 30 (Historic Farmstead) – 549 m south-east of the proposed DMF;
- Site PP 3 (Burial Ground) – 930 m south-west of the proposed DMF; and
- Site PP 32 (Historic Homestead with Possible Risk for Unmarked Graves) – 937 m south-east of the proposed DMF.

From these distances it is evident that the construction of the proposed DMF will have no impact on any of the identified heritage sites. As such, no mitigation is required for the construction of this DMF to continue.

The proposed Integrated Paardeplaats Section is primarily underlain by the Vryheid Formation of the Ecca Group (Karoo Supergroup). According to the South African Heritage, Resources Information System (SAHRIS) the palaeontological sensitivity of these rocks is considered very high (**Figure 10.17**). A palaeontological sensitivity rating of very high requires field assessment and protocol development for finds.

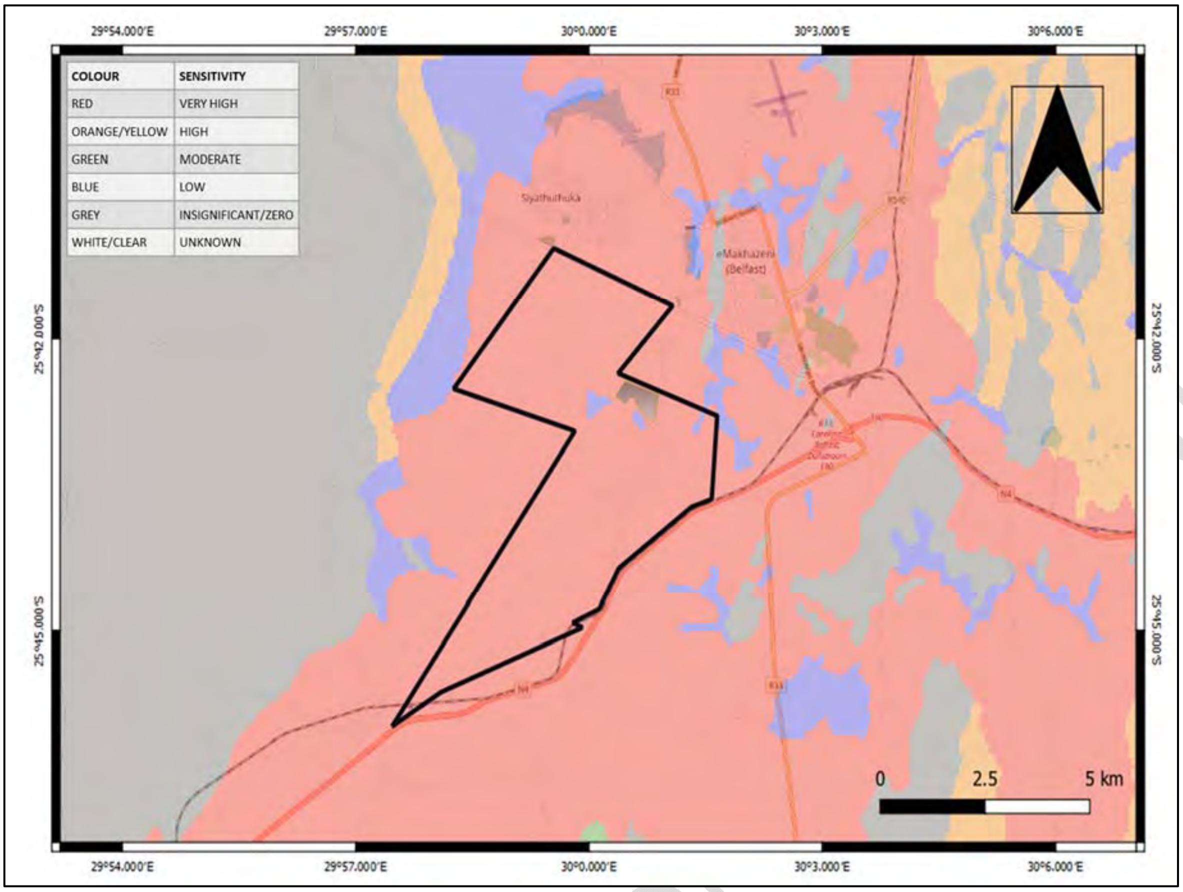

Figure 10.17: 1:250 000 SAHRIS PalaeoMap in Graded Colours Indicating the Integrated Paardeplaats Section.

10.1.9 Traffic

The impact assessment has been based on the operational stage of the mine, as this stage will be a worst case scenario from a traffic engineering perspective. During the operational phase of the mine the traffic generated will be at its highest on a daily basis and it is during this period that the impact will be the highest. The impact on the roads is measured in terms of performance (Level of Service (LoS)), which is the accepted methodology. The LoS is based on a scale of A - F, with A being the best case and F the worst case.

The LoS indicates the effectiveness of the road in ensuring that traffic is flowing freely. LoS A indicates that the road is operating in free flow conditions with vehicles travelling at or above the posted speed limit. LoS F indicates that the vehicular flow has broken down and that vehicles are frequently slowing and stopping, technically a road in constant jam would be at LoS F. Ideally a road should operate between LoS A and D, if a road operates at LoS E or F then it would indicate that upgrades are required in order for the road to operate at an acceptable LoS.

The roads associated with the Integrated Paardeplaats Section operate at a LoS C or better and there is no change in the LoS as additional traffic is added due to the mining activities. This indicates that additional traffic has no discernible impact on the operation of the links assessed. With regards to the intersections no alterations will be required in terms of capacity as the additional development traffic will have a minimal impact at the intersections.

10.1.10 Blast and Vibration

10.1.10.1 Operational Phase

Blasting operations have effect to the surroundings and apply during the operational phase of the Integrated Paardeplaats Section. These effects can manifest in the form of ground vibration, air blast, fumes, fly rock etc. The application of explosives breaking rock will always have a positive and negative manifestation of different energies. It is the effects that have negative outcome that will need to be managed.

10.1.10.1.1 Ground Vibration

Table 10.18 shows expected ground vibration levels for various distances calculated at three different charge masses - a low charge mass (127 kilograms (kg)), an expected medium charge mass (1,019 kg) mass, and a maximum charge mass (2,035 kg) as the worst case scenario. Limitations on ground vibration are in the form of maximum allowable levels for different installations and structures. These levels are normally quoted in Peak Particle Velocity (PPV) or as ground vibration in millimetres per second (mm/s).

Table 10.18: Expected Ground Vibration at Various Distances from Charges Applied.

NO.	DISTANCE (m)	EXPECTED PPV (mm/s)		
		LOW CHARGE MASS (127 kg)	MEDIUM CHARGE MASS (1,019 kg)	MAXIMUM CHARGE MASS (2,035 kg)
1	50.0	76.8	373.6	632.0
2	100.0	41.4	201.7	341.2
3	150.0	14.5	70.3	119.0
4	200.0	9.3	45.4	76.8
5	250.0	6.6	32.4	54.7
6	300.0	5.0	24.5	41.5
7	400.0	3.3	15.8	26.8
8	500.0	2.3	11.3	19.1
9	600.0	1.8	8.6	14.5
10	700.0	1.4	6.8	11.4

NO.	DISTANCE (m)	EXPECTED PPV (mm/s)		
		LOW CHARGE MASS (127 kg)	MEDIUM CHARGE MASS (1,019 kg)	MAXIMUM CHARGE MASS (2,035 kg)
11	800.0	1.1	5.5	9.3
12	900.0	0.9	4.6	7.8
13	1000.0	0.8	3.9	6.7
14	1250.0	0.6	2.8	4.7
15	1500.0	0.4	2.1	3.6
16	1750.0	0.3	1.7	2.8
17	2000.0	0.3	1.4	2.3
18	2500.0	0.2	1.0	1.7
19	3000.0	0.2	0.7	1.3
20	3500.0	0.1	0.6	1.0

A further aspect of ground vibration and frequency of vibration is the human perception. It should be realized that the legal limit for structures is significantly greater than the comfort zones for people. Humans and animals are sensitive to ground vibration and vibration of the structures.

Ground vibration is experienced as “Perceptible”, “Unpleasant” and “Intolerable” (to name three of the five levels tested) at different vibration levels for different frequencies. This is indicative of the human’s perceptions on ground vibration and clearly indicates that humans are sensitive to ground vibration. Humans already perceive ground vibration levels of 4.5 mm/s as unpleasant. Generally people also assume that any vibrations of the structure - windows or roofs rattling - will cause damage to the structure.

10.1.10.1.2 Air Blast

Air blast or air-overpressure is pressure acting and should not be confused with sound that is within audible range (detected by the human ear). Sound is also a build up from pressure but is at a completely different frequency to air blast. Air blast is normally associated with frequency levels less than 20 Hertz (Hz), which is the threshold for hearing. Air blast is the direct result from the blast process and can be influenced by meteorological conditions, blast layout, timing, stemming, accessories used, for example, all of which have an influence on the outcome of the result. The three main causes of air blasts can be observed as:

- Direct rock displacement at the blast (Air Pressure Pulse (APP));
- Vibrating ground some distance away from the blast (Rock Pressure Pulse (RPP)); and
- Venting of blast holes or blowouts (Gas Release Pulse (GRP)).

The recommended limit for air blast currently applied in South Africa is 134 decibels (dB). All attempts should be made to keep air blast levels generated from blasting operations below 120 dB or especially where public perception is of concern. **Table 10.19** presents the estimates of damage thresholds.

Table 10.19: Damage Limits for Air Blast.

LEVEL	DESCRIPTION
120 dB	Threshold of pain for continuous sound
>130 dB	Resonant response of large surfaces (roofs, ceilings)
150 dB	Some windows break
170 dB	Most windows break
180 dB	Structural Damage

Table 10.20 shows expected air blast values for various distances calculated at the three different charge masses (i.e., low, medium and maximum).

Table 10.20: Expected Ground Vibration at Various Distances from Charges Applied.

NO.	DISTANCE (m)	AIR BLAST (dB)		
		LOW CHARGE MASS (127 kg)	MEDIUM CHARGE MASS (1,019 kg)	MAXIMUM CHARGE MASS (2,035 kg)
1	50.0	155	163	166
2	100.0	151	159	161
3	150.0	144	151	154
4	200.0	141	148	151
5	250.0	139	146	148
6	300.0	137	144	146
7	400.0	135	141	144
8	500.0	133	139	141
9	600.0	131	137	140
10	700.0	130	136	138
11	800.0	129	135	137
12	900.0	127	134	136
13	1000.0	127	133	135
14	1250.0	125	131	133
15	1500.0	123	129	131
16	1750.0	122	128	130
17	2000.0	121	127	129
18	2500.0	119	125	127
19	3000.0	117	123	125
20	3500.0	116	122	124

10.1.10.1.3 Fly Rock

Blasting practices require some movement of rock to facilitate the excavation process. Fly rock from blasting can result from three mechanisms due to the lack of confinement of the energy in the explosive column, namely:

- Face burst - burden conditions usually control fly rock distances in front of the face;
- Cratering - if the stemming height to hole diameter ratio is too small or the collar rock is weak; and
- Rifling - if the stemming material is ejected with insufficient stemming height or inappropriate stemming material is used.

In short, the following are typical causes of fly rock:

- Burden to small/large;
- Burden to large;
- Stemming length to short;
- Out of sequence initiation of blastholes;
- Drilling inaccuracies;
- Incorrect blasthole angles; and
- Over charged blastholes.

The occurrence of fly rock in any form will have impact if found to travel outside the safe boundary of the blast. This safe boundary varies depending on what structures may be influenced by the blast. If a road, structure, animals or people are closer than the safe boundary, irrespective of the possibility of fly rock or not, precautions should be taken to stop the traffic, remove people or animals for the period of the blast. Fly rock will cause damage to a road, vehicles or even death to people or animals if the blast is not correctly planned, executed and managed.

10.1.10.1.4 Noxious Fumes

The creation of poisonous fumes such as nitrous oxides and carbon monoxide are particular undesirable. These fumes present themselves as red brown cloud after the blast has detonated. It has been reported that 10 - 20 parts per million (ppm) have been mildly irritating, whilst exposure to 150 ppm or more has been reported to cause death from pulmonary oedema, therefore anybody exposed to higher limits must be taken to hospital for proper treatment.

10.1.11 Noise

The following noise standards and impact criteria apply to the Integrated Paardeplaats Section prior to any impacts from noise generating activities:

- Rural residential: the noise impact on the farmhouse sites, residences, and guesthouses on farms in the area has been determined on the basis of rural residential district standards (SANS 10103), namely the daytime period ambient noise level should not exceed 45 decibel (dBA) and that for the night-time period should not exceed 35 dBA.
- Suburban residential: the noise impact on eMakhazeni and Siyathuthuka has been determined on the basis of suburban residential district standards (SANS 10103), namely the daytime period ambient noise level should not exceed 50 dBA and that for the night-time period should not exceed 40 dBA.
- Educational: the noise impact on the schools in the area have been determined on the basis that the daytime period ambient noise level should not exceed 50 dBA and that for the night-time period should not exceed 40 dBA.

Impacts from noise generating activities apply during the construction, operational and closure/decommissioning phases of the Integrated Paardeplaats Section.

10.1.11.1 Construction Phase

The level and character of the construction noise will be highly variable as different activities with different plant/equipment will take place at different times, over different periods, in different combinations, in different sequences and on different parts of the construction site. Typical noise levels generated by various types of equipment are presented in **Table 10.21**. These noise levels assume that the equipment is maintained in good order.

Table 10.21: Typical Noise Levels Generated by Equipment.

PLANT/EQUIPMENT	TYPICAL OPERATIONAL NOISE LEVEL AT GIVEN OFFSET (dBA)							
	5 m	10 m	25 m	50 m	100 m	250 m	500 m	1000 m
Air compressor	91	85	77	71	65	57	51	46
Compactor	92	86	78	72	66	58	52	46
Concrete batching plant	84	78	70	64	58	49	42	35
Concrete mixer	95	89	81	75	69	61	55	49
Concrete vibrator	86	80	72	66	60	52	46	40
Mobile Conveyor belt	77	71	63	57	51	43	37	32
Crusher (aggregate)	90	84	76	70	64	56	50	44
Crane (mobile)	93	87	79	73	67	59	53	47

PLANT/EQUIPMENT	TYPICAL OPERATIONAL NOISE LEVEL AT GIVEN OFFSET (dBA)							
	5 m	10 m	25 m	50 m	100 m	250 m	500 m	1000 m
Dozer	95	89	81	75	69	61	55	49
Loader	95	89	81	75	69	61	55	49
Mechanical shovel	98	92	84	78	72	64	58	52
Pile driver	110	104	97	91	85	77	71	65
Pump	86	80	72	66	60	52	46	40
Pneumatic breaker	98	92	84	78	72	64	58	52
Rock drill	108	102	94	88	82	74	68	62
Roller	84	78	70	64	58	50	44	38
Trucks	87	81	73	67	64	60	57	54

Using data from typical construction sites, the ambient noise conditions at various offsets from the following main construction activities are predicted:

- Noise from concrete batching plant (if required); and
- General concrete construction in the various proposed infrastructure areas, for example storm water culverts.

The general nature of the noise impacts from construction activities are as follows:

- Source noise levels from many of the construction activities will be high. Noise levels from all work areas will vary constantly and, in many instances, significantly over short periods during any daytime working period.
- It is estimated that the ambient noise level from general construction activities could negatively affect noise sensitive sites within a distance of 1,300 m of construction activities, whilst night-time construction could have a significant impact on noise sensitive sites within a radius of 3,000 m of the construction activities.
- There are likely to be significant noise nuisance effects during the day from intermittent loud noises on people living in the area. If there is any night-time construction, fairly significant impacts will be experienced.
- The level and character of the road construction noise will be highly variable as different activities with different plant/equipment take place at different times, over different periods, in different combinations, in different sequences and on different parts of the construction site. In general, the typical noise levels of road construction equipment at a distance of 15 m will lie in the range of 75 – 100 dBA.

It should be noted that higher ambient noise levels than recommended in SANS 10103 are normally accepted as being reasonable during the construction period, provided that the very noisy construction activities are limited to the daytime and that the contractor takes reasonable measures to limit noise from the work site. The construction noise impact is not likely to be severe, however the potential for notable impacts at sites in the immediate vicinity of construction activities do exist.

10.1.11.2 Operational Phase

The analysis of the noise impact of the operational phase of the project has focused on the critical noise footprint of the opencast pit. The noise contours presented reflect the worst meteorological conditions, namely when temperature inversion occurs. Certain of the sounds generated from the open pit operations will be continuous (over 24-hours) while others will be intermittent. The loudest of the continuous noise sources and intermittent noise sources are presented in **Table 10.22**.

Table 10.22: Loudest Continuous and Intermittent Noise Sources.

CONTINUOUS NOISE SOURCE	INTERMITTENT NOISE SOURCE
Pneumatic drills (for blast holes)	Blasting
Excavators, loaders, and bull-dozers	Ancillary transport in pit (blasting truck, service truck, water truck, supervisory vehicles)
Dewatering pumps	Coal haul trucks between mine and surface workings
Coal haul trucks	

The ambient noise profile that will be generated by continuous mining operations is predicted to be as indicated in **Table 10.23**. These unmitigated conditions could occur in the daytime or night-time under specific meteorological conditions.

Table 10.23: Predicted Ambient Noise Levels from Opencast Pits (Unmitigated).

TIME PERIOD	SOUND PRESSURE LEVEL AT GIVEN OFFSET (dBA)							
	100 m	500 m	1000 m	2000 m	3000 m	4000 m	5000 m	6100 m
Daytime (06h00 – 22h00) LReq,d	78.9	64.0	57.1	49.6	44.7	41.0	37.9	35.1
Night (22h00 – 06h00) LReq,n	78.9	64.0	57.1	49.6	44.7	41.0	37.9	35.1

It should also be noted that the mining operation will not extend over the whole pit area associated with the Integrated Paardeplaats Section at any one time but will instead be mined incrementally. This means that there will not be a static noise footprint from the mining operations. As well as moving in plan, the noise levels from the respective pits being mined will also vary (noise will decrease) as the depth of the pit increases due to the shielding from the sidewalls of the excavation and if berms are built.

The noise footprint presented in **Figure 10.18** is for the mining operations over the full mining period for the Integrated Paardeplaats Section and is therefore the total noise profile covering the noise generated by each of these pit scenarios for all situations over the full LoM of that pit. It indicates the worst situation that could occur at any specific receiver point for a specific period of the mining operation. As the mining operation is virtually continuous over 24 hours, the activities will remain similar over time and therefore noise contours for the daytime and night-time periods (as defined by SANS 10103) will be the same.

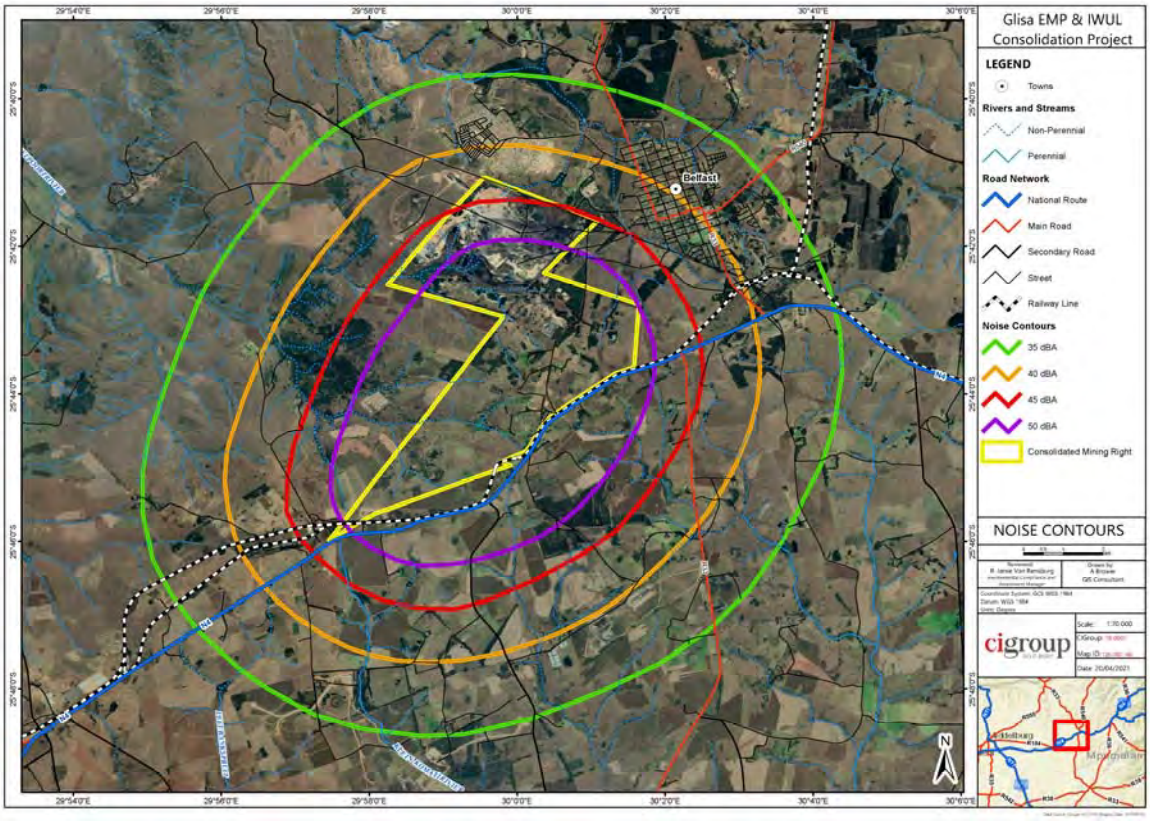

Figure 10.18: Noise Profile of Opencast Pits.

The 35 dBA ambient noise contour demarcates the outer limit of impact for rural residential living according to SANS 10103. The instantaneous noise footprint of the opencast pit will move within this band as mining progresses. There are some short-term noises that may, at times, be heard beyond the indicated positions of the respective 35 dBA contours, for example blasting and workshop noise. The calculated noise profiles as shown **Table 10.23** and in **Figure 10.18** reflect a worst case scenario approach. The noise levels given are for unmitigated conditions and it must be borne in mind that in reality there will be greater attenuation with distance than presented where there are houses, other buildings, vegetation, and terrain restraints in the intervening ground between the source and the receiver point.

Typically noise at dumps and stockpiles will be generated when trucks dump the load, and the material is worked into an orderly dump by means of bulldozers and front-end loaders. Certain of the sounds generated by dump operations will be virtually continuous (over 24-hours) while others will be intermittent. The loudest of the continuous noise sources will be from bulldozers and front-end loaders, whilst the intermittent noises will be from haul trucks up to the dump.

The ambient noise profile that will be generated by typical operations at the dump are predicted to be as indicated in **Table 10.24**. These are the unmitigated conditions. As the dumping operations will be virtually continuous over 24 hours, the activities will remain similar over this period, and therefore contours of the noise generated for the daytime and night-time periods (as defined by SANS 10103) will be the same.

Table 10.24: Predicted Ambient Noise Conditions From Operations at Dumps and Stockpiles (Unmitigated).

TIME PERIOD	SOUND PRESSURE LEVEL AT GIVEN OFFSET (dBA)							
	500 m	1000 m	1500 m	2000 m	2500 m	3000 m	3500 m	4000 m
Daytime (06h00 – 22h00) LReq,d	57.2	50.2	45.9	42.7	40.0	37.8	35.8	34.1
Night (22h00 – 06h00) LReq,n	57.2	50.2	45.9	42.7	40.0	37.8	35.8	34.1

Coal will be hauled by truck from the pit to the CSWP. The haul roads internal to the pit have their exits from the pit on the northern corner of Portion 30 of the farm Paardeplaats 380 JT. The maximum noise from a truck, loaded en route to the CSWP and unloaded on the return trip, at various distances from the source are given in **Table 10.25**.

Table 10.25: Predicted Noise Levels From Haul Trucks (Unmitigated).

TIME PERIOD	SOUND PRESSURE LEVEL AT GIVEN OFFSET (dBA)						
	100 m	500 m	1000 m	1500 m	2000 m	2500 m	3000 m
Loaded	67.7	52.8	45.9	41.5	38.5	35.6	33.4
Unloaded	43.9	28.7					

Mine-generated traffic will increase the noise profile along the Spitskop Road by 1.3 dBA, from 61.2 dBA to 62.5 dBA. The main impact of the heavy vehicles will occur during a single bypass of a truck, during which time annoyance may be experienced.

There is a potential for several noise sensitive receptors to be impacted by the mining operation noise, albeit at different periods of mining, and specifically during the night-time period.

10.1.11.3 Decommissioning, Closure and Rehabilitation Phases

Activities that will take place during these phases are the demolition and removal of infrastructure used during the operational phase, the infilling of the open cast pit (areas not handled by the roll-over procedure during operations), and the rehabilitation of the surface area of the pit (relay of the topsoil from the storage areas and revegetation of the area).

Source noise levels will be high. The level and character of the noise during these phases will be highly variable as different activities with different equipment will take place at different times, over different periods, in different combinations, in different sequences and on different parts of the site. The noise levels for equipment presented in **Table 10.21** will apply and assume that the equipment is maintained in good order. Conservative attenuation conditions related to intervening ground conditions and screening have been applied. There is a potential for several noise sensitive receptors to be impacted by noise generated by activities during these phases, specifically during the night-time period.

10.1.12 Visual

NBC intend to construct a DMF on Portion 24 of the farm Paardeplaats 380 JT (**Figure 4.12**). A Visual Impact Assessment (VIA) was undertaken to ascertain the visual impact of the DMF, which will be 35 m in height, especially on potential sensitive receptors as previous identified in **Figure 9.5**.

The concept of a Sense of Place does not equate simply to the creation of picturesque landscapes or pretty buildings, but to recognise the importance of a sense of belonging. In terms of the natural environment, it requires the identification, a response to and the emphasis of the distinguishing features and characteristics of landscapes. Different natural landscapes suggest different responses. The sense of place around the Integrated Paardeplaats Section is created by the predominant mining and agricultural activities in the area, and the human built up area of the town of Belfast and informal settlement of Siyathuthuka.

Viewpoints were selected based on prominent viewing positions in the area (**Figure 10.19**). The selected viewpoints and view corridors were used as a basis for determining potential visual ability and visual impacts of the proposed DMF.

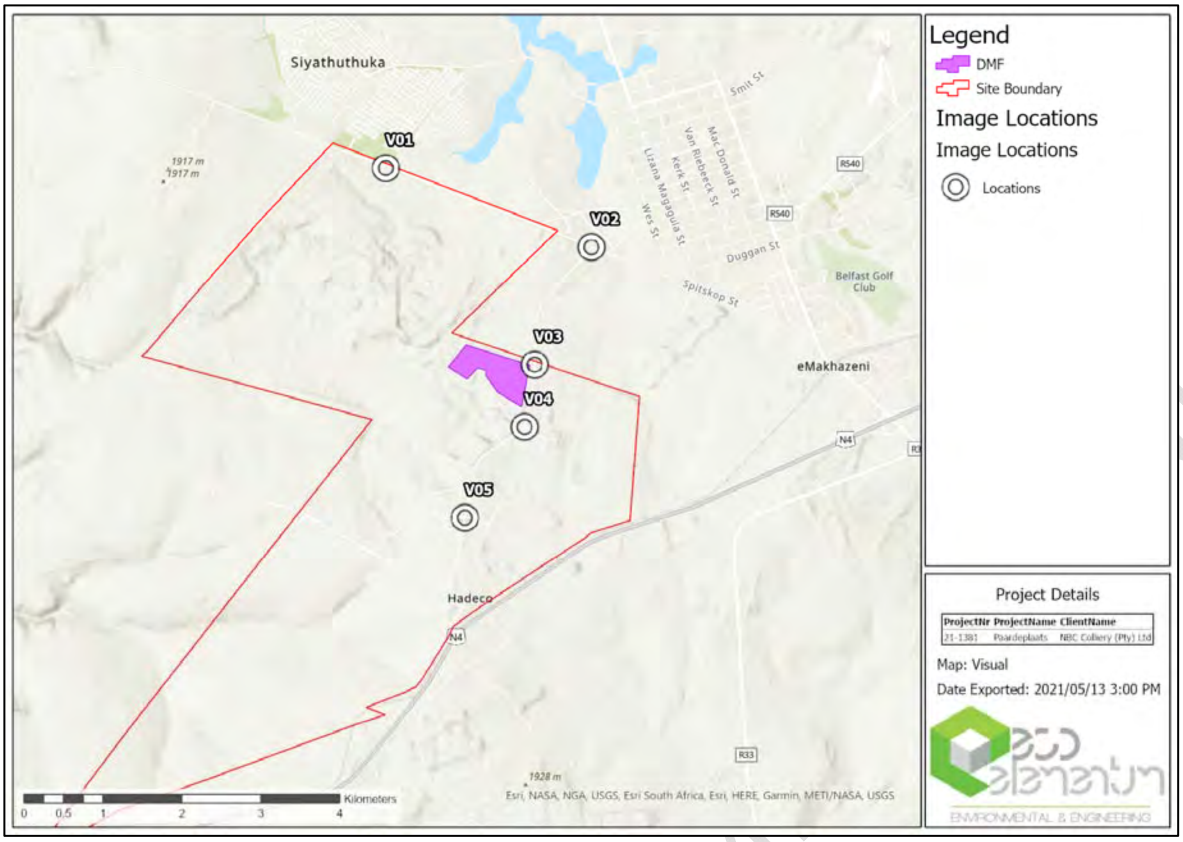

Figure 10.19: Location of Viewpoints.

Visual exposure which is based on distance from the project to selected viewpoints was assessed. Visual exposure or visual impact tends to diminish exponentially with distance. The visibility or visual exposure of any structure or activity is the point of departure for the visual impact assessment. It stands to reason that if the proposed structures were not visible, no visual impact would occur. Visual exposure within a 15 km buffer area around the proposed DMF was determined by assessing the following variables:

- Slope angle (**Figure 10.20**);
- Slope Position of structure (**Figure 10.21**);
- Aspect of slope (**Figure 10.22**);
- Landforms (**Figure 10.23**);
- Relative Elevation of structure (**Figure 10.24**); and
- Terrain Ruggedness (**Figure 10.25**).

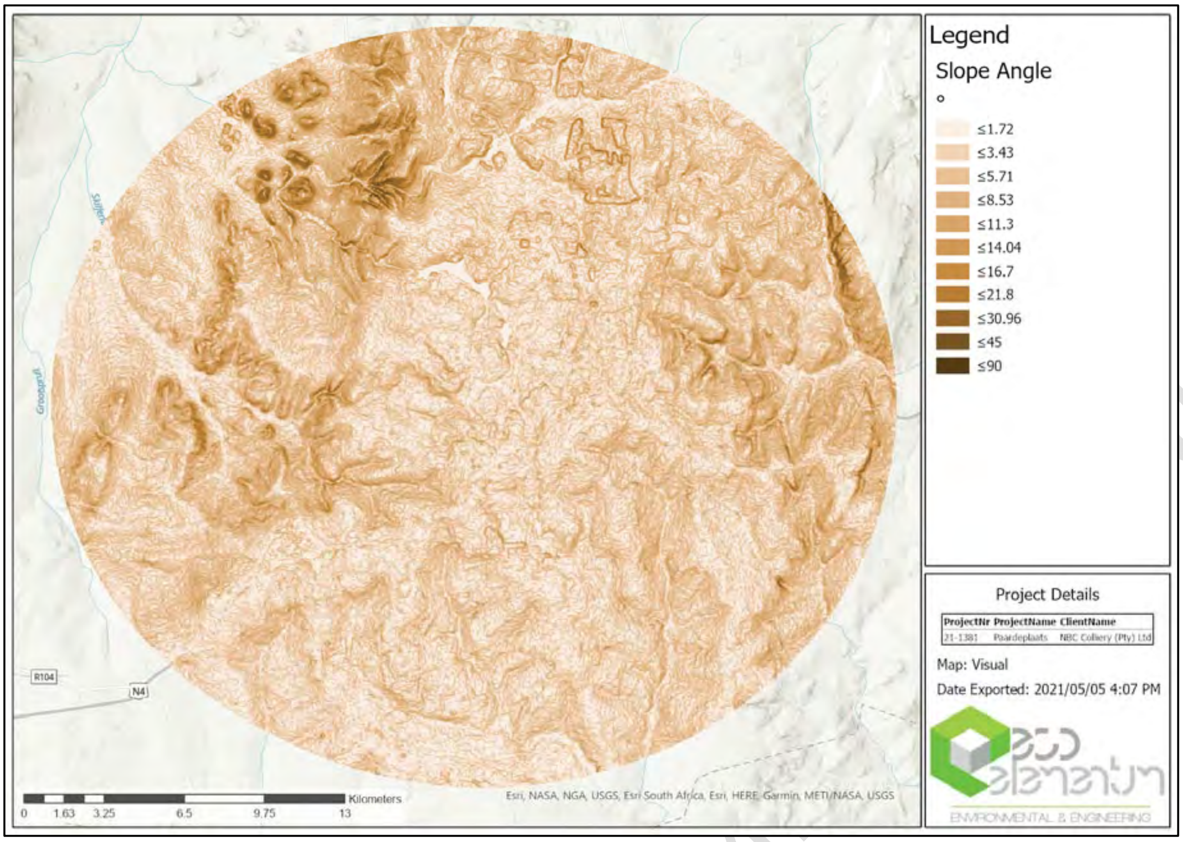

Figure 10.20: Slope Angles of Terrain.

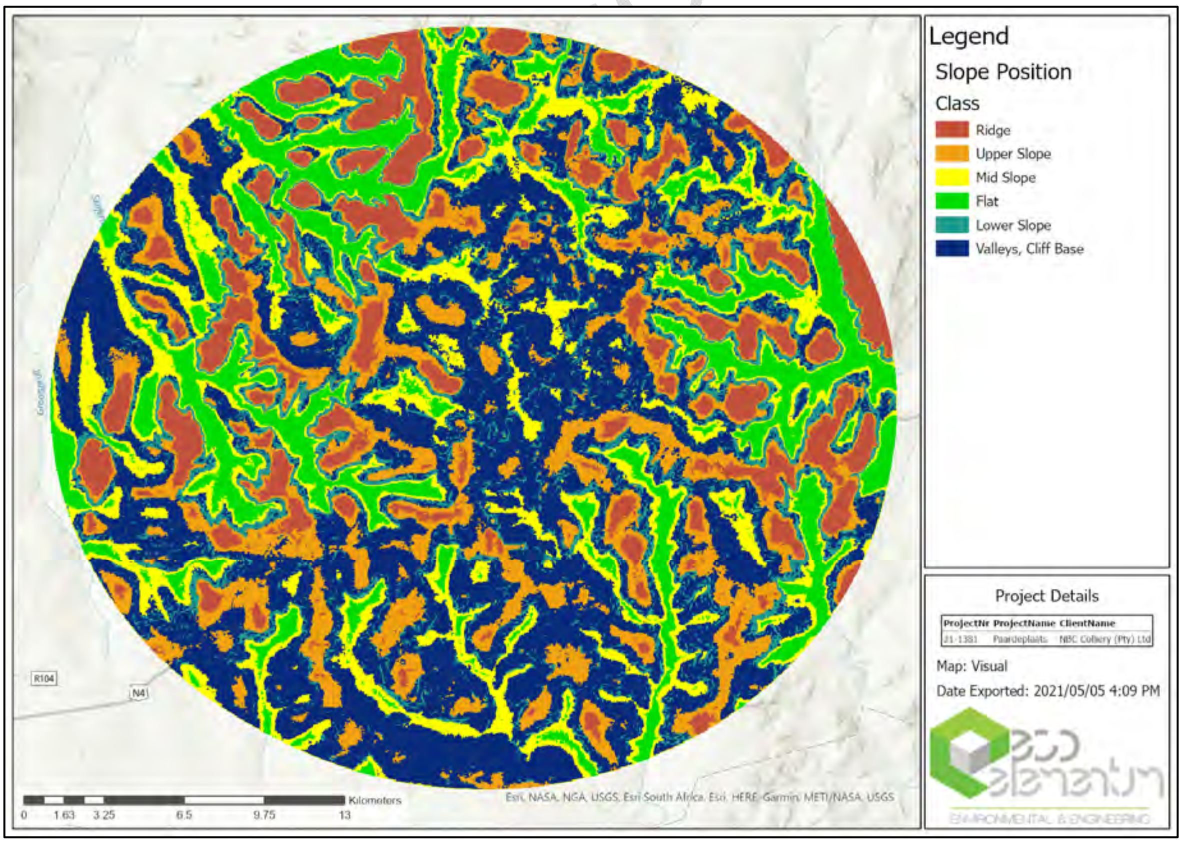

Figure 10.21: Slope Position.

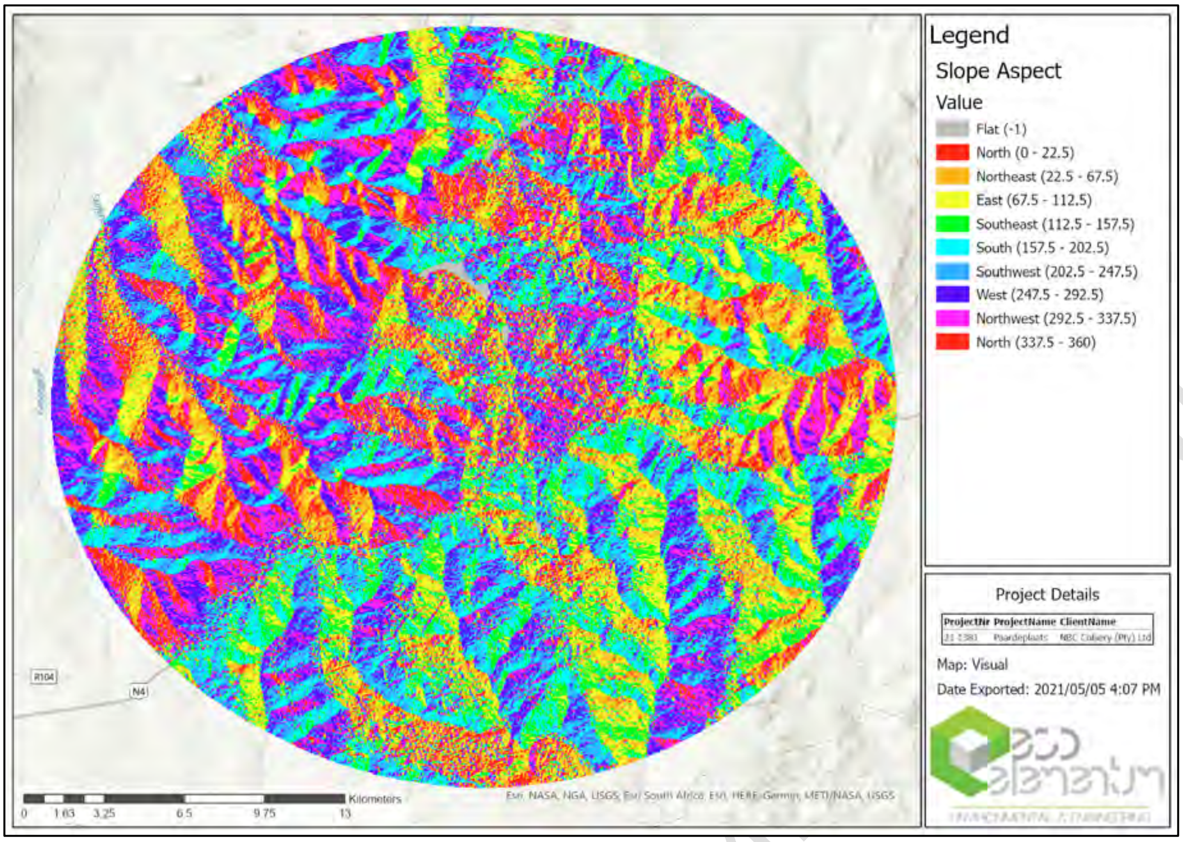

Figure 10.22: Aspect Direction of Terrain.

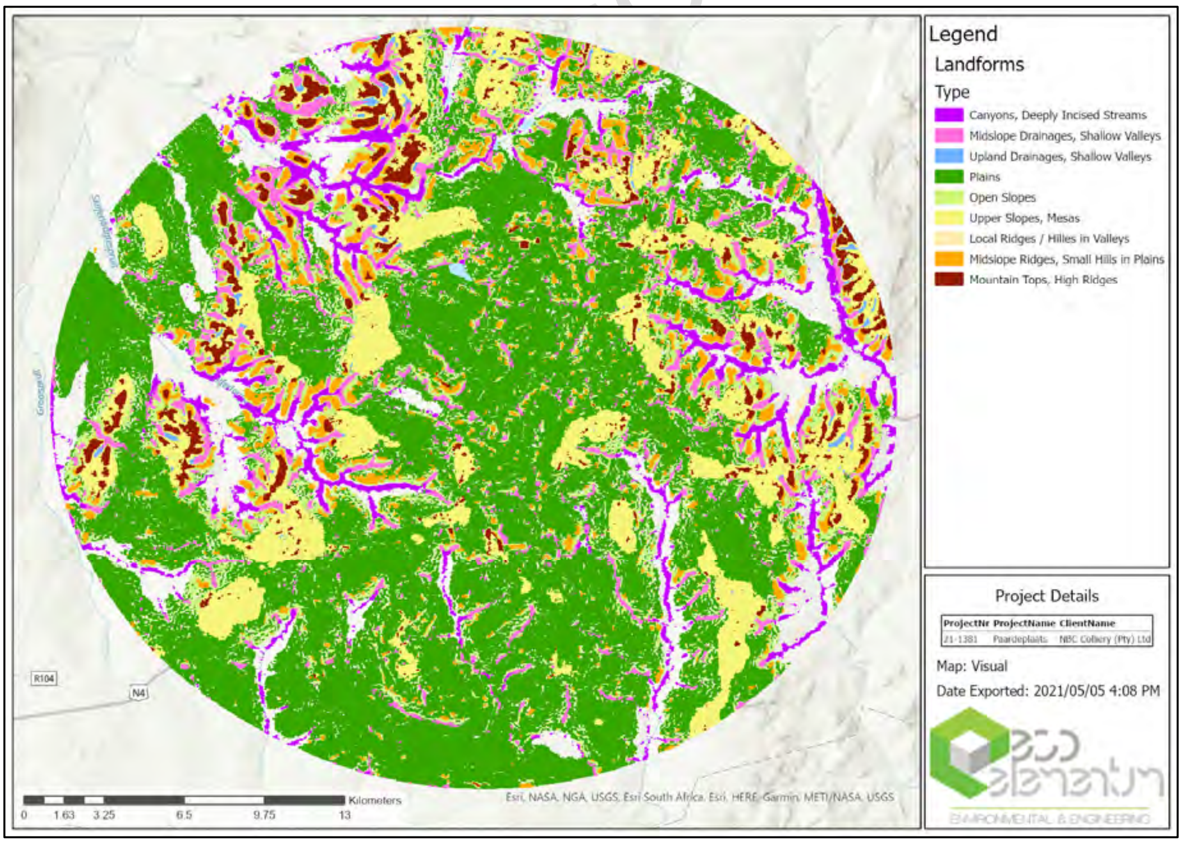

Figure 10.23: Landforms.

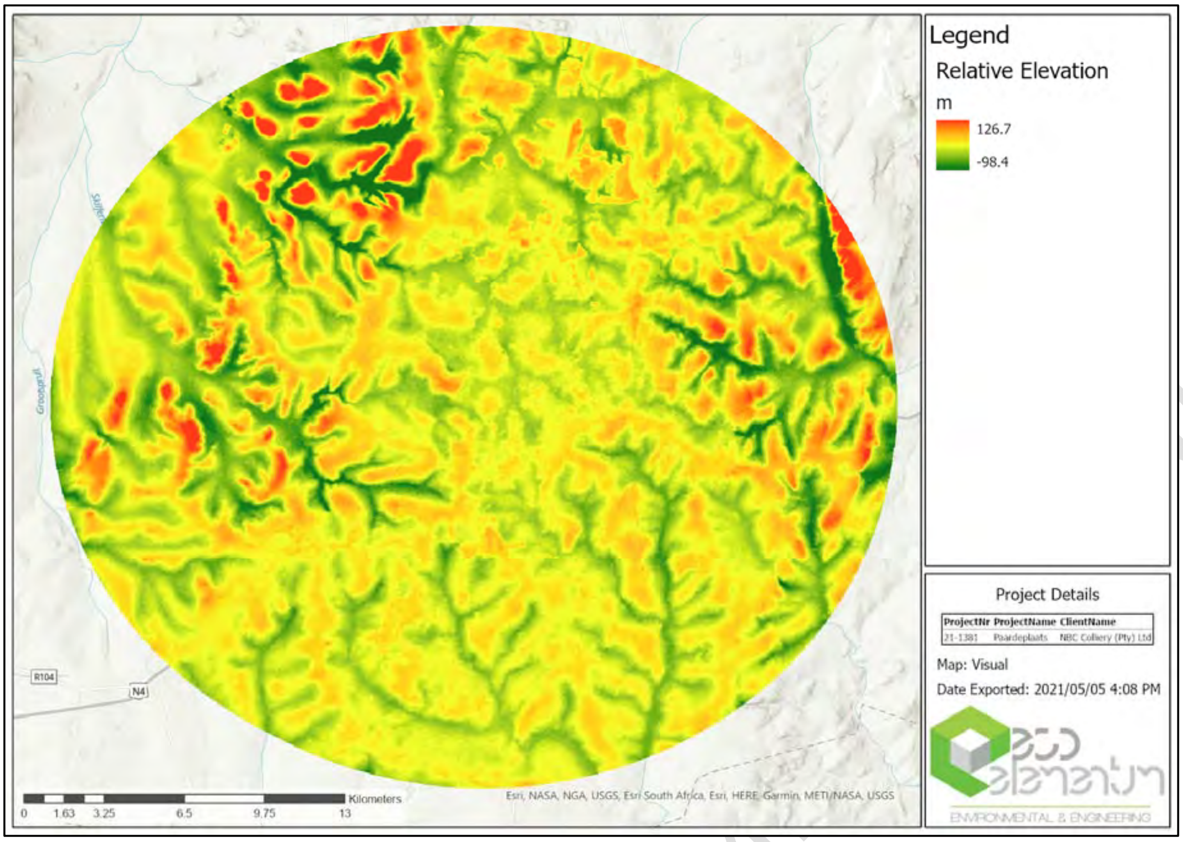

Figure 10.24: Relative Elevation of Terrain.

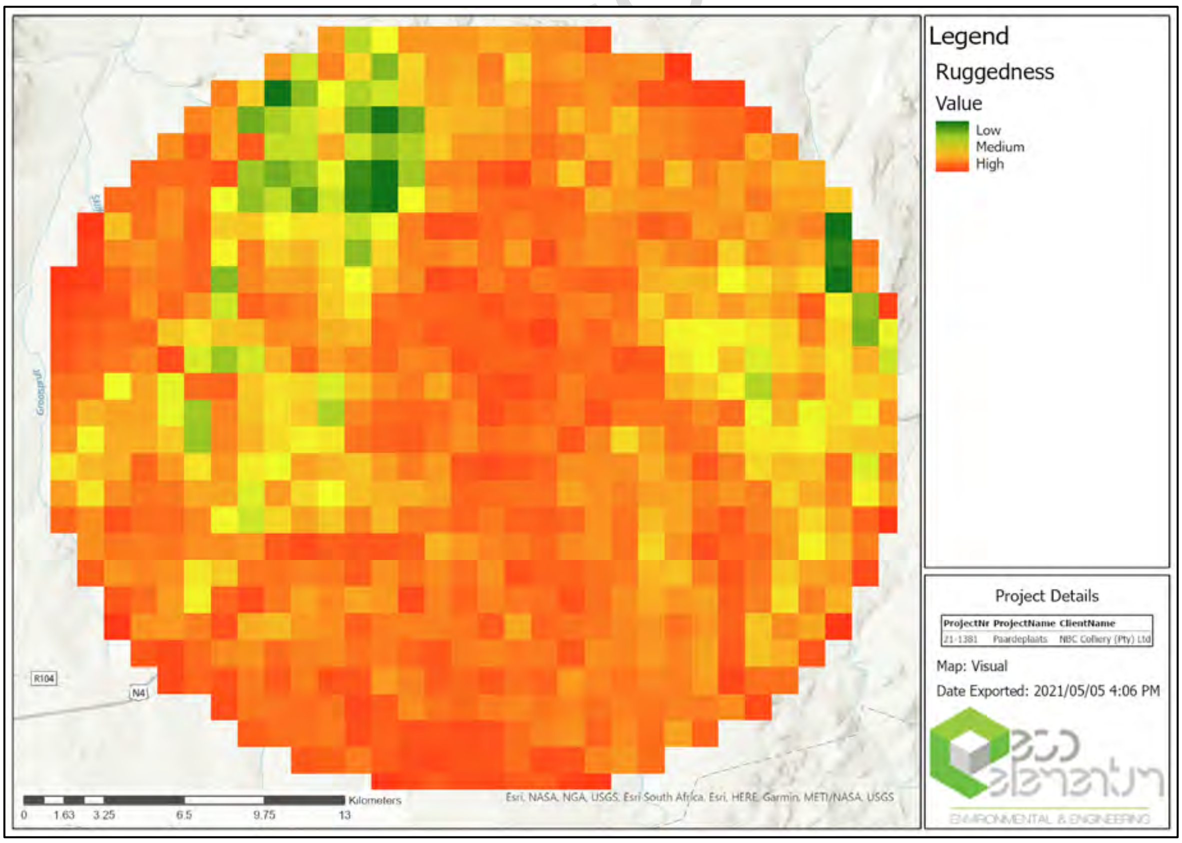

Figure 10.25: Terrain Ruggedness.

The Visual Absorption Capacity (VAC) is the capacity of the receiving environment to absorb the potential visual impact of the proposed DMF. The VAC is primarily a function of the vegetation, and will be high if the vegetation is tall, dense and continuous. Conversely, low growing, sparse and patchy vegetation will have a low VAC. Topography and built forms have the capacity to 'absorb' visual impact. The digital terrain model utilised in the calculation of the visual exposure of the facility does not incorporate potential VAC, so it is therefore necessary to determine the VAC by means of the interpretation of the vegetation cover, topography and structures, resulting in land cover being used in the ranking of the VAC (**Figure 10.26**).

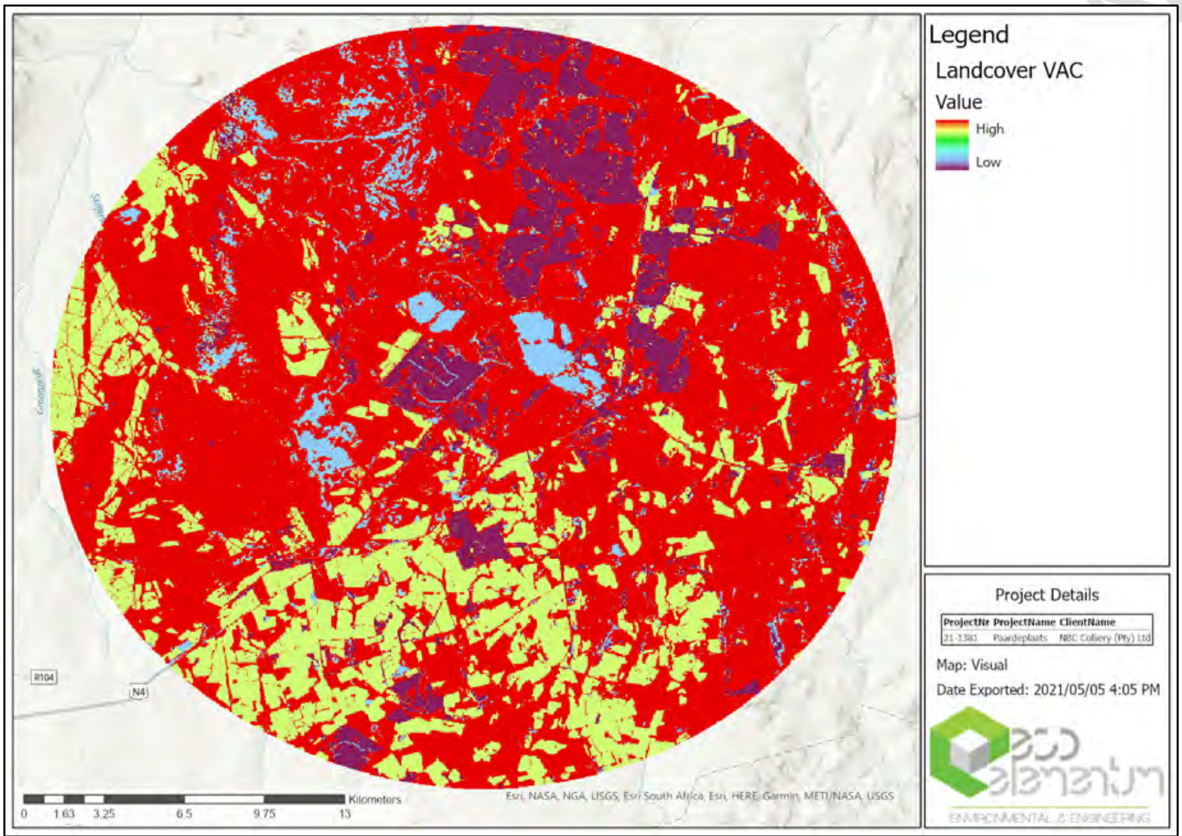

Figure 10.26: Possible VAC.

For the assessment of the visibility of the area, the DMF was allocated 20 control points and the viewshed was calculated for the amount of these control points that can be seen from any point on the map, as presented in **Figure 10.27**. The visible infrastructure count from the visibility assessment is then further ranked based on distance from the centre of the proposed infrastructure site as presented in **Figure 10.28**. Distances are rated as very low (12 – 15 km), low (9 – 12 km), medium (6 – 9 km), high (3 – 6 km), and very high (0 – 3 km).

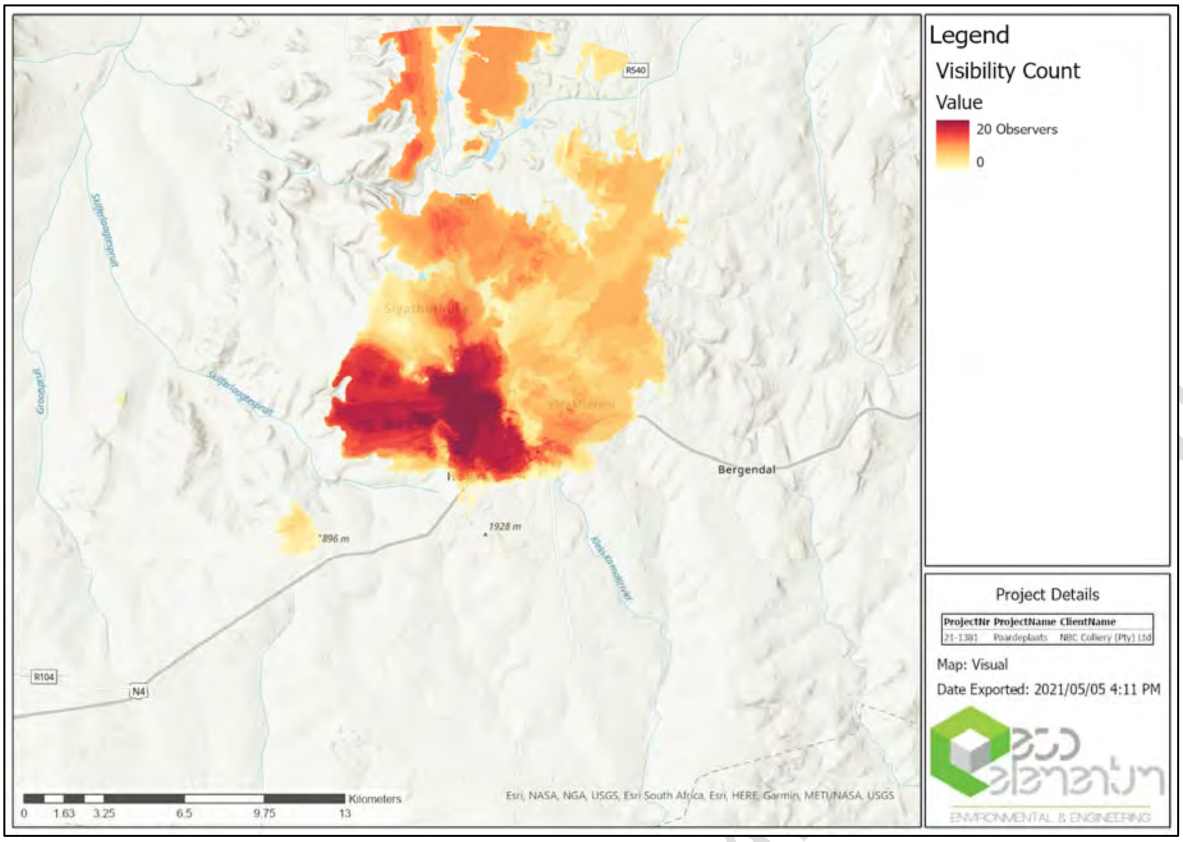

Figure 10.27: Viewshed Visibility Count.

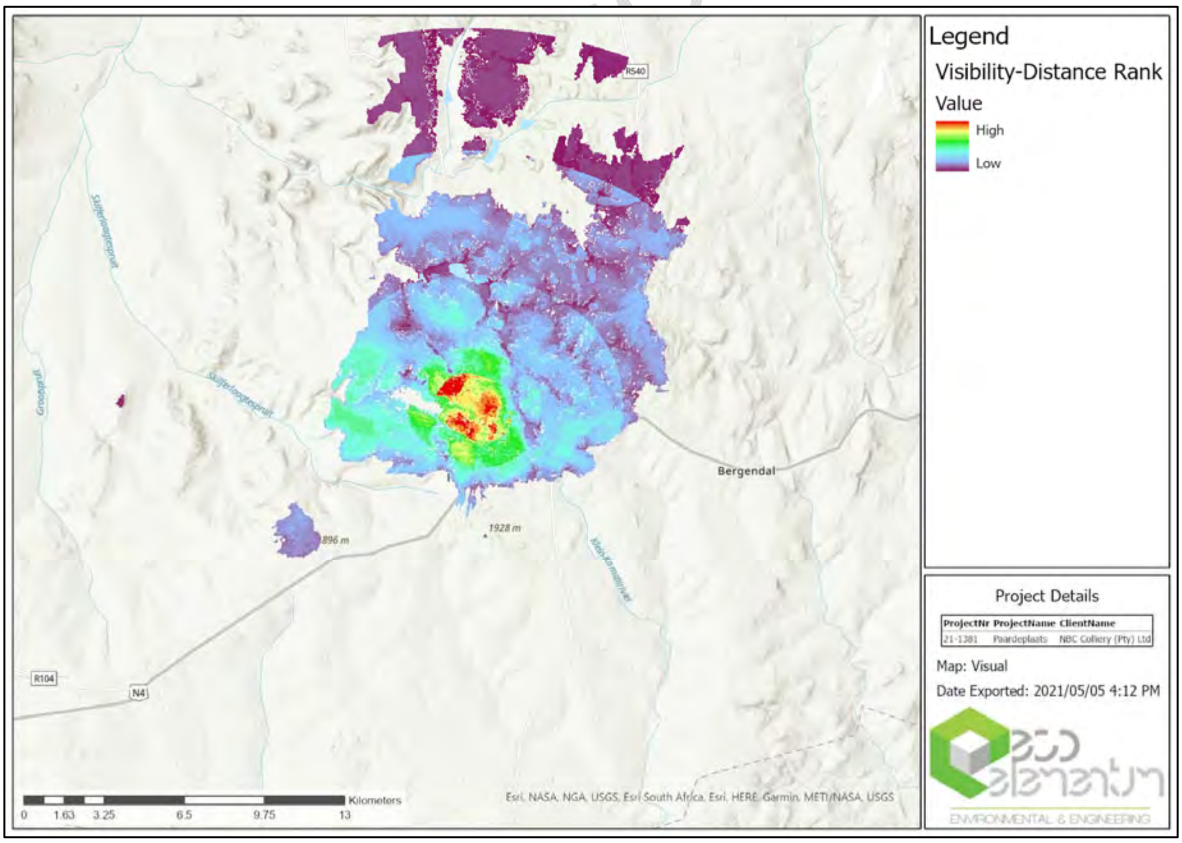

Figure 10.28: Viewshed Visibility Count Distance.

The visible infrastructure count is then combined with the distance from the source ranking together with the VAC of the land cover types, the slope, aspect, ruggedness, relative elevation, landforms and slope position to get a quantitative visual exposure ranking of all the areas where it may be possible to see the proposed development (**Figure 10.29**). Each identified sensitive receptor (**Figure 9.5**) is then overlaid on the visual exposure ranking and the value extracted to that pixel to give a quantitative ranking for each of the identified sensitive receptors as can be seen in **Figure 10.30**.

10.1.12.1 Construction Phase

The potential for there to be a visual impact on viewpoints that had a visual exposure rating exist during the construction phase, however this can be minimised by creating a visual barrier.

10.1.12.2 Operational Phase

Potential permanent visual impact on some sensitive receptors is anticipated, however this impact can be minimised by planting indigenous vegetation on the DMF as different land cover may offer some degree of visual screening.

10.1.12.3 Decommissioning, Closure and Rehabilitation Phase

As with the operational phase, potential permanent visual impact on some sensitive receptors is anticipated. During the decommissioning, closure and rehabilitation phase, the importance , however this impact can be minimised by planting indigenous vegetation on the DMF and ensuring that erosion and bare patches are minimised.

10.1.12.4 Cumulative Impact

Cumulative landscape and visual effects (impacts) result from additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated with or separate to it), or actions that occurred in the past, present or are likely to occur in the foreseeable future. They may also affect the way in which the landscape is experienced. Cumulative effects may be positive or negative. Where they comprise of a range of benefits, they may be considered to form part of the mitigation measures.

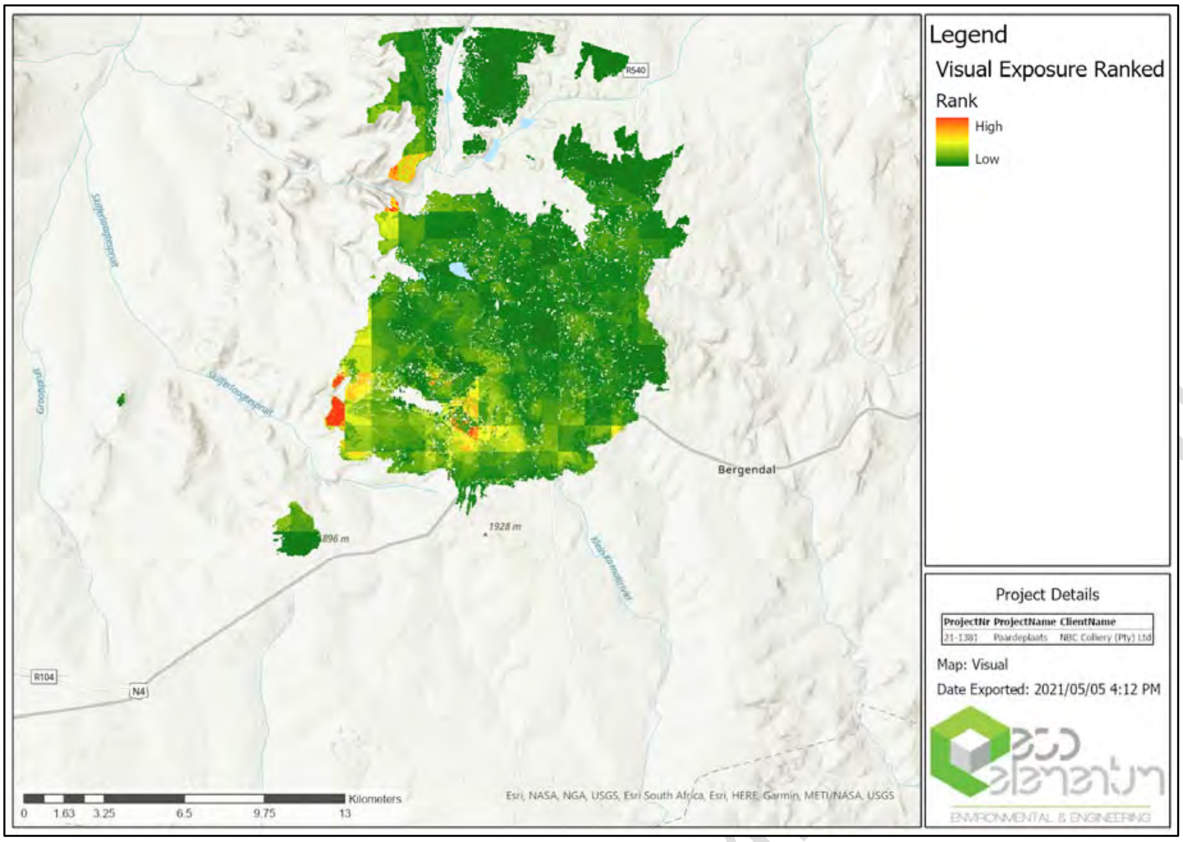

Figure 10.29: Viewshed Exposure Ranking.

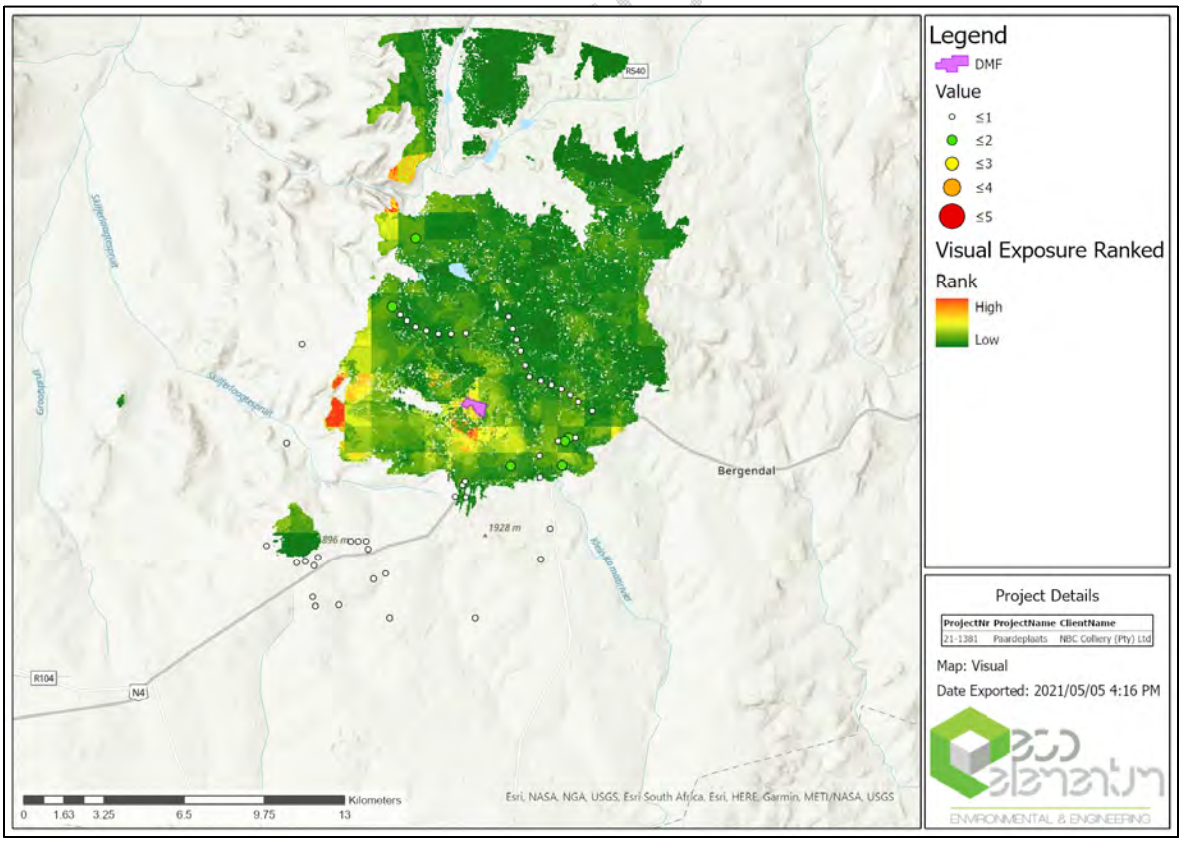

Figure 10.30: Visual Impact.

Cumulative effects can also arise from the inter-visibility (visibility) of a range of developments and/or the combined effects of individual components of the proposed development occurring in different locations or over a period of time. The separate effects of such individual components or developments may not be significant, but together they may create an unacceptable degree of adverse effects on visual receptors within their combined visual envelopes. Inter-visibility depends upon general topography, aspect, tree cover or other visual obstruction, elevation and distance, as this affects visual acuity, which is also influenced by weather and light conditions. (Institute of Environmental Assessment and The Landscape Institute, 1996).

The cumulative visual intrusion of the Integrated Paardeplaats Section will be moderate as it is a surface mining operation. The site location is also next to other mining operations which decreases the visual impact further. The visual impact and impact on sense of place of the proposed project will contribute to the cumulative negative effect on the aesthetics of the study area. It is recommended however, that the environmental authorities consider the overall cumulative impact on the agricultural and scattered mining character and the areas sense of place before a final decision is taken with regard to the optimal number of mining activities in the area.

10.1.13 Social

The social environment is dynamic and adapts to change and it is highly likely that predicted impacts predicted will change throughout the LoM of the Integrated Paardeplaats Section. The focus should rather be on the active management of social impacts than on the prediction and once-off mitigation thereof. Successful mitigation and management of social impacts requires long-term commitment and involvement and should form part of the strategic planning and management of the mine until closure.

The main social impacts anticipated include the following:

- Community Health and Safety: Increase in HIV/AIDS and other infectious diseases and general health impacts;
- Changes in the Social Environment: Conflict between local residents and newcomers and resettlement of communities (where applicable);
- Local/Regional Economy: Expectations regarding the benefits of the project and skills development;
- Local/Regional Infrastructure: Impact on infrastructure such as roads and housing and blasting impacts; and
- Physical Environment: Dust and water pollution.

The management and mitigation of some social impacts require input from a number of agencies, as these can only be addressed within the greater societal context. Proper mitigation and management would also take a number of years. Whilst the social impact is discussed, in some instances it is not possible for NBC to implement the mitigation without support from other role players.

10.2 Impact Assessment Methodology

To ensure uniformity, the assessment of potential impacts has been addressed in a standard manner so that a wide range of impacts are comparable. CIGroup employ a risk-based approach when undertaking the impact assessment and the ranking. CIGroup's risk-based approach makes use of a typical risk matrix in the 5 x 5 configuration (**Figure 10.31**), which considers likelihood and consequence into the analysis of the potential impact risk.

Figure 10.31: Risk-Based Reporting Matrix.

Risk-Based Approach - Before Mitigation

The likelihood of an impact occurring is determined by assessing the frequency of the activity, the frequency of the impact, the extent to which the activity is regulated and the ability to detect the occurrence of the impact, according to the criteria in **Table 10.26** – **Table 10.29**. The consequence of an impact is determined by assessing the spatial scale, duration, and severity, according to the criteria in **Table 10.30** – **Table 10.32**. The significance is then determined and assigned either a low, medium, or high significance.

Table 10.26: Frequency of the Activity.

DESCRIPTION	RATING
Annually or less	1
6-monthly	2
Monthly	3
Weekly	4
Daily	5

Table 10.27: Frequency of the Impact.

DESCRIPTION	RATING
Almost never / almost impossible / >20%	1
Very seldom / highly unlikely / >40%	2
Infrequent / unlikely / seldom / >60%	3
Often / regularly / likely / possible / >80%	4
Daily / highly likely / definitely / >100%	5

Table 10.28: Legal Regulation.

DESCRIPTION	RATING
No guidelines, standards, or legislation	3
Covered by guidelines, standards, or legislation	1

Table 10.29: Detection.

DESCRIPTION	RATING
Immediately	1
Without much effort	2
Needs some effort	3
With major effort	4
Remote or difficult to detect	5

Table 10.30: Spatial Scale.

DESCRIPTION	RATING
Area specific (at impact site)	1
Entire site (entire project area)	2
Local (5 km of site)	3
Regional / neighbouring areas (5 – 50 km of site)	4
National	5

Table 10.31: Duration.

DESCRIPTION	RATING
One day to one month (immediate)	1
One month to one year (Short term)	2
One year to 10 years (medium term)	3
Life of the activity (long term)	4
Beyond life of the activity (permanent)	5

Table 10.32: Severity.

DESCRIPTION	RATING
Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful / within a regulated sensitive area	5

Impact Mitigation Actions

After the likelihood, consequence and significance determinations, impact mitigation actions are proposed. In the NEMA EIA Regulations, 2014, mitigation means "to anticipate and prevent negative impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible." For this reason impact mitigation actions, which strive to align with impact management outcomes identified through the EIA process, are impact specific for all phases of a project.

Risk-Based Approach –After Impact Mitigation Action Determination

At this point, the likelihood and consequence are re-assessed in terms of the criteria presented in **Table 10.26** – **Table 10.32**, considering the impact mitigation actions proposed. Through this process the analysis of the potential impact risk following impact mitigation action implementation is determined. The significance is the re-assessed to determine whether the mitigation measures and action plans proposed serve to lessen the significance of the identified impact.

Risk-Based Approach Visual Representation

CIGroup's risk-based approach further plots the identified impacts before mitigation in the corresponding single square on the Risk-Based Reporting Matrix. The purpose of the impact mitigation action determination is to identify ways to move impacts from the top right (almost certain and catastrophic risk) in the Risk-Based Reporting Matrix Without Mitigation to the bottom left (insignificant and rare risk) in the Risk-Based Reporting Matrix After Mitigation as illustrated in **Figure 10.32**. In this way, the risks associated with each impact with or without impact mitigation action implementation can be visually presented and will easily show how, through the implementation of appropriate impact mitigation actions, the likelihood and consequence of identified impacts can be improved.

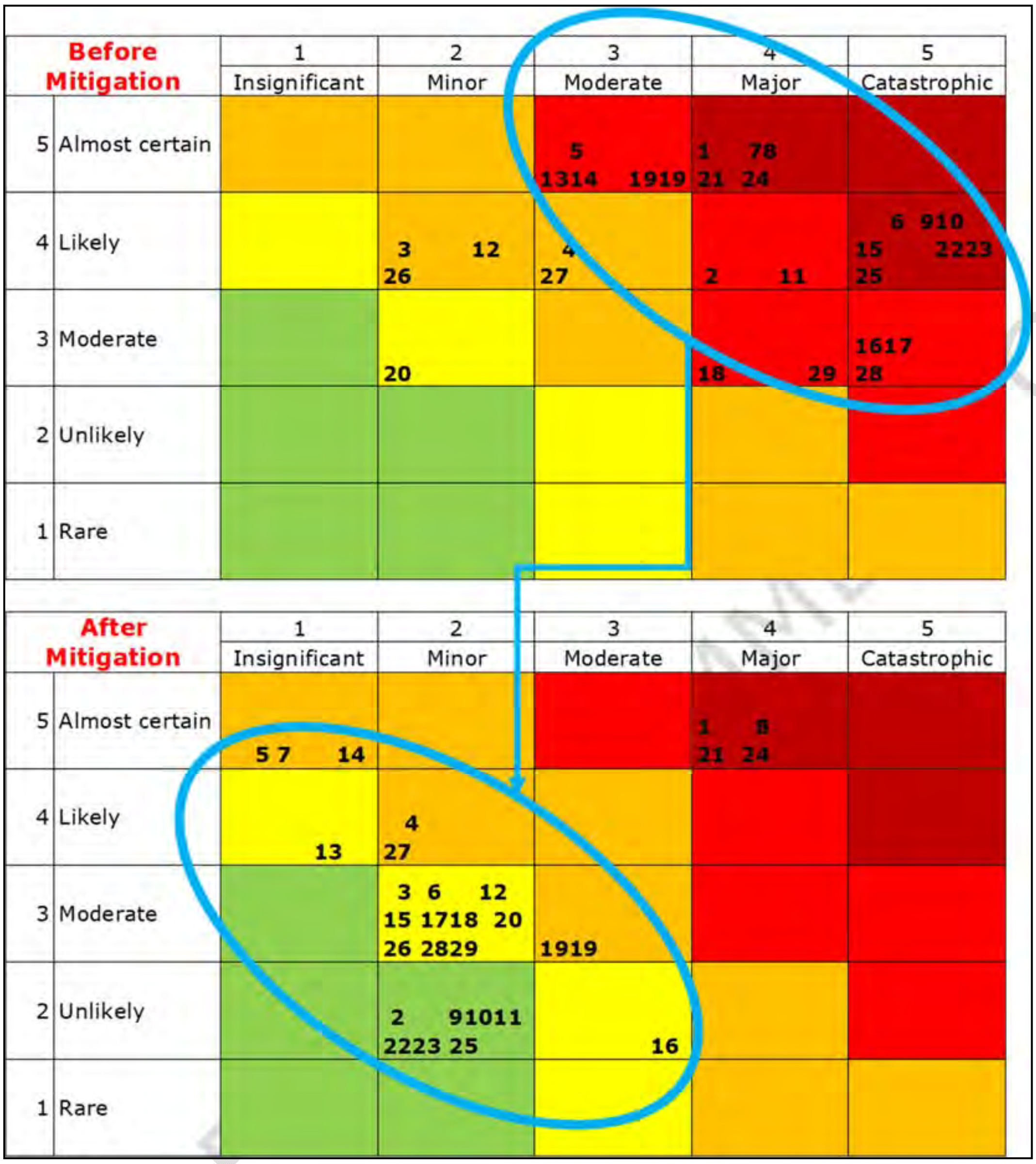

Figure 10.32: Risk-Based Reporting Matrix – Before and After Mitigation.

10.3 Proposed Mitigation Measures

The proposed mitigation measures are provided in **Table 11.1.**

10.4 Motivation Where No Alternative Sites Were Considered

No alternative development locations were considered because the proposed infrastructure is limited to the properties within the Integrated Paardeplaats Section, which is constrained by existing infrastructure within the mining area, and the presence of other active and future mining operations, farms, and residential areas outside of the mining areas. The presence of a provincial road within the central portion of the Section and a National road on the eastern and southern side of the Section further restricts alternative development locations. Finally, the resource location further restricts the development location, as does previous opencast mining operations and rehabilitation activities.

10.5 Motivation For The Final Development Location

The layout of the activities was determined by the operational requirements of the mine. Through the utilisation of the existing CSWP in the northern portions of the Integrated Paardeplaats Section, the old Glisa Section, negates the need for a full new plant and contains the processing activities in an already disturbed area. The decision to utilise Portion 24 of the farm Paardeplaats 380 JT was done bearing environmental considerations in mind, once again confining activities to a previously disturbed area.

11 ASSESSMENT OF EACH IDENTIFIED POTENTIALLY SIGNIFICANT IMPACT

The complete impact assessment based on the methodology presented in **Section 10.2** is presented overleaf in **Table 11.1**.

Table 11.1: Impact Assessment.

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	SIGNIFICANCE WITHOUT MITIGATION	SIGNIFICANCE AFTER MITIGATION	MITIGATION MEASURES
Air Quality						
Construction	Site Clearance	Liberation of dust	Dust-fall rates exceeding the residential guideline of 600 mg/m²/day, beyond the mine boundary. Elevated PM 10 levels beyond the mine boundary. Elevated PM 2.5 levels beyond the mine boundary.	Low	Low	Dust suppression on all gravel roads within the mining boundary through the use of water sprayers or chemical stabilisers. Use of water sprayers at crushers. Establish wind breaks where possible.
Construction Operational Decommissioning Closure Rehabilitation	Vehicular and Machinery movement	Liberation of dust	Dust liberation as a result of vehicular and machinery use and movement.	Medium	Low	Dust suppression on all gravel roads within the mining boundary through the use of water sprayers or chemical stabilisers. Exhaust pipes of vehicles should be directed so that they do not raise dust.
Construction Operational Decommissioning Closure Rehabilitation	Site Clearance and Vehicular and Machinery movement	Liberation of dust	Dust liberation as a result of dust accumulation on surfaces.	Low	Low	Hard surfaced haul roads or standing areas should be swept or washed down to remove accumulated dust.
Construction Operational Decommissioning Closure Rehabilitation	Site Clearance and Vehicular and Machinery movement	Liberation of dust	Dust liberation as a result of wind.	Low	Low	Revegetation of exposed areas with indigenous vegetation as an erosion control option. Keep soil stockpiles moist or vegetated to lessen dust liberation.
Construction Operational Decommissioning Closure Rehabilitation	Site Clearance and Vehicular and Machinery movement	Liberation of dust	Dust liberation as a result of soil handling.	Medium	Low	Handling of soil should be undertaken on less windy days.
Soil, Land Use and Land Capability						
Construction Operational	Site clearance	Loss of Fertile topsoil	Loss of fertile topsoil due to vegetation clearance. Increased susceptibility to erosion due to removal of vegetation cover. Increased soil erosion due to vegetation clearance.	Medium	Low	Retain maximum surface vegetation cover. Restrict vegetation clearance as far as possible. Restrict vegetation clearance to a minimum footprint area. Undertake vegetation clearance in as short a duration as possible.
Construction Operational	Infrastructure establishment and open cast mining	Loss of Fertile topsoil	Loss or reduction in soil fertility due to activities connected to mine infrastructure establishment and opencast mining.	Medium	Low	Retain maximum surface vegetation cover. Restrict vegetation clearance to a minimum footprint area.
Construction Operational Decommissioning Closure Rehabilitation	Vehicular and Machinery movement	Soil surface compaction	Compaction of soil surface due to various activities and vehicular and machinery use and movement.	Medium	Low	Restrict vehicular and machinery use and movement as far as possible.

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	SIGNIFICANCE WITHOUT MITIGATION	SIGNIFICANCE AFTER MITIGATION	MITIGATION MEASURES
Construction Operational Decommissioning Closure Rehabilitation	Chemical and water use	Soil contamination	Contamination of soil due to chemical or affected water spillages.	Medium	Low	Implement correct procedures for chemical handling and storage to minimise spillages. Implement management procedures for clean and dirty water handling and storage to minimise spillages. Address chemical and water spillages promptly through accepted corrective actions.
Construction	Construction activities	Terrain alterations	Alteration in prevailing terrain due to construction activities.	Medium	Low	Keep excavation to minimum and avoid, where possible, wetlands and depression areas.
Construction Operational	Removal of soils	Agricultural potential loss	Loss of soil with an arable agricultural potential due to the removal and storage of soils.	High	Low	Ensure that soil is correctly removed and stockpiled. Stockpile soil for the shortest duration possible. Retain topsoil.
Operational	Stockpiled soils	Stockpiled soils erosion	Increased tendency for stockpiled soils to erode.	Medium	Low	Stockpile soil for the shortest duration possible. Ensure that stockpile slopes are not too steep. Implement management procedures to ensure that erosion due to water is minimised.
Operational	Stockpiled soils	Stockpiled soils compaction	Increased compaction of stockpiled soils.	Medium	Low	Stockpile soil for the shortest duration possible. Restrict vehicular and machinery use and movement as far as possible.
Operational	Open cast mining	Water pollution	Excess pollution and runoff due to opencast mining.	Medium	Low	Implement stormwater management procedures for clean and dirty water handling within and around the opencast pit area. Control drainage of water from the opencast pit area through the use of berms, collection areas, and the dewatering pipeline.
Operational	Soil and spoil removal	Altered landscape	Change in natural landscape due to soil and spoil removal.	Medium	Low	Minimise changes to natural landscape as far as practically implementable.
Construction Operational	Infrastructure development	Soil potential, compaction and erosion	Loss of pre-mining potential due to use of land for infrastructure. Increased soil compaction due to use of soil for infrastructure. Increased potential for soil erosion after removal of infrastructure.	Medium	Low	Remove all infrastructure down to foundations. Loosen areas where infrastructure was removed prior to topsoil replacement. Replace with suitable topsoil to optimum depth. Fertilise and revegetate as soon as possible after topsoil replacement.
Construction Operational	Infrastructure development	Arable agriculture	Reduction in ability of soil profile to be used for arable agriculture.	Medium	Low	Ensure that soil is replaced evenly, then loosened prior to seeding.
Rehabilitation	Soil replacement	Soil compaction	Increased compaction of soil profile after replacement.	Medium	Low	Ensure that soil is replaced evenly, then loosened prior to seeding. Restrict vehicular and machinery use and movement as far as possible.
Rehabilitation	Altering of pre mining patterns	Soil fertility and erosion	Alteration of pre-mining terrain patterns due to rehabilitation. Natural soil fertility decreases after rehabilitation. Increased occurrence of soil erosion after rehabilitation.	Medium	Low	Rehabilitate in accordance with the final landform design plan factoring the original contours of the area into the plan. Fertilise and revegetate as soon as possible after topsoil replacement. Revegetate as soon as possible to minimise erosion due to wind and

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	SIGNIFICANCE WITHOUT MITIGATION	SIGNIFICANCE AFTER MITIGATION	MITIGATION MEASURES
						water. Monitor revegetation to ensure that bare areas are minimised.
Heritage						
Construction	DMF construction	Heritage sites impact	Impact on heritage sites due to DMF construction.	Low	Low	No heritage impact is expected as a result of the DMF construction. No mitigation required.
Construction Operational	Construction and operational activities	Low significant sites impact	No impact is expected on low significant sites (PP 1, PP 7, PP 8, PP 9, PP 18, PP 19, PP 20, PP 23, PP 24, PP 34, PP 35, PP 38, PP 39, PP 41, PP 42, PP 43, PP 44 & PP 45).	Low	Low	No mitigation required.
Construction Operational	Construction and operational activities	Graves and burial grounds impact	Impact on Graves and Burial Grounds (PP 2, PP 3, PP 4, PP 5, PP 10, PP 16, PP 28, PP 31 and PP 37).	Low	Low	The best option is to change the mining development footprint to allow for the in situ preservation of these sites. Should in situ preservation not be possible then the following mitigation measures will apply: A grave relocation process must be undertaken. A detailed social consultation process, at least 60 days in length, consisting of the attempted identification of the next-of-kin in order to obtain their consent for the relocation. Bilingual site and newspaper notices indicating the intent of the relocation. Permits from all the relevant and legally required authorities. An exhumation process that keeps the dignity of the remains and family intact. An exhumation process that safeguards the legal rights of the families as well as that of the mining company. The exhumation process must be done by a reputable company well versed in the mitigation of graves.
Construction Operational	Construction and operational activities	Homestead and structures impact	Impact on historic homesteads and structures with the possible risk for unmarked graves (PP 6, PP 11, PP 15, PP 16, PP 21, PP 22, PP 25, PP 26, PP 29, PP 32 and PP 40).	Medium	Low	A social consultation process to assess whether any local residents or the wider public is aware of the presence of graves at sites PP 6, PP 11, PP 15, PP 16, PP 21, PP 22, PP 25, PP 26, PP 29, PP 32 and PP 40. Depending on the outcome of the social consultation process, three different outcomes would be the result, namely: Outcome 1: The social consultation absolutely confirms that no graves are located here. Outcome 2: The social consultation absolutely confirms that graves are located here. Outcome 3: The social consultation does not yield any confident results. The following mitigation measures would be required for sites falling under Outcome 1: No further grave-related mitigation would be required.

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	SIGNIFICANCE WITHOUT MITIGATION	SIGNIFICANCE AFTER MITIGATION	MITIGATION MEASURES
						The following mitigation measures would be required for sites falling under Outcome 2: A grave relocation process must be undertaken. A detailed social consultation process, at least 60 days in length, comprising the attempted identification of the next-of-kin in order to obtain their consent for the relocation. Bilingual site and newspaper notices indicating the intent of the relocation. Permits from all the relevant and legally required authorities. An exhumation process that keeps the dignity of the remains and family intact. An exhumation process that safeguards the legal rights of the families as well as that of the mining company. The process must be done by a reputable company well versed in the mitigation of graves. The following mitigation measures would be required for sites falling under Outcome 3: Test excavations to physically confirm the presence or absence graves. If no evidence for graves is found, the site will fall within Outcome 1 as outlined above. This means that no further mitigation measures would be required. If evidence for graves is found, the site will fall within Outcome 2 as outlined above. This means that a full grave relocation process must be implemented. All structures and site layouts from each site must be recorded using standard survey methods. The end result would be site layout plans for all these sites. A mitigation report must be compiled for these sites within which all the mitigation measures and its findings will be outlined. The recorded drawings from the previous item must also be included in this mitigation report. The completed mitigation report must be submitted to the relevant heritage authorities.
Construction Operational	Construction and operational activities	Historic farmsteads and structures impact	Impact on historic farmsteads and historical structures (PP 27 and PP 30).	Low	Low	An architectural historical specialist must be appointed to undertake a specialist assessment of these sites. The recommendations made by the specialist must be implemented.
Construction Operational	Construction and operational activities	Rock art site impact	Possible rock art site (PP 4).	Low	Low	A suitably qualified rock art specialist must be appointed to undertake a specialist assessment of the site. The recommendations made by the specialist must be implemented.

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	SIGNIFICANCE WITHOUT MITIGATION	SIGNIFICANCE AFTER MITIGATION	MITIGATION MEASURES
Construction Operational	Construction and operational activities	Historic coal shafts and structures impact	Historic coal mine shafts and associated structures (PP 12, PP 13, PP 17, PP 33 and PP 36).	Low	Low	Due to the uniqueness of these historic coal mine shafts, every attempt must be made to preserve them in situ. The following general mitigation measures, which forms part of the in situ management measures of these sites, must be undertaken: Mine shafts must be recorded by way of site plans and photographs. Archival and historical research must be undertaken on the history of these very old mine shafts. A mitigation report must be compiled for these sites within which the recorded drawings, photographs and history of these shafts must be compiled. The completed mitigation report must be submitted to the relevant heritage authorities.
Construction Operational	Construction and operational activities	New graves discovery	Chance finds of a potential grave during construction.	Low	Low	All activities must be halted in the area of the discovery and a qualified archaeologist contacted. The archaeologist needs to evaluate the finds on site and make recommendations towards possible mitigation measures. If mitigation is necessary, an application for a rescue permit must be lodged with SAHRA. After mitigation, an application must be lodged with SAHRA for a destruction permit. This application must be supported by the mitigation report generated during the rescue excavation. Only after the permit is issued may such a site be destroyed.
Construction Operational	Construction and operational activities	New graves discovery	Accidental discovery of graves during construction.	Low	Low	Upon the accidental discovery of graves, a buffer of at least 20 m should be implemented. All activities must cease in the area and a qualified archaeologist be contacted to evaluate the find. To remove the remains, a permit must be applied for from SAHRA and other relevant authorities. The local South African Police Services must immediately be notified of the find. Where it is recommended that the graves be relocated, a full grave relocation process that includes a comprehensive social consultation must be followed.
Construction Operational	Construction and operational activities	Palaeontology finds	Impact on paleontological (fossil) finds.	Medium	Low	When fossiliferous material is found an appropriate palaeontological expert must be appointed so that the material can be thoroughly assessed, recorded and professionally excavated or sampled. Inspections should be performed during any excavations that disturb bedrock, and between blasting cycles in opencast mines, when the face wall and floor of the pit are exposed for evidence of fossil floras. In the event that lenses of sedimentary rocks containing well-preserved fossil floras are found, a palaeontological expert must be

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	SIGNIFICANCE WITHOUT MITIGATION	SIGNIFICANCE AFTER MITIGATION	MITIGATION MEASURES
						afforded the opportunity to excavate a representative sample of the flora, and to document the depositional context as reflected by the adjacent rocks and coal seams. A scientifically useful palaeobotanical collection must be made. A strategy of bulk collecting must be employed, whereby a relatively large and unbiased sample of the flora is collected, with collectors not giving undue attention to those elements that are attractive, well-preserved or rare. The associated geology, which will also be destroyed during mining must be documented photographically (with scale). Floras with no context are increasingly coming to be considered of limited palaeontological value. To avoid delays, the mine must be prepared to assist in the removal of blocks containing high quality plant fossil material, and in the storage on the mine property of unprepared fossiliferous blocks until such a time as the material can be properly processed by a palaeontological expert. Storage facilities must be such that the blocks are not exposed directly to the elements.
Traffic						
Construction Operational	Traffic	Heavy traffic on adjacent road network	An increase in heavy vehicle traffic on the adjacent road network.	Medium	Low	All lanes must have minimum width of 4 m on approach to any intersection. Ensure that all roads are clearly marked and sign-posted with warning signs and speed limit signs as required.
Construction Operational	Mining	Heavy traffic on bridges and culverts	Additional heavy traffic on bridges and culverts over watercourses within the mining right area.	Medium	Low	Avoid environmentally sensitive areas, where possible, by designing the mine layout in such a way that the routes between the opencast pit and processing plants and other areas are the shortest route possible. If it is not possible to avoid environmental sensitive areas, then river crossings, bridges and culverts should be designed to have the minimum impact on the environment as possible. Bridges and culverts should, where practically possible, be temporary structures that can be removed once the section of the road is not required.
Construction Operational	Mining	Heavy vehicles on gravel roads	Additional heavy vehicles on gravel haul roads within the mining right area.	Medium	Low	Enforce a speed limit to minimise vehicle entrained dust liberation. Dust suppression on all gravel roads within the mining boundary through the use of water sprayers or chemical stabilisers.
Construction Operational	Mining	Heavy vehicles through	Additional heavy vehicles travelling through communities or urban areas.	Medium	Low	Ensure that transportation contractors are instructed to avoid all communities and urban areas unless absolutely necessary to get to/from their destinations.

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	SIGNIFICANCE WITHOUT MITIGATION	SIGNIFICANCE AFTER MITIGATION	MITIGATION MEASURES
		communities and urban areas				
Noise						
Construction Operational	Mining	Noise nuisance urban and rural	Noise disturbance and noise nuisance at urban and rural noise sensitive receptors	Medium	Low	Construction site yards, maintenance facilities, and other noisy fixed facilities should be located well away from noise sensitive areas adjacent to the development sites. All vehicles and equipment are to be kept in good repair. Where possible, stationary noisy equipment (for example compressors, pumps, pneumatic breakers,) should be encapsulated in acoustic covers, screens or sheds (proper sound insulation can reduce noise by up to 20 dBA). Portable acoustic shields should be used in the case where noisy equipment is not stationary (for example drills, angle grinders, chipping hammers, poker vibrators and drilling associated preparation for blasting in the pit). Activities, and particularly the noisy ones, are to be confined to reasonable hours during the day and early evening. Where possible, very noisy activities should not take place at night (between the hours of 20h00 - 06h00). Blasting should be restricted to the period between 08h00 - 16h00. Particularly noisy equipment must be insulated. With regard to unavoidable very noisy activities in the vicinity of noise sensitive areas, the mine should liaise with local residents on how best to minimise the impact. Machines in intermittent use should be shut down in the intervening periods between work or throttled down to a minimum. Staff working in areas where the 8-hour ambient noise levels exceed 75 dBA should wear ear protection equipment. The stockpiles of spoil rock and overburden (berms) from the opencast pit excavations should, where possible, be used as interim or long-term noise attenuation barriers. Berms should particularly be considered around the whole periphery of the pit.
Blast and Vibration						
Construction Operational	Mining	Vibration on structures	Ground vibration could cause damage to structures and upset the community	Medium	Low	Ensure that blasting operations are designed to reduce ground vibration. Develop a detailed blast design for each blast with consideration of the effects from blasting i.e. ground vibration, air blast and fly rock. Calculate the expected ground vibration levels for the planned blast and, if necessary, redesign the plan to minimise ground vibration through one of the following methods:

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	SIGNIFICANCE WITHOUT MITIGATION	SIGNIFICANCE AFTER MITIGATION	MITIGATION MEASURES
						Reduce the change mass per delay; Use electronic initiation of blast; or Drill smaller diameter blastholes that will reduce the charge per blasthole and per delay.
Construction Operational	Mining	Air blasts on structures	Air blast could cause damage to structures and induce effects that will upset homeowners	Medium	Low	Ensure that blasting operations are designed to reduce air blast. Develop a detailed blast design for each blast with consideration of the effects from blasting i.e. ground vibration, air blast and fly rock. Use of proper stemming lengths of between 25 - 30 blasthole diameters. Use of crushed aggregate of 10% the blasthole diameter as stemming material. Record stemming lengths for each blast and correct if necessary, prior to every blast blasted. Monitor each blast done.
Construction Operational	Mining	Fly rock damage and safety	Fly rock could cause damage to structures, injure people or animals	Medium	Low	Ensure that blasting operations are designed to reduce fly rock. Develop a detailed blast design for each blast with consideration of the effects from blasting i.e. ground vibration, air blast and fly rock. Use of proper stemming lengths of between 25 - 30 blasthole diameters. Use of crushed aggregate of 10% the blasthole diameter as stemming material. Record stemming lengths for each blast and correct if necessary, prior to every blast blasted. Monitor each blast done.
Visual						
Construction Operational	Mining	Day-time visual on sensitive receptors	Day-time visual impact on the surrounding sensitive receptors	High	Low	Paint buildings and structures with colours that reflect and complement the natural colours of the surrounding landscape. Avoid pure light colours and pure blacks. Reduce the potential of glare, external surfaces of buildings and structures should be articulated or textured to create interplay of light and shade. Rehabilitate exposed areas as soon as possible after construction or mining activities are complete.
Construction Operational	Mining	Night-time visual on sensitive receptors	Night-time visual impact on the surrounding sensitive receptors	Medium	Low	Avoid high pole top security lighting along the periphery of the project area and use only lights that are activated on illegal entry to the project area. Illuminate public movement areas (pathways and roads) with low level 'bollard' type lights and avoid post top lighting.
Construction Operational	Mining	Visual intrusion	Visual intrusion	Medium	Low	Create a visual barrier between construction and operational areas and sensitive receptors.

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	SIGNIFICANCE WITHOUT MITIGATION	SIGNIFICANCE AFTER MITIGATION	MITIGATION MEASURES
						When using vegetation such as trees as a visual barrier be aware that they are not immediately effective so should be used in conjunction with other visual barriers such as earth berms. Plant indigenous vegetation on the slopes of the DMF.
Construction Operational	Mining	Visual on sensitive receptors	The visual impact of dust on the surrounding sensitive receptors	Low	Low	Dust suppression techniques should be in place at all times during all phases. Limit site clearance to the smallest footprint area possible. As much vegetation as possible should be kept during site clearance. Rehabilitate exposed areas as soon as possible after construction or mining activities are complete.
Social						
Construction Operational	Mining opportunities	Social unrest and conflict	The potential for social unrest and conflict between local residents and newcomers to the area due to income discrepancies and opportunities provided by the mine.	Low	Low	Implement a community relations strategy. Ensure that local SMMEs are utilised for direct ancillary service provision. Implement local procurement policy and encourage employees to live locally.
Operations	Mining role	Services to community	Expectations about the role of the mine in the provision of services to the community and the benefits to the community from the mine over the short and long term.	Medium	Low	Implement a community relations strategy. Communicate with the community to ensure that they understand the role of the mine in meeting their expectations to ensure that they do not develop unrealistic expectations.
Construction Operational	Mine transportation	Transportation shared activities	Transportation activities have a negative impact on shared road infrastructure.	Medium	Low	Ensure that transportation contractors adhere to speed limits and general road rules. Maintain the entrance to the mine to ensure it is operating at an acceptable level of service.
Operations	Mine blasting	Cracks in houses	Cracks in houses surrounding the mine due to the blasting operations of the mine.	Medium	Low	Adhere to the blast and vibration management plan. Conduct a pre-blast baseline survey including photographic inspections of privately owned structures within 1,500 m of the identified blast area.
Operations	Community health	Health impact	Impact of dust fallout on the livelihoods of the agricultural community. Health impacts such as asthma, sinusitis, allergies and other respiratory diseases attributed to dust generated by the operation of the mine.	Low	Low	Undertake dust suppression on all gravel roads within the mining boundary through the use of water sprayers or chemical stabilisers. Effective monitoring of ambient air quality, including nuisance dust-fall and PM 10.
Operations	Community health	HIV/AIDS impact	Increase of HIV/AIDS due to labour influx.	Medium	Low	Implement an HIV/AIDS awareness programme for all mine employees and contractors. Offer HIV/AIDS counselling to all employees and contractors as required.
Operations	Mining	Water quantity and quality	Impact of the reduction in the quantity of water available for use and water quality deterioration, especially from acid mine drainage.	Medium	Low	Impact of the reduction in the quantity of water available for use and water quality deterioration, especially from acid mine drainage. Undertake surface and groundwater monitoring to determine the

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	SIGNIFICANCE WITHOUT MITIGATION	SIGNIFICANCE AFTER MITIGATION	MITIGATION MEASURES
						impact the mine is having on the quality and quantity of water in the project area. Implement mitigation measures for surface and groundwater as proposed. - -
Operations	Mining	Existing settlements	Impact on existing settlements within the mining right area and mining footprint.	Low	Low	Impact should be avoided if possible. If not possible, a Resettlement Action Plan (RAP), in line with international best practice standards, should be developed. The RAP must be monitored and audited and implemented by an experienced specialist.
Operations	Mining	Graves, burial grounds and heritage features	Impact on graves, burial grounds and heritage features.	Medium	Low	Implement all mitigation measures as proposed by the heritage specialist.
Operations	Mine governance	Social and labour Plan	Non-adherence to the Social and Labour Plan.	Medium	Low	Ensure that the commitments in the SLP are implemented. Update the SLP regularly to align with the needs of the local and labour-sending communities. Align the SLP with the requirements of the local and district municipality and the associated IDP. Ensure that skills development and training is implemented as specified in the SLP.
Surface Water						
Operations	Mine dewatering	Aquifer impact	Dewatering of the aquifer closest to the pits and inflow of groundwater into the pit will result in a drop in water levels and it is anticipated that many springs and wetlands will be drained.	Medium	Medium	No mitigation measures are possible or this impact.
Operations	Mining	Surface water pollution	Pollution of surface water due to spillages, seepages or leaks and improper waste handling, storage and disposal.	Medium	Low	Clean and dirty water system infrastructure must be installed prior to any construction activities and take into consideration the design capacities and location restrictions stipulated in GN 704 of the NWA. All hazardous substances must be stored and handled on impervious substrates and bunded areas that are able to contain potential spillage. Storage areas must be kept as dry as is practically possible and all storm and rainwater collected in storage areas must be removed and disposed of in the PCDs. Waste handling and storage facilities must be constructed away from surface water resources and drainage lines. All vehicles and equipment must be kept in good working order and regularly serviced. Should a spill occur then the incident management procedure of the mine should be followed.

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	SIGNIFICANCE WITHOUT MITIGATION	SIGNIFICANCE AFTER MITIGATION	MITIGATION MEASURES
Construction	Dams, trenches, channels and berms	Surface water drainage patterns and slopes altered	The construction and operation of dams, trenches, channels and berms have the potential to alter the sites natural, pre-existing surface water drainage patterns influencing the volume of water that enters the receiving environment.	Medium	Low	Areas should be sloped to allow for free runoff toward either clean and dirty water separation systems infrastructure and appropriately re-directed depending on whether water is either clean or dirty. Clean and dirty water system infrastructure must be installed prior to any construction activities and take into consideration the design capacities and locations restrictions stipulated in GN 704 of the NWA. Clean and dirty water system infrastructure must allow for clean water to re-enter the receiving environment and dirty water to be contained in PCDs. Ensure that clean and dirty water system infrastructure is operating effectively and efficiently to separate clean and dirty water. Clean and dirty water system infrastructure must be located away from surface water resources and drainage lines. Restrict the use and/or abstraction of surface water.
Operations	Alterations to natural drainage patterns	Erosion and sedimentation entering receiving surface water bodies	Alteration of the natural pre-existing surface water drainage patterns and slopes of the area may result in increased erosion and sedimentation which may enter receiving surface water bodies.	Medium	Low	No development should occur within the 1:100 year flood line of any drainage line, unless authorised. Vegetation clearance and soil disturbances should be limited to the smallest footprint area possible and erosion control measures implemented. Movement of machinery and vehicles must be limited to identified roads and must avoid soil stockpiles. Clean and dirty water system infrastructure must be installed prior to any activities and take into consideration the design capacities and locations restrictions stipulated in GN 704 of the NWA. Areas should be sloped to allow for free runoff toward either clean and dirty water separation systems depending on whether water is dirty or clean. Clean and dirty water system infrastructure must be located away from surface water resources and drainage lines. PCDs must be lined and equipped with a silt trap that is regularly cleaned and maintained.
Operations	Open cast mining	Contamination of clean water	Opencast mining and the use of machinery and equipment have the potential to result in pollution of surface water due to spillages, seepages or leaks and improper waste handling, storage and disposal. Clean surface water may enter the opencast pit and become contaminated and may also become contaminated through contact with pollutants on site as a result of spills, seepages, leaks and improper waste handling.	Medium	Low	Clean and dirty water system infrastructure must be maintained and kept in good working order. Upstream clean and dirty water system infrastructure must be installed close to the edge of the pit in order to effectively deviate clean water flow around the pit and prevent it from entering. Upstream clean and dirty water system infrastructure must be protected from erosion through the installation of surface water energy disruptors to reduce storm water velocity. Dirty water contained and pumped from the pit must be stored in lined

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	SIGNIFICANCE WITHOUT MITIGATION	SIGNIFICANCE AFTER MITIGATION	MITIGATION MEASURES
						PCDs equipped with silt traps. All hazardous substances must be stored and handled on impervious substrates and bunded areas that are able to contain potential spillages. Storage areas must be kept as dry as is practically possible and all storm and rainwater collected in storage areas must be removed and disposed of in the PCDs. Waste handling and storage facilities must be constructed away from surface water resources and drainage lines. All vehicles and equipment must be kept in good working order and regularly serviced. Should a spill occur then the incident management procedure of the mine should be followed. Undertake concurrent rehabilitation and backfilling to keep the open pit as small as is practically possible to reduce the amount of surface water able to come in contact with the pit and contaminated water.
Operations	Open cast mining	Flooding risk at drainage lines	Due to the close proximity to drainage lines the risk of flooding exists.	Medium	Low	Implementation of storm water management plan.
Decommissioning	Decommissioning	Surface water	Decommissioning activities related to the removal of infrastructure and the use of machinery and equipment have the potential to result in pollution of surface water due to spillages, seepages or leaks and improper waste handling, storage and disposal.	Medium	Low	Clean and dirty water system infrastructure must be installed prior to any construction activities and take into consideration the design capacities and locations with regard to GN 704 of the NWA. All hazardous substances must be stored and handled on impervious substrates and bunded areas in order to handle potential spillages. All hazardous substances must be stored in designated areas constructed to ensure their safe storage. All vehicles and equipment must be kept in good working order and regularly serviced.
Operations Rehabilitation	Groundwater decant	Contamination of clean water	Groundwater decanting from the opencast pit will be contaminated and will flow down gradient, likely to enter and contaminate surface water resources.	High	Medium	Decant must be collected in dedicated lined PCD for treatment at the WTP. Continued maintenance of all dams to ensure that there are no spills, seepage or leakage. Continued maintenance of clean and dirty water system infrastructure. Pipelines and sumps to be kept clean and in good working order. Continue to investigate various water treatment options including pH adjustment, controlled release and further containment options. Ensure that proper backfilling is undertaken throughout the operation to ensure less recharge of oxygen rich water and reduction in AMD produced. Align with the AMD Strategy.

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	SIGNIFICANCE WITHOUT MITIGATION	SIGNIFICANCE AFTER MITIGATION	MITIGATION MEASURES
Groundwater						
Operations	Clearing topsoil	Infiltration to groundwater system	Clearing topsoil for footprint areas can increase infiltration rates of water to the groundwater system.	Medium	Low	Ensure that footprint clearance is kept to a minimum and that the area is not over-cleared.
Operations	Waste handling and building material transportation	Infiltration to groundwater system	Handling of waste and transport of building material can cause various types of spills (domestic waste, sewage water, hydrocarbons) which can infiltrate and contaminate of the groundwater system.	Medium	Low	Waste should be discarded in the allocated waste area. The waste area should be bunded. Spills should be cleaned up immediately. Solid waste must similarly either be stored at site on an approved waste disposal area or removed by credible contractors.
Operations	Opencast dewatering	Groundwater dewatering	Opencast mining will result in groundwater inflows into the workings which need to be pumped out for mine safety and the resultant dewatering (water level decrease) of the groundwater system in the immediate vicinity of the workings.	Medium	Medium	Keeping the workings dry is necessary for mining and mitigation is not possible. No users are currently likely to be affected. Should any external users be impacted, then an alternative water supply should provided by the mine.
Operations	Coal stockpiling	ARD influencing groundwater	Stockpiling of coal will expose coal to water and oxygen, resulting in ARD from roads and stockpiles. Contamination of the groundwater system will occur from these sites, although at a lower significance than the opencast pits.	Medium	Low	Clean water needs to be kept away from the stockpiling area to minimise water infiltrating from the site. Keep stockpiles as small as possible, to minimise their footprint.
Operations	Opencast exposure to geological strata	Deterioration of quality of groundwater	Exposure of geological strata in the opencast areas will result in a deterioration in quality of groundwater flowing into the opencast areas.	Medium	Medium	Disturbing geological strata is a result of mining. Pits need to be kept as dry as possible to reduce contact time of water and oxygen with exposed rock and therefore keep contamination to a minimum. Mine water must be contained, re-used, and/or treated.
Operations	Dirty water pumped to pollution control dams	Groundwater contamination from unlined dams	Dirty water from the opencast pit should be pumped to pollution control dams. Unlined dams will contribute highly to contamination of the groundwater system, while lined dams might still contaminate but to a lesser degree.	Medium	Low	Pollution control dams should be lined and maintained in a good operating state ensuring that no overflow of dirty water occurs
Construction and operation	Handling of waste	Groundwater contamination	Handling of waste can cause various types of spills (domestic waste, sewage water, hydrocarbons) which can infiltrate and cause contamination of the groundwater system.	Medium	Low	All vehicles and machinery shall be kept in good working order and inspected on a regular basis for possible leaks and shall be repaired as soon as possible if required. Repairs shall be carried out in a dedicated repair area only, unless in-situ repair is necessary as a result of a breakdown. Drip trays shall at all times be placed under vehicles that require in-situ repairs. Drip trays shall be emptied into designated containers only and the contents disposed of at a licenced hazardous material disposal facility. Accidental spills (concrete, chemicals, process water, hydrocarbons, waste, sewage) need to be reported immediately so that effective

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	SIGNIFICANCE WITHOUT MITIGATION	SIGNIFICANCE AFTER MITIGATION	MITIGATION MEASURES
						remediation and clean-up strategies and procedures can be implemented. Soil that is contaminated by fuel or oil spills, for example, from vehicles, must be collected to be treated at a pre-determined and dedicated location, or must be treated in situ, using sand, soil or cold coal-ash as absorption medium.
Operations Rehabilitation	Decant of water from old opencast areas	Groundwater contamination	Decant of mine water from old opencast areas will continue. Decant water will flow into surface water drainage channels.	High	Medium	Rehabilitation of opencast areas must be completed to minimise infiltration and prevent ponding of surface water. Management and treatment of decant water will be undertaken where applicable through the use of the treatment plant and pit water management levels. Ongoing rehabilitation of existing mine areas must be undertaken. A decant management level can however also be established to reduce seepage to streams from the rehabilitated opencast.
Operations Rehabilitation	Groundwater seepage to streams	Surface water contamination	Groundwater seepage to streams (salt load).	High	Medium	Surface water monitoring of the streams will be essential. Quarterly groundwater sampling is recommended to establish a database of plume movement trends, to aid eventual mine closure. The contaminated seepage can be managed, and the water pumped to the water treatment plant. A decant management level can however also be established to reduce seepage to streams and associated salt load contribution from the Rehabilitated opencast. Should the Class C liner below the proposed DMF remain intact then the impact associated with the DMF is likely to be low.
Operations Rehabilitation	Groundwater seepage to streams	Surface water contamination	Contaminated groundwater seepage to streams (salt load).	High	Medium	Groundwater levels in the backfilled pits and underground workings will recover. Pollution plumes may migrate to surface water bodies. All mined areas should be flooded as soon as possible to bar oxygen from reacting with remaining pyrite. Quarterly groundwater sampling should be done to establish a database of plume movement trends, to aid eventual mine closure. The seepage can be collected in the Mahim dam and be treated via the WTP.
Operations Rehabilitation	Groundwater contamination plume	Groundwater contamination plume	Groundwater contaminant plume.	High	Medium	Quarterly groundwater sampling should be done to establish a database of plume movement trends, to aid eventual mine closure. The drilling of boreholes into mining areas is recommended so that recovery of water in mining areas can be monitored. The presence of groundwater users should be assessed bi-annually.
Operations Rehabilitation	Groundwater seepage to streams	Surface water contamination	Decant from opencast operations.	High	Medium	Decant can be managed in pit and then pumped to the WTP for treatment to an acceptable water quality for discharge or re-use.

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	SIGNIFICANCE WITHOUT MITIGATION	SIGNIFICANCE AFTER MITIGATION	MITIGATION MEASURES
Operations Rehabilitation	Groundwater seepage to streams	Surface water contamination	Contaminated groundwater seepage to streams (salt load).	High	Medium	Groundwater levels in the backfilled pits and underground workings will recover. Pollution plumes may migrate to surface water bodies. All mined areas should be flooded as soon as possible to bar oxygen from reacting with remaining pyrite. Quarterly groundwater sampling should be done to establish a database of plume movement trends, to aid eventual mine closure. The seepage can be collected in the Mahim dam and be treated via the WTP.
Operations Rehabilitation	Groundwater contamination plume	Groundwater contamination plume	Groundwater contaminant plume.	Medium	Medium	Quarterly groundwater sampling should be done to establish a database of plume movement trends, to aid eventual mine closure. The drilling of boreholes into mining areas is recommended so that recovery of water in mining areas can be monitored. The absence of groundwater users should be assessed bi-annually.
Operations Rehabilitation	Groundwater seepage to streams	Surface water contamination	Decant from opencast operations.	High	Medium	Decant can also be managed in pit and then pumped to the WTP for treatment to an acceptable water quality for discharge or re-use.
Freshwater Ecosystems						
Operations	Wetland an aquatic habitat protection	Loss of wetland and aquatic habitat.	Loss of wetland and aquatic habitat.	High	High	Ensure that as far as possible and additional infrastructures are placed outside of delineated watercourse areas and their associated zones of regulation. Ensure that sound environmental management is in place during the planning phase. Design of infrastructure should be environmentally and structurally sound and all possible precautions taken to prevent spillage and/or seepage to the surface and groundwater resources present. It must be ensured that the design and construction of all infrastructures prevents failure. Limit the footprint area of the construction and operational activities to what is absolutely essential in order to minimise impacts as a result of vegetation clearing and compaction of soils. Wetland areas outside of the opencast footprint should be fenced off and should be designated as No-go areas for all unauthorised personnel. Clean and dirty water separation systems to be implemented prior to the commencement of activities and to be maintained throughout the life of the proposed project. Loss of wetland habitat, with special mention of Critical Biodiversity Areas will need to be mitigated with the implementation of a suitable wetland offset strategy.

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	SIGNIFICANCE WITHOUT MITIGATION	SIGNIFICANCE AFTER MITIGATION	MITIGATION MEASURES
Operations	Fragmentation of watercourses.	Fragmentation of watercourses.	Fragmentation of watercourses.	High	High	Pipe culverts are not to be allowed at any watercourse crossings to limit opportunities of flow confinement and channel incision of the wetland units and drainage lines.
Operations	Wetland an aquatic habitat protection	Disturbance and degradation of wetland and aquatic habitat.	Disturbance and degradation of wetland and aquatic habitat.	High	High	Ensure soil management programme is implemented and maintained to minimise erosion and sedimentation. All erosion noted within the project footprint should be remedied immediately and included as part of an ongoing rehabilitation plan. Active rehabilitation, re-sloping, and re-vegetation of disturbed areas immediately after construction and operational activities. Implement and maintain alien vegetation management programme. All delineated watercourses and their associated 100 m zones of regulation in terms of GN 704 should be designated as “No-Go” areas and be off limits to all unauthorised vehicles and personnel, with the exception of approved construction and operational areas. No vehicles or heavy machinery may be allowed to drive indiscriminately within any delineated watercourses. All vehicles must remain on demarcated roads and within the project footprint. No material may be dumped or stockpiled within delineated watercourses. A suitable dust control program should be put in place.
Operations	Wetland an aquatic habitat protection	Sediment transportation and deposition	Increased sediment transport and deposition in wetland and aquatic habitat.	Medium	Medium	Measures must be put in place to attenuate water from infrastructure areas and reduce runoff. Attenuation measures during construction are to include but are not limited to - the use of sandbags, hessian sheets, silt fences, retention or replacement of vegetation and geotextiles such as soil cells which must be used in the protection of slopes. All stockpiles must be protected from erosion, stored on flat areas where runoff will be minimised, and be surrounded by bunds. Stockpiles must also only be stored for the minimum amount of time necessary. Delay vegetation clearing and clear only the minimum area required at any one time. Ensure soil management and stormwater management programmes are implemented and maintained to minimise erosion and sedimentation. All erosion noted within the project footprint should be remedied immediately and included as part of an ongoing rehabilitation plan. Active rehabilitation, re-sloping, and re-vegetation of disturbed areas immediately after construction and operational activities.

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	SIGNIFICANCE WITHOUT MITIGATION	SIGNIFICANCE AFTER MITIGATION	MITIGATION MEASURES
						Ensure that no incision and canalisation of the wetland features present takes place as a result of the proposed activities. Erosion berms should be installed on roadways and downstream of stockpiles to prevent gully formation and siltation of the freshwater resources.
Operations	Wetland an aquatic habitat protection	Water quality deterioration	Water quality deterioration.	Medium	Medium	Clean and dirty water separation systems to be implemented prior to the commencement of activities and to be maintained throughout the life of the proposed project. Ensure that as far as possible that all operational infrastructures are placed outside of wetland/riparian areas and their associated 32 or 100 m zones of regulation, respectively. All vehicles must be regularly inspected for leaks. Vehicles are to be maintained in good working order so as to reduce the probability of leakage of fuels and lubricants. Storage of potentially hazardous materials (including but not limited to fuel, oil, cement, bitumen etc.) must be above any 100-year flood line or outside the designated watercourse buffer, whichever is greater. A walled concrete platform, dedicated store with adequate flooring or bermed area must be used to accommodate chemicals such as fuel, oil, paint, herbicide and insecticides, as appropriate, in well-ventilated areas. Re-fuelling must take place on a sealed surface area away from wetlands to prevent ingress of hydrocarbons into topsoil. All spills should be immediately cleaned up and treated accordingly. Provide sufficient storage capacity to contain contaminated waters i.e., adopt a zero-discharge policy. Should contaminated water due to spillages or other unforeseen circumstances enter identified wetland or watercourse, a wetland/aquatic specialist must be consulted regarding implementation of suitable mitigation and/or rehabilitation measures. Surface water draining off contaminated areas containing hydrocarbons are required to be channelled towards a sump which will separate the chemicals and oils. No uncontrolled discharges to any surface water resources are permitted. Any discharge points need to be approved by the relevant authority. In the case of pollution of any surface or groundwater, the Regional Representative of the DHSWS must be informed immediately. Appropriate sanitary facilities must be provided for the duration of the operational activities and all waste must be removed to an appropriate

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	SIGNIFICANCE WITHOUT MITIGATION	SIGNIFICANCE AFTER MITIGATION	MITIGATION MEASURES
						waste facility. Under no circumstances may ablutions occur outside of the provided facilities.
Operations	Wetland an aquatic habitat protection	Provincial freshwater conservation targets.	Impact on provincial freshwater conservation targets.	High	High	A suitable wetland offset strategy may assist in mitigating this impact to some extent. Ongoing rehabilitation, mitigation of impacts and monitoring should be carried out to identify emerging impacts and trends so that the necessary preventative measures can be timeously implemented.
Operations	Wetland an aquatic habitat protection	Water quality deterioration	Water quality deterioration.	Medium	Medium	During rehabilitation, no vehicles, heavy machinery or unauthorised personnel may be allowed to drive indiscriminately within any delineated watercourses. All vehicles must remain on demarcated roads and within the project area footprint. All vehicles must be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area away from wetlands to prevent ingress of hydrocarbons into topsoil. All spills should be immediately cleaned up and treated accordingly. To mitigate the potential impacts of decant, appropriate wetland rehabilitation design and implementation must ensure that wetland functionality of remaining wetlands is maintained and where necessary, restored. In the event of decant occurring and water quality and/or quantity negatively affecting the associated aquatic biota (as determined through routine biomonitoring activities), water must be pumped to the WTP that will treat the water to a quantity and quality appropriate to be released back into the receiving aquatic ecosystem. It must be ensured that decant is of an acceptable water quality to meet the ecological requirements of the Steelpoort River as set in the Reserve and to prevent deviation from the RQOs.
Operations	Wetland an aquatic habitat protection	Increased surface water runoff	Increased surface water runoff into wetland and aquatic habitat.	Medium	Low	Good soil management should take place taking care not to mix topsoil and subsoils during stripping. Care should be taken to follow the soil management plan closely. Topsoil should not be stockpiled for extended periods and should be utilised in ongoing rehabilitation activities within 3 years or as indicated in the soil management program to prevent loss of soil viability. Topsoil depths on rehabilitated areas should be maximised as far as possible. Replaced soils should be appropriately shaped and profiled to the natural landscape profile and should be free draining. Steep slopes should be avoided to prevent erosion.

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	SIGNIFICANCE WITHOUT MITIGATION	SIGNIFICANCE AFTER MITIGATION	MITIGATION MEASURES
						As much vegetation growth as possible should be promoted within the proposed development area during all phases. In order to protect soils, vegetation clearance should be kept to a minimum. All areas where active erosion is observed should be ripped, re-profiled and seeded with indigenous grasses endemic to the region. Ongoing wetland rehabilitation is necessary both within and in the vicinity of the proposed study area and appropriate wetland monitoring techniques must take place on an annual basis during the summer/wet season in order to identify any emerging issues, and to make recommendations on any trends, declines or improvements in the receiving environment.
Operations	Invasive alien plant species control	Invasive alien plant species encroachment.	Invasive alien plant species encroachment.	Medium	Medium	An alien vegetation management plan to be implemented and managed for the life of the proposed project. The alien vegetation management plan should remain in place for a period of at least five (5) years post-closure. Bi-annual vegetation surveys and alien vegetation clearing activities should take place to remove saplings of alien trees. Saplings should ideally be removed before they reach 1 m in height.
Operations	Buffer zone control	Buffer zone impacts.	Buffer zone impacts.	Medium	Low	No activities, roads or infrastructure are to be located within the final designated buffer zone areas. Indigenous vegetation cover within the designated buffer zones are to be maintained at a minimum of 80% to ensure that the buffer remains functional, and must be assessed annually. Alien vegetation establishment within these buffer zone areas is to be strictly controlled through the development and implementation of a detailed alien management plan developed in accordance with the legislative requirements that considers management actions to be taken during all phases of the lifecycle of the mine, including post-closure management requirements.
Terrestrial Biodiversity						
Operations	Terrestrial biodiversity protection	Influence on terrestrial biodiversity	Loss of plant communities including floral SCC; Loss of biodiversity. Increased erosion. Potential for AIP proliferation. Loss of faunal habitat including faunal SCC. Loss of vegetation types including Grassland, Rocky Outcrop and Wetland vegetation units.	High	Medium	Keep site clearing to a minimal, and restrict vehicle movement outside of dedicated areas, specifically close to wetlands (pans). Keep site clearing and impacts to the Mining Right Application. Alien plant management strategy should be implemented. Make use of existing roads to encourage minimal impacts/footprint. Adhere to 100 m protective buffers around pans. Replacement of removed protected species during rehabilitation.

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	SIGNIFICANCE WITHOUT MITIGATION	SIGNIFICANCE AFTER MITIGATION	MITIGATION MEASURES
Operations	Terrestrial biodiversity protection	Influence on terrestrial biodiversity	Removal of vegetation and basal layer. Increased proliferation of AIPs. Increased faunal casualties. Increased dust pollution.	Medium	Low	Keep site clearing to a minimum. If any erosion occurs, corrective actions must be taken to minimise any further erosion from taking place at regular intervals or after high rainfall events. Staff of the mine must adhere to policies within the operation of the mine, such as adhering to designated speed limits. Restoration and rehabilitation of removed vegetation and SCC during rehab phase. Construction must be kept within the infrastructure footprint area, to reduce as much fragmentation as possible. AIPs should be continuously monitored and controlled throughout the life of the mine and thereafter.
Operations	Terrestrial biodiversity protection	Influence on terrestrial biodiversity	Heavy machinery utilised increasing vehicle movement in the area, increasing soil compaction, habitat disturbances and vegetation removal. Blasting will increase loss of habitat, faunal casualties, loss of ecosystem functioning and encourage habitat fragmentation. Natural vegetation will be removed for the Open Pits working promoting edge effects and AIP proliferation. Increased dust pollution and erosion.	Medium	Low	Restoration and rehabilitation of removed vegetation and SCC during rehab phase. Construction must be kept within the infrastructure footprint area, to reduce as much fragmentation as possible. Alien invasive plants should be continuously monitored and controlled throughout the life of the mine and thereafter. Corridors (infrastructure and ecological) set aside within the mine area would mitigate fragmentation substantially, especially if this could be managed with the community over an extended period of time.
Operations	Terrestrial biodiversity protection	Influence on terrestrial biodiversity	Habitat destruction by removal of vegetation. Increase in dust production. AIP spread. Increased compaction, erosion, and consequently sedimentation potential. Increased faunal casualties.	Medium	Low	The footprint of the mine should be kept as small as possible with only necessary areas being cleared. Existing roads should be used with no new roads constructed, if new roads need to be constructed, these should be done outside of the identified vegetation communities and as close as possible to the existing roads. Access should be restricted to already impacted areas (haul roads, open pits and dumps) by rehabilitating these areas as soon as possible by removal of infrastructure and planting. To minimise loss of Faunal SCC, awareness campaigns with activated anti-poaching units incorporated during the mine life cycle. Security patrols to prevent snaring. Create a sanctuary for faunal species identified within the Project area during the operational phase (See measures for Grey Crowned Crane conservation in Land Management Plan). Alien invasive plants should be continuously monitored and controlled throughout the life of the mine and thereafter. It is recommended that AIP programme be established to control the spread. Monitoring of the vegetation communities present must be completed

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	SIGNIFICANCE WITHOUT MITIGATION	SIGNIFICANCE AFTER MITIGATION	MITIGATION MEASURES
						every 2 years to document to impacts of the edge effect and fragmentation.
Operations	Terrestrial biodiversity protection	Influence on terrestrial biodiversity	Removal of vegetation, habitats and increased soil erosion and compaction. Loss of faunal SCC. Destruction of and changes to the habitats. Increased dust pollution due to erosion and vehicular activity. Risk of AIP proliferation.	Medium	Low	Monitoring of alien invasive sprawl during the operation is recommended as the surrounding vegetation is relatively intact and free from alien invasive plants. Ensure no loss of faunal SCC by activating anti-poaching units that will be incorporated during the mine life cycle. Monitor dust pollution. Keep sight clearing to a minimal, and restrict vehicle movement outside of dedicated areas, specifically close to wetlands (pans). Vegetate stockpiles to prevent soil loss, organic material loss, erosion, and sedimentation.
Operations	Terrestrial biodiversity protection	Influence on terrestrial biodiversity	Contamination of soil, water and surrounding areas / habitats (pan vegetation) from Hydrocarbon waste/spills (lubricants, oil, explosives, and fuels).	Medium	Low	All spills should be immediately cleaned up and treated accordingly. Re-fuelling must take place on a sealed surface area away from sensitive habitats such as the pan vegetation to prevent the ingress of hydrocarbons into the topsoil.
Operations	Terrestrial biodiversity protection	Influence on terrestrial biodiversity	Compaction of soil. Potential faunal casualties. Increased runoff potential. Increased erosion and decline in revegetation potential.	Medium	Low	Rehabilitate the compacted, eroded areas by deep ripping to loosen the soil and revegetate the area as soon as possible. Ensure proper stormwater management designs are in place to ensure no run-off or pooling occurs. Adhere to health and safety protocols within the operations of the mine and adhere to speed limits to minimise faunal casualties. Only designated access routes are to be used to reduce any unnecessary compaction.
Operations	Terrestrial biodiversity protection	Influence on terrestrial biodiversity	Disturbance of soils, and subsequent erosion by wind, and water. Increased vehicle movement in the area, increasing soil erosion and habitat destruction. Potential spillage of hydrocarbons such as oils, fuels, and grease, thus contamination of the surrounding grounds. AIP proliferation. Unexpected changes in topography and landscape.	Medium	Low	Continue with Concurrent Rehabilitation, begin with stockpiles, open pits and dumps, implement rehabilitation measures. Address eroded and compacted areas by deep ripping to loosen the soil, and revegetate the area as soon as possible to prevent AIP sprawl. Inventory of hazardous waste materials stored on-site should be compiled and complete removal arranged. Ensure proper stormwater management designs are in place to ensure no run-off or pooling occurs. Only designated access routes are to be used to reduce any unnecessary compaction.
Operations	Terrestrial biodiversity protection	Influence on terrestrial biodiversity	Exposure of soils, and subsequent compaction, erosion, and sedimentation. Soil compaction, and increased runoff potential due to vehicle movement during rehabilitation programs. AIP proliferation.	Medium	Low	During the decommissioning phase, rehabilitation must start as soon as possible and preferably in the growing season to ensure adequate plant recruitment. Address eroded and compacted areas by deep ripping to loosen the soil and revegetate the area as soon as possible.

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	SIGNIFICANCE WITHOUT MITIGATION	SIGNIFICANCE AFTER MITIGATION	MITIGATION MEASURES
			Loss of organic material, basal layer and vegetation cover. Potential spillage of hydrocarbons such as oils, fuels, and grease, thus contamination of soil.			Inventory of hazardous waste materials stored on-site should be compiled and complete removal arranged. Only designated access routes are to be used to reduce any unnecessary compaction.
Operations	Terrestrial biodiversity protection	Influence on terrestrial biodiversity	Minimal negative impacts on the environment. Environmental Monitoring Plan.	Medium	Low	During the decommissioning phase, rehabilitation must start as soon as possible and preferably in the growing season to ensure adequate plant recruitment. Stockpiles, open pits and dumps are to be rehabilitated. Ensure sufficient irrigation (can use water cart) and fertilizing of newly planted vegetation to facilitate a rapid establishment. Replant with species identified within each vegetation community.
Operations	Terrestrial biodiversity protection	Hazardous substance leaks and spillages	Leaking or spillage of hazardous substances from pipelines and waste storage.	Medium	Low	If a spill occurs, it is to be cleaned up immediately (Drizit/Zupazorbtype spill kits) and consequently reported to the authorities. All infrastructure carrying or transporting such substances is to be checked frequently and maintained. Ensure all staff are adequately informed and safety measures are in place for such instances.
Operations	Terrestrial biodiversity protection	Hydrocarbon spillage from vehicles.	Hydrocarbon spillage from vehicles.	Low	Low	If leak occurs from vehicle, place drip trays below the leak. All vehicles are to be serviced on concrete areas and off site. Machines must be parked upon hard parking surfaces and checked daily for leaks.
Operations	Terrestrial biodiversity protection	Infrastructure malfunction	Infrastructure malfunction leading towards dirty water spillage or spontaneous combustion.	Medium	Low	All infrastructure, machinery and associated setups are to be serviced and checked throughout the project life cycle. All staff are to be informed about potential hazards and consequently prepared for malfunctioning. Protocols are to be induced at every phase of the project life cycle. If such hazards were to incur, the appropriate authorities are to be notified and the incident recorded.
Operations	Terrestrial biodiversity protection	Dust pollution	Excess dust pollution.	Medium	Low	Excess dust in construction sites is mitigated via various methods and are site specific. The recommended methods for this site would be spraying of water, tackifiers and soil stabilisers that do not harden the soils.

Figure 11.1 presents the Risk-Based Reporting Matrix Without Mitigation, whilst **Figure 11.2** presents the Risk-Based Reporting Matrix After Mitigation. As can be seen in the figures, the risks associated with each impact with or without impact mitigation action implementation show, through the implementation of appropriate impact mitigation actions, the likelihood and consequence of identified impacts can be improved.

Without Mitigation		1 Insignificant	2 Minor	3 Moderate	4 Major	5 Catastrophic
5	Almost certain	**0**	**1**	**2**	**25**	**18**
4	Likely	**0**	**1**	**6**	**34**	**3**
3	Moderate	**0**	**0**	**2**	**2**	**1**
2	Unlikely	**0**	**0**	**1**	**2**	**0**
1	Rare	**0**	**0**	**0**	**0**	**0**

Figure 11.1: Risk-Based Reporting Matrix Without Mitigation.

After Mitigation		1 Insignificant	2 Minor	3 Moderate	4 Major	5 Catastrophic
5	Almost certain	**0**	**1**	**3**	**3**	**9**
4	Likely	**0**	**7**	**12**	**5**	**4**
3	Moderate	**1**	**14**	**11**	**9**	**0**
2	Unlikely	**5**	**7**	**3**	**2**	**0**
1	Rare	**0**	**0**	**2**	**0**	**0**

Figure 11.2: Risk-Based Reporting Matrix After Mitigation.

12 SUMMARY OF SPECIALIST RECOMMENDATIONS

Specific recommendations of the specialists consulted are presented in **Table 12.1**.

Table 12.1: Specialist Recommendations.

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
Climate and Air Quality	It is recommended that ambient air quality monitoring be expanded to include the recommended locations to get a baseline condition prior to the onset of the operations and in order to establish the level at which the proposed operations are noted to impact on the ambient air quality.	X	Section 11 and EMP.
	Fallout monitoring should be continued for the life of mine to better assess the level of nuisance dust associated with the related operations. Sampling of fallout should be expanded.	X	Section 11 and EMP.
	PM 10 and PM 2.5 dust monitoring must also be undertaken at at the locations presented but also in and around potential fugitive emission sources to determine mitigation measures and focus management efforts.	X	Section 11 and EMP.
Soils	The following stockpiling recommendations apply: • Strip a suitable distance ahead of the construction (disturbance) at all times, to avoid loss and contamination; • Supervise stripping to ensure soils are not mixed. • Strip soils only when moisture content is as low as possible to minimise compaction risk. Stripping and replacement of soil should be done during the dry winter when rainfall is at its lowest and soils are driest. • Strip and replace in one action wherever possible Wherever possible, stripping and replacing of soils should be done in a single action. This is both to reduce compaction and also to increase the viability of the seed bank contained in the stripped surface soil horizons. Stockpiling both increases compaction and decreases the viability of the seed bank and should only be done when no areas of reshaped impacted land are available for direct placement. • Wherever possible, soils should be stripped and replaced using shovel (backhoe) and truck equipment.	X	Section 11 and EMP.
	The following topsoil management recommendations apply: • Locate soil stockpiles so that re-handling of soil is minimised. Soil stockpiles should not be moved after initial stripping unless the soil is being replaced in its final location in the rehabilitated profile. This is because each re-handling damages soil structure and increases compaction. While it may cost more initially, it is better to place stockpiles in areas where they will not have to be moved. • Placing soil stockpiles in drainage lines has two major harmful effects: the soils become waterlogged and lose desirable physical and chemical characteristics and the risk of loss of soil materials due to erosion is increased. Ideally, stockpiles should be placed on a topographical crest which provides free drainage in all directions. Alternatively, a side-slope location with suitable cut-off berm construction upslope is acceptable. • Soils should be stockpiled loosely at no more than 5 m high. The use of heavy equipment over soil piles results in soil structure damage. If direct dumped soil piles are too low, then it is possible to increase stockpile height using a bulldozer blade or back-actor bucket to raise the materials.		
	The following soil preparation management recommendations apply: • Prior to planting or seeding, the site should be prepared to ensure that appropriate conditions for plant growth are provided.		

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	• Retain and respread soils so that their natural order is reflected (i.e. subsoils at the bottom and topsoil at the top). • Rake the surface so that big clods are broken up, the surface is even and the soil is easy to handle during planting. • Ensure that soil is not overly dry and powdery. It should be slightly damp but not sodden and muddy or the soil structure will be damaged. If it is very dry, watering it the day before planting is recommended. • The lack of available weed and pathogen-free soil material is a common limiting factor to restoration and re-vegetation works in disturbed areas. A minimum depth of 200 mm of soil material is generally required to sustain plant growth for most species. As a result, protection of the existing soil material on and around work sites is essential for successful restoration works.		
Terrestrial Biodiversity	All identified faunal SCC identified must be located and relocated, if possible, before the construction phase. All floral SCC must be identified and located in a pre-screening assessment prior to construction. Permits will be required to relocate and/or destroy the identified protected floral species within the Project area. Replant suitable and indigenous flora during the rehabilitation phase as a means to revegetate the area after decommissioning the mine. Restriction of vehicle movement over sensitive areas to reduce degradation of untouched areas. Minimise unnecessary removal of the natural vegetation cover outside the development footprint. After rehabilitation, the area must be fenced, and animals should be kept off the area until the vegetation is self-sustaining and established.	X	Section 11 and EMP.
Freshwater Ecosystems	Wetland areas outside of the opencast footprint should be fenced off and should be designated as No-Go areas for all unauthorised personnel. All delineated watercourses and their associated 100 m zones of regulation in terms of GN 704 should be designated as No-Go areas and be off limits to all unauthorised vehicles and personnel, with the exception of approved construction and operational areas. Ongoing wetland rehabilitation is necessary both within and in the vicinity of the proposed study area and appropriate wetland monitoring techniques must take place on an annual basis during the summer/wet season in order to identify any emerging issues, and to make recommendations on any trends, declines or improvements in the receiving environment. An alien vegetation management plan must be implemented and managed for the life of the proposed project. The alien vegetation management plan should remain in place for a period of at least five (5) years post-closure. Bi-annual vegetation surveys and alien vegetation clearing activities should take place to remove saplings of alien trees. Indigenous vegetation cover within the designated buffer zones is to be maintained at a minimum of 80% to ensure that the buffer remains functional and must be assessed annually. It is recommended that a detailed wetland mitigation and offset strategy be developed for the mine in order to ensure long-term wetland functioning within the catchment. Such a strategy must consider the feasibility of	X	Section 11 and EMP.

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	rehabilitation of the remaining wetlands on site, as well as the offsetting of the residual wetland loss resulting from the proposed mining through of wetlands.		
Surface Water	Update the water balance on an annual basis.	X	Section 11 and EMP.
	Undertake quarterly monitoring of proposed and existing surface water monitoring locations.		
	Implement the SWMP and ensure that infrastructure is not damaged and functioning optimally.		
Groundwater	The mine floor elevations and extents of mining should be confirmed for the Glisa section as this largely governs the decant location and flooding rate.	X	Section 11 and EMP.
	The groundwater monitoring network should be updated based on the existing and proposed monitoring positions. A number of boreholes plot wrongly or are numbered wrongly. The exact location and status of each borehole currently or previously monitored should be established by means of a field survey.		
	A monitoring database should be established contain all historic and future monitoring data.		
	Geochemical samples must be obtained from the backfill areas to properly characterise the actual backfill geochemical properties. The samples must be representative over both the vertical and horizontal extent of each backfilled pit. At least 10 boreholes must be sampled over their entire vertical profile to the bottom of pit.		
	Kinetic leaching tests must be performed on coal, overburden and discard samples at Glisa and Paardeplaats section in order to determine the pyrite oxidation rate. Kinetic leach testing will also give a better quantification than static leach tests of the chemicals that may potentially leach out of the rock.		
	The geochemical model must be updated to calibrate and validate its results and to construct an effective closure plan for the mine. The geochemical model must also assess the effectiveness of potential mitigation measures.		
	A comprehensive geochemical study for the Paardeplaats area is warranted and should be conducted as mining commences. This should be done such that a geochemical management plan can be implemented as part of the mining plan to ensure a reduced post closure impact.		
	The groundwater numerical model should be updated every 2 years to reflect the operational and post-rehabilitation conditions and to be re-calibrated using the most recent groundwater levels. This will improve groundwater level recovery and time-to-decant calculations. The model should also be updated when new geochemical data is available to update the contaminant transport model.		
	A site assessment re-calculating the decant volumes using numerical model results and spreadsheet calculations should be carried out every 2 years based on the rehabilitation design of each opencast.		
	Re-estimations of the recharge based on the used capping and determination of the backfill porosity into each pit should be assessed when backfilling is complete. This will improve the accuracy of the decant volumes and time-to-decant to be expected and therefore to verify if the water treatment plant is properly designed.		
	Delineations of mining areas, contribution of each of those mining areas to the constructed decant points and anticipated decant volumes (average and seasonal variations) should be assessed and/or confirmed and these volumes should correspond to values in the site water balance.		
	It is recommended to conduct surface wate blending model to assess the risk associated with the salt load contribution of the base flow.		

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	A mine water decant action plan should be developed to address the current and post closure impacts associated with decant, seepage and base flow salt loads.		
	Closure of the mining operation should be undertaken in line with the EMP closure plan. It is however likely that not enough material will be available for backfilled all the opencasts to natural ground level. A s a result of the material deficit, finals voids would be present. Therefore, a pit lake/final void closure feasibility study should be considered to assess the impact of leaving a final void/pit lake in the mining areas. This study should be based on the post closure landform design. This could potentially reduce the post impacts as well as the required volume of water to be treated post closure.		
Heritage	A full EIA level Palaeontological Impact Assessment (PIA) report is recommended to assess the value and prominence of fossils in the development area and the effect of the proposed development on the palaeontological heritage.	X	Section 11 and EMP.
Traffic	A structural assessment of all culverts on the haul route should be undertaken to determine their current condition and if upgrades are required then these are designed to have the minimum impact on the environment;	X	Section 11 and EMP.
	To minimise the impact on the adjacent communities a traffic management plan should be prepared, which would identify appropriate routes for heavy vehicles to avoid communities and limit time of operation.		
	Any culverts required within the site are designed to have minimum impact on the environment and can be removed when no longer required;		
	The internal roads should be positioned to ensure minimum impact on the sensitive wetland ecosystems, as the current plan indicates;		
	Existing roads within the site are used where possible to minimise the impact.		
	The provincial D 2809 gravel road should be realigned to avoid the planned mining area.		
Blast and Vibration	A minimum recommendation is that a minimum of 500 m must be maintained from any blast done. This may be greater but not less. The blaster has a legal obligation concerning the safe distance and he needs to determine this distance.	X	Section 11 and EMP.
	All persons and animals within 500 m from a blast must be cleared and where necessary evacuation must be conducted with all the required pre-blast negotiations.		
	Road closure will need to be considered when blasting closer than 500 from the road. The N4 and any service roads will need to be closed for blasting at distances 500 m from the pit edge. Local authorities will need to be informed of such requirements and road closure conducted according to authority requirements.		
	It is highly recommended that a monitoring program be put in place. This will also qualify the expected ground vibration and air blast levels and assist in mitigating these aspects properly. This will also contribute to proper relationships with the neighbours.		
	A base line of structure inspection should be considered for all privately owned structures within 1,500 m from the mine.		
	A further consideration of blasting times is when weather conditions could influence the effects yielded by blasting operations. Recommended is not to blast too early in the morning when it is still cool, or the possibility of inversion is present or too late in the afternoon in winter as well. Do not blast in fog. Do not blast in the dark. Refrain		

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	from blasting when wind is blowing strongly in the direction of an outside receptor. Do not blast with low overcast clouds. These 'do not's stem from the influence that weather have on air blast. The energy of air blast cannot be increased but it is distributed differently to unexpected levels where it was not expected. It is recommended that a standard blasting time is fixed and blasting notice boards setup at various entrance routes that will inform the town's people of dates of blasting and blast times. Consideration must be given to the school times as pupils use secondary roads that lead to the main road directly across from the project area.		
	Third party consultation and monitoring should be considered for all ground vibration and air blast monitoring work. This will bring about unbiased evaluation of levels and influence from an independent group. Monitoring could be done using permanent installed stations. Audit functions may also be conducted to assist the mine in maintaining a high level of performance with regards to blast results and the effects related to blasting operations.		
	A detailed list of boreholes must be compiled. Necessary data for each borehole must be logged including, location, condition, qualities, levels etc. Detail of recordings required must be confirmed with the groundwater consultant. Ground vibration levels at boreholes must be maintained below 50 mm/s at the surface of borehole.		
Noise	The National Noise Control Regulations and SANS 10103:2008 should be used as the main guidelines for addressing any further noise issues on this project.	X	Section 11 and EMP.
	The noise mitigation measures will need to be designed and/or checked by an acoustical engineer in order to optimise the design parameters and ensure that the cost/benefit of the measure is optimised.		
	Noise Monitoring Guidelines should be developed for the construction and operational phases of the project. The following details and issues should be addressed: • General Details of the Colliery • Noise Area of Influence • Residual (Baseline) Noise Climate of the Study Area • Noise Standards/Impact Criteria • Noise Measurement Procedures • Selection of Noise Monitoring/Measurement Sites • Length of Measurement Period • Frequency of Monitoring Measurement • Measurement Data Requirements.		
Visual	-	-	-
Social	-	-	-
Financial Provision	Compile a topsoil balance. The current assumption of replacing 300 mm topsoil across the backfilled open pit areas and the contractor, plant and hards stockpile disturbed footprints must be tested against available volumes.	X	Section 11 and EMP.
	Implement concurrent rehabilitation where possible to incrementally achieve the closure objectives over time and reduce the financial burden at closure.		
	Once the earth bund wall is in place, allowance is made to excavate a trench at toe of earth bund wall for safety purposes and to prevent inadvertent access to the void. The excavated trench to be a depth of 2 x 2.5 m wide.		

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	It is recommended that the method to rehabilitate voids should be revised once detailed information is available from the final land reform rehabilitation plan.		
	The groundwater model should be updated, and any other additional studies should be completed before the next assessment, to ensure the water liability is calculated with the most practicable water treatment option for the NBC operations.		
	Confirm the waste disposal strategy and environmental authorisation requirements with the relevant authorities, particularly relating to backfilling pits with carbonaceous material and capping requirements for the discard dump.		
	The financial provision needs to be updated on an annual basis as a requirement of the NEMA. This will ensure that all costs become more accurate over time and will reflect prevailing market conditions.		
	Complete the relevant studies and the rehabilitation and management plan to restore the watercourse at Glisa to ensure environmentally acceptable and sustainable conditions post closure. Once approval is granted for the relevant plan the financial provision should be updated to include the rehabilitation costs.		

13 ENVIRONMENTAL IMPACT STATEMENT

13.1 Key Findings of the Environmental Impact Assessment

It has been noted that the Integrated Paardeplaats Section will not only stimulate the local economy, but also the national economy. The importance of the Integrated Paardeplaats Section in meeting South Africa's energy demands cannot be underplayed. The EAP would be amiss in not noting the potential negative impact on natural resources as a result of the Integrated Paardeplaats Section, however these are inevitable if the benefits of the project are to be realised. It is for this reason that monitoring of key environmental resources must be of the utmost importance throughout all phases of the mine. All environmental impacts identified must be managed throughout the LoM of the Integrated Paardeplaats Sections. This will ensure that NBC operate in an environmentally and socially conscious manner, and in so doing, warrant the economic sustainability of the Integrated Paardeplaats Section.

To assist in determining which impacts must be given precedence to a prioritisation is determined by assessing the public response to the impact, the potential for the impact to have a cumulative effect, and the potential for a resource to be lost, according to the criteria in **Table 13.1** – **Table 13.3**. The prioritisation serves to assist the EAP in identifying impacts that require immediate of extensive action to mitigate or address. From a risk management perspective, the prioritisation of impacts involves the organisation of the impacts that need to be addressed and ranking them according to the criteria in **Table 13.1** – **Table 13.3**

Table 13.1: Public Response.

DESCRIPTION	RATING
Low (Issue not raised in public response)	1
Medium (Issue has received a meaningful and justifiable public response)	3
High (Issue has received an intense meaningful and justifiable public response)	5

Table 13.2: Cumulative Impact.

DESCRIPTION	RATING
Low (Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change)	1
Medium (Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change)	3

DESCRIPTION	RATING
High (Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change)	5

Table 13.3: Loss of Irreplaceable Resource.

DESCRIPTION	RATING
Low (The impact is unlikely to result in irreplaceable loss of resources)	1
Medium (The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited)	3
High (The impact may result in the irreplaceable loss of resources of high value (services and/or functions)	5

The impacts that are prioritised as high are presented in summary in **Table 13.4**.

13.2 Final Site Map

The final site layout plan is presented in **Figure 13.1**.

Table 13.4: Summary of Prioritised Impacts.

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	PRIORITISING
Social				
Operations	Mining	Water quantity and quality	Impact of the reduction in the quantity of water available for use and water quality deterioration, especially from acid mine drainage.	High
Surface Water				
Operations Rehabilitation	Groundwater decant	Contamination of clean water	Groundwater decanting from the opencast pit will be contaminated and will flow down gradient, likely to enter and contaminate surface water resources.	High
Groundwater				
Operations Rehabilitation	Decant of water from old opencast areas	Groundwater contamination	Decant of mine water from old opencast areas will continue. Decant water will flow into surface water drainage channels.	High
Operations Rehabilitation	Groundwater contamination plume	Groundwater contamination plume	Groundwater contaminant plume.	High
Operations Rehabilitation	Groundwater seepage to streams	Surface water contamination	Decant from opencast operations.	High
Operations Rehabilitation	Groundwater contamination plume	Groundwater contamination plume	Groundwater contaminant plume.	High
Operations Rehabilitation	Groundwater seepage to streams	Surface water contamination	Decant from opencast operations.	High
Freshwater Ecosystems				
Operations	Wetland an aquatic habitat protection	Loss of wetland and aquatic habitat.	Loss of wetland and aquatic habitat.	High
Operations	Fragmentation of watercourses.	Fragmentation of watercourses.	Fragmentation of watercourses.	High

PHASE	ACTIVITY	ASPECT (CAUSE)	POTENTIAL IMPACT (EFFECT ON ENVIRONMENT)	PRIORITISING
Operations	Wetland an aquatic habitat protection	Disturbance and degradation of wetland and aquatic habitat.	Disturbance and degradation of wetland and aquatic habitat.	High
Operations	Wetland an aquatic habitat protection	Water quality deterioration	Water quality deterioration.	High
Operations	Wetland an aquatic habitat protection	Provincial freshwater conservation targets.	Impact on provincial freshwater conservation targets.	High
Terrestrial Biodiversity				
Operations	Terrestrial biodiversity protection	Influence on terrestrial biodiversity	Loss of plant communities including floral SCC; Loss of biodiversity. Increased erosion. Potential for AIP proliferation. Loss of faunal habitat including faunal SCC. Loss of vegetation types including Grassland, Rocky Outcrop and Wetland vegetation units.	High
Operations	Terrestrial biodiversity protection	Influence on terrestrial biodiversity	Habitat destruction by removal of vegetation. Increase in dust production. AIP spread. Increased compaction, erosion, and consequently sedimentation potential. Increased faunal casualties.	High

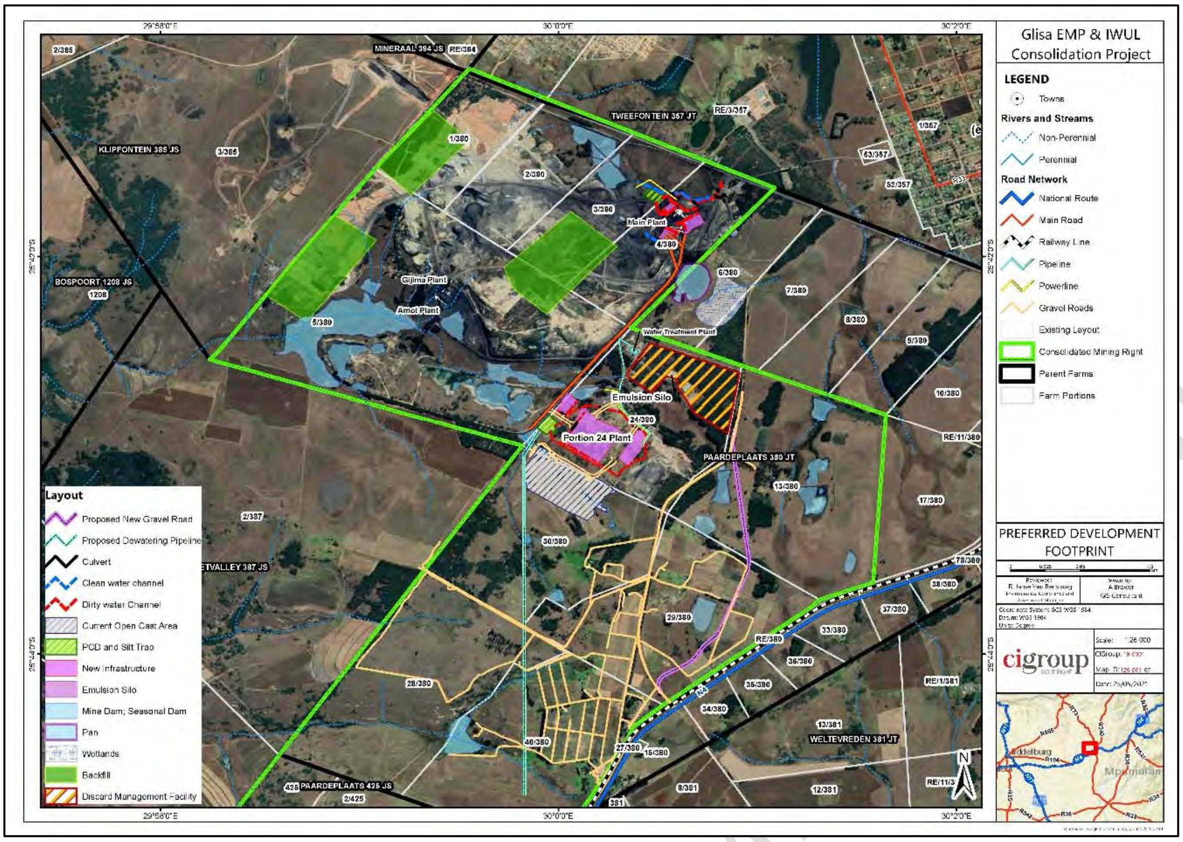

Figure 13.1: Preferred Development Footprint.

14 FINAL PROPOSED ALTERNATIVES

No alternatives were considered because the proposed infrastructure is limited to the properties within the Integrated Paardeplaats Section, which is constrained by existing infrastructure within the mining area, and the presence of other active and future mining operations, farms, and residential areas outside of the mining areas. The presence of a provincial road within the central portion of the Section and a National road on the eastern and southern side of the Section further restricts alternative development locations. Finally, the resource location further restricts the development location, as does previous opencast mining operations and rehabilitation activities.

15 ASSUMPTIONS AND KNOWLEDGE GAPS

The assumptions and knowledge gaps are presented in **Table 15.1**.

Table 15.1: Assumptions and Knowledge Gaps.

SPECIALIST ASSESSMENT	ASSUMPTIONS AND KNOWLEDGE GAPS
Climate and Air Quality	-
Soils	-
Terrestrial Biodiversity	Whilst every effort is made to cover as much of the site as possible, representative sampling was completed as per the nature of this type of investigation. The major limitation associated with the sampling approach is the narrow temporal window of sampling. Ideally, a site should be visited several times during the different seasons to ensure a comprehensive fauna and flora species list. However, due to time and cost restraints, this is not always possible. It is therefore possible that some plant and animal species that are present on site were not recorded during the field investigations. In order to overcome this limitation, the list of species observed during the site visit is supplemented with species of conservation concern that are known to occur in the area. In the absence of a detailed soil map (1:10 000 scale), it is difficult to (with high confidence) map the extent of the natural grassland communities as vegetation reflects the soil conditions. In order to obtain a comprehensive understanding of the dynamics of terrestrial communities, as well as the status the status of endemic, rare or threatened species in my area, faunal assessments should always consider investigations at different time scales (across seasons/years) and through replication. However, due to time constraints such long-term studies are not feasible and more often based on instantaneous sampling bouts. SARCA and SAFAP provide distribution data and the Quarter Degree Squares (QDS) resolution. Expected species list may therefore represent an overestimation of the diversity expected as very specific habitat types may be required by a species which may be present in a QDS but not necessarily on the study site within the QDS. Conversely, many large areas in South Africa are poorly sampled for herpetofauna and expected species lists may therefore underestimate the species diversity. All possible attempts were made to refine the expected species list based on species-specific habitat requirements and a deeper understanding of the habitat types and quality of the study area which was obtained during the summer survey.

SPECIALIST ASSESSMENT	ASSUMPTIONS AND KNOWLEDGE GAPS
	The scope of work for this biodiversity assessment did not cover wetland delineation and assessments. Previous assessments by De Castro & Brits c.c. and Wetland Consulting Services (Pty) Ltd were used as reference guides in the development of this study.
Freshwater Ecosystems	To obtain a comprehensive understanding of the dynamics and diversity of the wetlands/watercourses present within the study area and its immediate surrounds, studies should include investigations through the different seasons of the year, over a number of years, and extensive sampling of the area. This is particularly relevant where seasonal limitations to biodiversity assessments exist for the area of the proposed activity. Due to project time constraints inherent with Environmental Authorisation application processes, such long-term research is seldom feasible, and information contained within this report is based on a single field survey conducted during a single season as well as review of biodiversity-related studies conducted by the mine over the years. Where possible, additional information was added from available sources and previous studies conducted in the area. Furthermore, detailed assessment of the wetlands/watercourses within and in the vicinity of the study area was not carried out as part of this assessment and historical wetland studies and delineations were reviewed, scrutinised and amended based on the observations of the site visit carried out from the 13th – 16th April 2021. It is therefore possible that some discrepancies in the delineation and data provided may occur in some places.
Surface Water	-
Groundwater	-
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 well as the density of vegetation cover found in some areas. As such, should any heritage features and/or objects not included in the present study 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 assess as to the significance of the site (or material) in question. This applies to graves and cemeteries as well. If any graves or burial places are identified or

SPECIALIST ASSESSMENT	ASSUMPTIONS AND KNOWLEDGE GAPS
	exposed during the development, the procedures and requirements pertaining to graves and burials will apply. The scope of work that PGS was appointed for, was to undertake intensive walkthroughs of the DMF area coupled with revisits to the heritage sites identified during the previous heritage study by PGS in 2012. This report and its recommendations reflect this scope of work. Should any development footprint areas located outside the areas defined by the appointed scope of work by PGS be proposed, such additional footprint areas will have to be assessed in the field and included in a heritage impact assessment.
Traffic	-
Blast and Vibration	Considering the stage of the project, the data observed was sufficient to conduct an initial study. Surface surroundings change continuously, and this should be considered prior to any final design and review of this report. This report is based on data provided and international accepted methods and methodology used for calculations and predictions.
Noise	-
Visual	At this stage of the project it is still unsure whether people that are located on site or bordering the site will be relocated or whether they will stay on the proposed properties. It will therefore be assumed that these residents will stay on site and will therefore be sensitive receptors. Concurrent rehabilitation will take place during the mining process and it is assumed that the overburden dumps will be used during the rehabilitation process.
Social	Not every individual in the community could be interviewed, therefore only key people in the community were approached for discussion. Additional information was obtained using existing data, records of public meetings and via telephonic and personal interviews. The social environment constantly changes and adapts to change, and external factors outside the scope of the project can offset social changes, for example changes in local political leadership. It is therefore difficult to predict all impacts to a high level of accuracy, although care has been taken to identify and address the most likely impacts in the most appropriate way for the current local context within the limitations. Social impacts can be felt on an actual or perceptual level, and therefore it is not always straightforward to measure the impacts in a quantitative manner. Social impacts commence when the project enters the public

SPECIALIST ASSESSMENT	ASSUMPTIONS AND KNOWLEDGE GAPS
	domain. Some of these impacts are thus already taking place, irrespective of whether the project continues or not. These impacts are difficult to mitigate and some would require immediate action to minimise the risk. There are different groups with different interests in the community, and what one group may experience as a positive social impact, might be experienced as a negative impact by another group. This duality will be pointed out in the impact assessment phase of the report.
Financial Provisioning	The closure costing addresses decommissioning, demolition, surface rehabilitation, the final closure and monitoring and corrective action of the site. Other aspects that are not addressed in this costing include staffing, separation packages, retraining or reskilling etc. It is assumed that third party contractors would be commissioned to establish on site (preliminary and general costs included) and implement the mass earth works, demolition, site clean-up, related rehabilitation work and the post rehabilitation monitoring and maintenance. The Preliminary and General costs are applied as a percentage of the total (12%). If the current amendments to GN R. 1147 circulated for comment are promulgated, this figure will probably increase to align with industry standards. Unless firm agreements with the next land users are in place, it is assumed that all infrastructure will be demolished and removed. Aligned with the requirements of international accounting standards and GN R.1147, no discounting of potential value recovered from the sale of the plant, steel or other material removed from site is considered. No legal due diligence was done as part of this assessment. The closure costing is based on the information provided by NBC. A contingency of 10% has been allowed for in the closure cost. The contingency considers price fluctuations regarding plant hire, fuel prices, possible omissions and uncertainties in the cost estimate. The closure cost estimate does not include VAT.

SPECIALIST ASSESSMENT	ASSUMPTIONS AND KNOWLEDGE GAPS
	Site specific assumptions are reflected in the Financial Provision Reports.

16 REASONED OPINION AS TO WHETHER THE PROPOSED ACTIVITY SHOULD BE AUTHORISED

16.1 Climate Change and Air Quality

The mitigation and management measures for the operation as discussed in the Air Quality Report (Eco Elementum, 2021) should be sufficient to ensure that the operation can be conducted with minimal impact on the receiving environment and therefore not have a detrimental effect. The report goes on to say that the proposed activities can go ahead.

16.2 Soils

It must be noted that opencast mining has already been approved and is currently underway. Whilst the information in the Soil, Land Use and Land Capability Report (ARC, 2012) was utilised as baseline information for this application, a reasoned opinion with respect to the activities applied for cannot be inferred, and as such no reasoned opinion is provided. It is, however, important to note that the mitigation measures proposed in the report are still relevant to the opencast mining area. With that being said, the Soil, Land Use and Land Capability Report (ARC, 2012) notes that any soil that is removed, stockpiled and then replaced, would not result in the loss of soil resources as such, however a combination of reduction in land capability, loss of productivity, and general deterioration of the pre-mining soil profile will be resultant.

16.3 Terrestrial Biodiversity

Based on the baseline information and impact assessment significance ratings in the Terrestrial Biodiversity Assessment Report (Digby Wells Environmental, 2021), it is the opinion of the specialist that the activities applied for are feasible and should be considered for approval. This opinion relies heavily on the recommendation that concurrent rehabilitation is employed, and the correct implementation of the specified management and mitigation measures are correctly implemented to minimise all potential impacts on the fauna and flora of the site. The measures proposed in the Report (Digby Wells Environmental, 2021), should form part of the conditions for approval, and should be applied throughout the LoM. Protected species permit applications will be required for the removal of identified protected species within the development footprint, so it is strictly advised to keep development and species removal within the identified footprints.

16.4 Freshwater Ecosystems

With the expansion of opencast mining activities into the Paardeplaats Section and considering the proposed LoM Plan (2021), the Freshwater Ecosystem Assessment Report (Ecology International, 2021) reports that the proposed LoM Plan results in the loss of 86.74 hectares of wetlands consisting predominantly of hillslope seepage wetlands. The wetland systems affected include the upper reaches of tributaries draining into the Glisa Section, as well as wetland systems draining westwards and forming part of the upper Steelpoort River catchment and the FEPA designated Fish Sanctuary Area. Based on the outcomes of the impact assessment, it is the opinion of the ecologist that should mining proceed as per the LoM Plan, the loss of wetland habitat cannot be successfully mitigated, and it is likely that offsets will need to be considered.

Whilst no reasoned opinion is provided it must be noted that the loss of wetlands is unlikely to be addressed through mitigation and that a wetland offset strategy, as presented in the EMP, should be considered and should be included as a condition of the authorisation.

16.5 Surface Water

It must be noted that opencast mining has already been approved and is currently underway. Whilst the information in the Hydrology Report (Aqua Earth Consulting, 2012) was utilised as baseline information for this application, a reasoned opinion with respect to the activities applied for cannot be inferred, and as such no reasoned opinion is provided. It is, however, important to note that the current and proposed mining areas are situated in the headwater of the two catchments and the risks of flooding, although always present, is not that great due the topographical position of the Integrated Paardeplaats Section. It must also be noted that NBC hold valid IWULs for all activities associated with the Integrated Paardeplaats Section.

NBC have a robust surface water monitoring programme in place to monitoring and analysis water associated with the NBC Glisa and Paardeplaats Sections to ensure compliance to certain conditions of their approved IWULs. This monitoring programme is essential in ensuring that NBC are aware of the impact that their operations are having on surface water resources in order to allow for a timely response, if required.

16.6 Groundwater

The Hydrogeological Assessment Report (Milnex, 2021) reported on the potential groundwater impacts associated with opencast mining and long-term groundwater contamination and decant. Milnex (2021) assessed the potential impacts associated with the proposed DMF, including a waste classification (Type 3) and liner determination (Class C). In addition Milnex (2021) identified the groundwater drawdown level during mining, the impact on groundwater at LoM end and 50- and 100- years post closure, as well as identified potential decant points. The impacts of the DMF, an activity in this application, were assessed and modelled for the no-leak and leak liner options and whilst no reasoned opinion is provided it must be noted that the Report provided a detailed groundwater management plan for implementation during all phases of the operation.

It is further noted that the robust groundwater monitoring programme that is in place serves to ensure not only compliance to certain conditions of the approved IWULs, but also in ensuring that NBC are aware of the impact that their operations are having on groundwater resources in order to allow for a timely response, if required.

16.7 Heritage

The Phase 1 Heritage Impact Assessment Report (PGS Heritage, 2021) included a review of 32 heritage sites identified in the 2012 assessment as part of the original Paardeplaats Section mining right application. In addition, PGS Heritage were requested to assess Portion 24 to identify any potential heritage resources that may be impacted on by infrastructure placement and the proposed DMF. The filed work identified an additional 13 heritage sites within the Integrated Paardeplaats Section, however none of them were located on Portion 24. PGS Heritage (2021) identified 5 classes of heritage sites including (a) graves and burial grounds, (b) historical homesteads and structures with the possible risk of unmarked graves, (c) historic farmsteads and structures, (d) a possible rock art site, and (e) historical mine shafts and associated structures.

The Report concludes that none of the identified heritage sites are located within 100 m of the proposed DMF, and as a result, no impact is expected with the construction thereof. Whilst the Report includes management and mitigation measures for all the identified heritage sites it also states that, on the condition that the recommendations made in the Report (PGS Heritage, 2021) are adhered to, no heritage reasons can be given for the development of the DMF not to continue.

16.8 Traffic

The Environmental Traffic Impact Assessment undertaken by Arup Transport Planning in 2012 considered the anticipated traffic impacts associated with the Paardeplaats Section. It must be noted that opencast mining at the Glisa Section has ceased and opencast mining in the Paardeplaats Section has already been approved and is currently underway. The information in the Report (Arup Transport Planning, 2012) was utilised as baseline information for this application, and the traffic volumes were based on the volumes of the Glisa Section when fully operational. Whilst no reasoned opinion is provided, it must be noted that the analysis indicated that traffic associated with the

Paardeplaats Section would have no impact on the adjacent road network and that each link would operate at level of service C or better, which was considered acceptable from a traffic engineering perspective.

16.9 Blast and Vibration

The Ground Vibration and Air Blast Assessment (Blast Management and Consulting, 2012) provided an initial review of possible impacts with regards to blasting operations at the Paardeplaats Section of the Integrated Paardeplaats Section. The Report concluded that it would be possible to operate the Paardeplaats Section in a safe and effective manner provided attention was given to recommendations as indicated.

It is important to note that the Report was used to assess the impacts related to blast and vibration, and that the impacts associated therewith need to be borne in mind with the construction and operation of the DMF. Whilst the Report itself does not relate to any of the activities applied for in this application, the recommendations made remain important.

16.10 Noise

The Noise Impact Assessment (Jongens Keet Associates, 2012) assessed the potential noise impacts associated with opencast mining in the Paardeplaats Section and not the activities applied for in this authorisation. The impacts identified for all phases of the opencast mining operation are still of relevance in this application as the construction and operation of the infrastructure will generate noise at varying levels. The noise contours dictate the mitigation measures required and these can be applied beyond just opencast mining activities.

Whilst no reasoned opinion is provided, the Report notes that the operations at the Glisa Section have already raised the ambient noise levels in the area, and provides mitigation measures that can be introduced to mitigate some of the construction and operational noise generated.

16.11 Visual

Eco Elementum undertook a Visual Impact Assessment for the proposed DMF on Portion 24. The Report notes that the visual impact due to the DMF can be seen as having a MODERATE impact on the surrounding environment and inhabitants before mitigation measures are implemented (Eco Elementum, 2021). The visual impact from the DMF can be sufficiently mitigated to a point where it can be seen as insignificant, however it must be noted that mitigation measures are very important and one of the most significant mitigation measures relates to the rehabilitation of the

DMF after mining waste deposition has been concluded. Eco Elementum (2021) report that if rehabilitation is not appropriately executed and the final landform design does not fit in with the surrounding area that the visual impact may remain high and become a lasting concern. Whilst no reasoned opinion is provided, it is noted that, with appropriate design, the impact of the DMF will be minimal during operations and with adequate landform design there should be no visual impact after the landform has been restored.

16.12 Social

Ptersa Environmental Management Consultants undertook a Social Impact Assessment for the proposed mining oof the Paardeplaats Section in 2012. The Report found that mining within the Paardeplaats Section would have a notable impact on the Hadeco farming operations and the Hadeco village (Ptersa Environmental Management Consultants, 2012). Since the finalisation of this report much has changed in the area most notably the closure of the Hadeco faming operations, the resultant loss of jobs stemming therefrom, and the resettlement process associated therewith. The Report did not provide a reasoned opinion on whether mining should be undertaken at the Paardeplaats Section, instead it provided recommendations for the operator (NBC) to consider and implement.

Whilst the Report does not apply specifically to the application at hand, there are notable findings and recommendations that apply to this application. The report advises that all recommendations and mitigation measures proposed in all other specialist assessments undertaken should be implemented or considered to lessen the biophysical impacts on surrounding communities. It also reiterates the importance of open communication between NBC and surrounding communities and I&APs, as well as proposes the appointment of a specialist to assist with any resettlement required. The Report also finds that the management of social impacts is a long-term process and advises a cooperative approach to manage such impacts.

Based on the information presented in this report, together with the consideration of all previous and current specialist reports, the reasoned opinion of the EAP is that the activities proposed and applied for should be authorised. Considering that the activities proposed have been selected to address historical environmental concerns and to contain environmental impacts related to coal handling, stockpiling, processing and waste disposal within an area that is already relatively degraded, support this opinion.

17 CONDITIONS FOR INCLUSION IN THE AUTHORISATION

The following conditions for inclusion in the IEA are proposed:

1. All identified faunal SCC identified must be located and relocated, if possible, before the construction phase.
2. Permits will be required to relocate and/or destroy the identified protected floral species within the Project area. Replant suitable and indigenous flora during the rehabilitation phase as a means to revegetate the area after decommissioning the mine.
3. Wetland areas outside of the opencast footprint should be fenced off and should be designated as No-Go areas for all unauthorised personnel.
4. All delineated watercourses and their associated 100 m zones of regulation in terms of GN 704 should be designated as No-Go areas and be off limits to all unauthorised vehicles and personnel, with the exception of approved construction and operational areas.
5. An alien vegetation management plan must be implemented and managed for the life of the proposed project. The alien vegetation management plan should remain in place for a period of at least five (5) years post-closure.
6. Bi-annual vegetation surveys and alien vegetation clearing activities should take place to remove saplings of alien trees.
7. It is recommended that a detailed wetland mitigation and offset strategy be developed for the mine in order to ensure long-term wetland functioning within the catchment. Such a strategy must consider the feasibility of rehabilitation of the remaining wetlands on site, as well as the offsetting of the residual wetland loss resulting from the proposed mining through of wetlands.
8. Update the water balance on an annual basis.
9. The geochemical model must be updated to calibrate and validate its results and to construct an effective closure plan for the mine.
10. A comprehensive geochemical study for the Paardeplaats area is warranted and should be conducted as mining commences.
11. The groundwater numerical model should be updated every 2 years to reflect the operational and post-rehabilitation conditions and to be re-calibrated using the most recent groundwater levels.
12. A mine water decant action plan should be developed to address the current and post closure impacts associated with decant, seepage and base flow salt loads.
13. A full EIA level Palaeontological Impact Assessment (PIA) report is recommended to assess the value and prominence of fossils in the development area and the effect of the proposed development on the palaeontological heritage.

18 REHABILITATION OBJECTIVES

It is essential that closure objectives are identified prior to closure of the mine to ensure that long-term mine plans can be generated to accommodate the end use proposals, where necessary. The factors that influence the closure of a mine change through time, the Rehabilitation, Decommissioning and Mine Closure Plan (RDMCP) must always adhere to the environmental and socio-economic requirements at the time of closure. The closure vision is to leave behind a mine site which is safe, stable and non-polluting. The post-mining landscape must be sustainable over the long term and achieve the desired end land use as agreed with stakeholders. The overall closure objectives are outlined below:

1. **Suitable Land Capability and Land Use Post-closure:** To rehabilitate all disturbed land to a state that is suitable for its post closure use to be determined in consultation with I&APs and other key stakeholders.
2. **Health and Safety:** To ensure that affected areas are safe, secure, and non-polluting for both human and animal activities.
3. **Physical and Chemical Stability:** The physical and chemical stability of the remaining structures should be such that risk to the environment through naturally occurring forces is eliminated or adequately minimised.
4. **Ecological Sustainability:** To rehabilitate all disturbed land to a state where limited or preferably no post closure management is required.
5. **Environmental Compliance:** To rehabilitate all disturbed land to a state that facilitates compliance with current environmental quality objectives.
6. **Stakeholder Management:** To follow an appropriate stakeholder engagement process with all I&APs and authorities.

Specific closure objectives set in support of the overall closure vision include:

- Return land, mined by opencast methods, as far as possible to a land capability similar to that which existed prior to mining;
- Ensure that as little water as possible seeps out of the various sections of the mine and where this is unavoidable, ensure that the water is contained. Water then should be treated if the volume is significant and if it does not meet statutory water quality requirements;
- Remove mine infrastructure that cannot be used by a subsequent landowner or a third party. Where buildings can be used by a third party, arrangements will be made to ensure their long-term sustainable use;
- Clean up all coal stockpiles and loading areas and rehabilitate these as far as possible to a land capability similar to that which existed prior to mining;

- Follow a process of closure that is progressive and integrated into the short and long term mine plans and that will assess the closure impacts proactively at regular intervals throughout project life;
- Rehabilitate the disturbed land to a state that facilitates compliance with applicable environmental quality objectives;
- Landscape the rehabilitated areas in alignment with the surrounding topography to prevent the unnecessary pooling of water which will recue the runoff in the catchment;
- Implement progressive rehabilitation measures;
- Physically and chemically stabilise any remaining structures to minimise residual risks;
- Leave a safe and stable environment for both humans and animals;
- To prevent any soil and surface/groundwater contamination by managing all water on site;
- Comply with local and national regulatory requirements;
- Form active partnerships with local communities to take care of management of the land after mining, where possible; and
- To maintain and monitor all rehabilitated areas following re-vegetation or capping (placement of a layer of material, e.g. clay or sandstone, which prevents/limits capillary movement of water between soil and pollution source) and, if monitoring shows that the objectives have been met, making an application for closure.

19 PERIOD FOR WHICH THE ENVIRONMENTAL AUTHORISATION IS REQUIRED

Due to the operational aspects associated with the Integrated Paardeplaats Section activities, the IEA will be required for the duration of activities, as per Regulation 26(d)(ii) of the EIA Regulations, 2014, as amended. The Glisa Section MR is valid until 2039, whilst the Paardeplaats MR is valid until 2038. It is evident therefore that all operational activities associated with the integrated Paardeplaats Section will continue for the duration of the Paardeplaats MR, and it is established that the date by which operational activities at the Integrated Paardeplaats Section will be concluded will be in 2038. The IEA is therefore requested for a period of eighteen (18) years (i.e. conclusion date for activities in terms of Regulation 26(d)(ii)).

20 FINANCIAL PROVISION FOR CLOSURE AND REHABILITATION

Mine closure is not a single event but rather a process. The mine closure stages outline the closure processes which are separated by the activities within these. Closure implications for each of these periods will be considered within the Rehabilitation, Decommissioning and Mine Closure Plan (RDMCP). The mine closure stages are illustrated and defined in **Figure 20.1**.

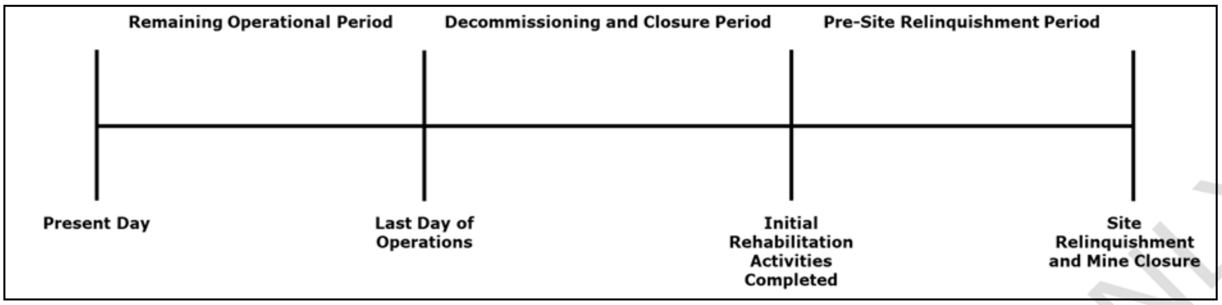

Figure 20.1: Mine Closure Stages.

Remaining Operational Period: This period covers the time which mining activities are expected to continue, commonly referred to as the LoM. In this period, closure planning will be refined and updated as stakeholders are engaged, studies are implemented to close knowledge gaps, technology changes or learnings from other operations are noted. Operational rehabilitation must also be carried out within this period to minimise the liability at the end of operations.

Decommissioning and Closure Period: The operational mining team would have left the site and the site would be handed over to closure contractors, whether these be external contractors, under the MR holder's supervision, or in-house personnel. The closure measures would be implemented and legal transfer of infrastructure to third parties would take place as per the detailed closure plan. The initial rehabilitation measures are completed at the end of this period, but the closure process is still not completed.

Pre-Site Relinquishment Period: For a period, the closure measures and state of the site will have to be monitored and maintenance undertaken if needed to ensure that rehabilitation was completed to pre-determined targets. The closure targets or site relinquishment criteria are developed prior to closure and serve as a measure to determine whether the long-term environmental, social, physical, and economic risks have been adequately addressed. Site relinquishment is when ownership and responsibility of the site can be transferred, and the mine is considered closed.

All activities on site will continue for the remaining operational period, after which decommissioning of infrastructure will be undertaken. Initial rehabilitation activities will continue until completed, and a period of monitoring and maintenance implemented prior to the site relinquishment and ultimate mine closure.

20.1 Calculation of Financial Provision

The financial provision estimate was calculated in terms of the Financial Provisioning Regulations, 2015 (GNR 1147), as amended. The estimated financial provision for the unscheduled closure of the Glisa Section is **R 442,931,626.00 (excluding VAT)**. The estimated financial provision for the unscheduled closure of the Paardeplaats Section is **R 26,537,686.00 (excluding VAT)**. The 2020 unscheduled financial provision breakdown and comparison with the 2019 estimate for the Glisa Section is presented in **Table 20.1** whilst the 2020 unscheduled financial provision for the Paardeplaats Section is presented in **Table 20.2**. The 2021 financial provision updated is scheduled for the latter half of 2021.

20.2 Confirmation of How Financial Provision Will be Provided For

The financial provision can and will be provided for from operational expenditure.

Table 20.1: Unscheduled Financial Provision Summary – Glisa Section.

AREA AND DESCRIPTION	UNSCHEDULED CLOSURE (2020)	PREVIOUS ASSESSMENT (2019)	DIFFERENCE 2019-2020		REASON FOR CHANGE
Infrastructure and Rehabilitation					
Area 1: Infrastructure (Plant, Security, Offices & Workshop)	R 5,755,945.00	R 4,940.285.00	R 815,660.00	16.5%	▪ New ancillary infrastructure was added since 2019. CPI rate adjustment.
Area 2: Mining area (Pit, Dumps and Disturbed areas)	R 202,357,468.00	R 189,446,958.00	R 12,910,509.00	6.8%	▪ Mining areas (i.e. Voids and dumps) were revised and Block D void was included as per the new survey data received from the mine. CPI rate adjustment.
Area 3: Dams	R 5,569,443.00	R 5,345,468.00	R 223,975.00	4.2%	▪ CPI rate adjustment
Area 4: Linear Infrastructure	R 627,589.00	R 645,541.00	R 27,048.00	4.2%	▪ CPI rate adjustment
Area 5: Water Treatment Plant	R 0.00	R 1,160,590.00	-R 1,160,590.00	-100.0%	▪ Assumed that the water treatment plant will remain at LoM for post closure water treatment.
Area 6: Explosive Magazine	R 42,728.00	R 41,010.00	R 1,718.00	4.2%	▪ CPI rate adjustment
Sub-Total	**R 214,398,172.00**	**R 201,579,852.00**	**R 12,818,320.00**		
Monitoring and Maintenance					
Monitoring Costs (Groundwater and Surface water)	R 8,394,029.00	R 1,627,200.00	R 6,766,829.00	415.9%	▪ Base on values received from Universal Coals. It is assumed that water monitoring will be done for 5 years.

AREA AND DESCRIPTION	UNSCHEDULED CLOSURE (2020)	PREVIOUS ASSESSMENT (2019)	DIFFERENCE 2019-2020		REASON FOR CHANGE
Monitoring Costs (Vegetation)	R 270,537.00	R 159,024.00	R 111,514.00	70.1%	▪ Due to changes above
Maintenance Costs (Vegetation)	R 10,701,290.00	R 9,981,962.00	R 719,328.00	7.2%	▪ Due to changes above
Sub-Total	**R 19,365,856.00**	**R 11,768,185.00**	**R 7,597,670.00**		
Water Treatment Costs					
Water Treatment (30 years)	R 162,000,000.00	R 151,446,161.00	R 10,553,839.00	7.0%	▪ Values based on operational cost recalculated for 30 years. ▪ The water treatment costs include Glisa, Paardeplaats and Eerstelingsfontein.
Sub-Total	**R 162,000,000.00**	**R 151,446,161.00**	**R 10,553,839.00**		▪
Project Management (12%)	R 25,727,781.00	R 12,094,791.00	R 13,632,990.00	112.7%	▪ Preliminary and General Costs were changes to 12%, the proposed amendments to the GN R.1147 that states that P&G's must be market related. The current market related P&G's are 20% or higher. In future updates the 12% will have to be increased.
Contingency (10%)	R 21,439,817.00	R 20,157,985.00	R 1,281,832.00	6.4%	▪ Due to changes above
GRAND TOTAL	**R 442,931,626.00**	**R 397,046,974.00**	**R 45,884,652.00**	**11.6%**	

Table 20.2: Unscheduled Financial Provision Summary – Paardeplaats Section.

AREA AND DESCRIPTION	UNSCHEDULED CLOSURE (2020)	NOTE
Infrastructure and Rehabilitation		
Area 1: General Mining Right Area	R 336,760.00	▪ New Infrastructure on site. Workshop, Silt Trap and Washbay was added in 14/05/2020.
Area 2: Mining Area	R 19,001,587.00	▪ Mining activities starter in 2019 and mining area was revised as per survey data received at 30/04/2020 by the mine.
Area 4: Linear Infrastructure	R 561,804.00	▪ Roads were added
Sub-Total	**R 19,900,151.00**	
Monitoring and Maintenance		
Monitoring Costs (Groundwater and Surface water)	R 51,995.00	▪ Due to changes above
Monitoring Costs (Vegetation)	R 1,863,798.00	▪ Due to changes above
Maintenance Costs (Vegetation)	R 343,708.00	▪ Due to changes above
Sub-Total	**R 2,259,501.00**	
Project Management (12%)	R 2.388.018.00	▪ Due to changes above
Contingency (10%)	R 1.990.015.00	▪ Due to changes above
GRAND TOTAL	**R 26,537,686.00**	

21 DEVIATIONS FROM THE APPROVED SCOPING REPORT AND PLAN OF STUDY

21.1 Deviations from Impact Assessment Methodology

No deviations were made.

21.2 Motivation for the Deviation

Not applicable as no deviations were made.

22 OTHER INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

22.1 Compliance with the provisions of sections 24(4)(a) and (b) read with section 24 (3) (a) and (7) of the National Environmental Management Act (Act 107 of 1998) the EIA report must include the:-

22.1.1 Impact on the Socio-Economic Conditions of Any Directly Affected Person

A summary of the impacts on the socio-economic conditions of any directly affected person is presented in **Table 22.1**.

Table 22.1: Socio-Economic Impact Summary.

IMPACT	SIGNIFICANCE BEFORE MITIGATION	SIGNIFICANCE AFTER MITIGATION
The potential for social unrest and conflict between local residents and newcomers to the area due to income discrepancies and opportunities provided by the mine.	Low	Low
Expectations about the role of the mine in the provision of services to the community and the benefits to the community from the mine over the short and long term.	Medium	Low
Transportation activities have a negative impact on shared road infrastructure.	Medium	Low

IMPACT	SIGNIFICANCE BEFORE MITIGATION	SIGNIFICANCE AFTER MITIGATION
Cracks in houses surrounding the mine due to the blasting operations of the mine.	Medium	Low
Impact of dust fallout on the livelihoods of the agricultural community. Health impacts such as asthma, sinusitis, allergies and other respiratory diseases attributed to dust generated by the operation of the mine.	Low	Low
Increase of HIV/AIDS due to labour influx.	Medium	Low
Impact of the reduction in the quantity of water available for use and water quality deterioration, especially from acid mine drainage.	Medium	Low
Impact on existing settlements within the mining right area and mining footprint.	Low	Low
Impact on graves, burial grounds and heritage features.	Medium	Low
Non-adherence to the Social and Labour Plan.	Medium	Low

22.1.2 Impact on Any National Estate Referred to in Section 3(2) of the National Heritage Resources Act

A summary of the impacts on any national estate is presented in **Table 22.2**.

Table 22.2: National Estate Impact Summary.

IMPACT	SIGNIFICANCE BEFORE MITIGATION	SIGNIFICANCE AFTER MITIGATION
Impact on heritage sites due to DMF construction.	Low	Low
No impact is expected on low significant sites (PP 1, PP 7, PP 8, PP 9, PP 18, PP 19, PP 20, PP 23, PP 24, PP 34, PP 35, PP 38, PP 39, PP 41, PP 42, PP 43, PP 44 & PP 45).	Low	Low
Impact on Graves and Burial Grounds (PP 2, PP 3, PP 4, PP 5, PP 10, PP 16, PP 28, PP 31 and PP 37).	Low	Low
Impact on historic homesteads and structures with the possible risk for unmarked graves (PP 6, PP 11, PP 15, PP 16, PP 21, PP 22, PP 25, PP 26, PP 29, PP 32 and PP 40).	Medium	Low
Impact on historic farmsteads and historical structures (PP 27 and PP 30).	Low	Low
Possible rock art site (PP 4).	Low	Low

IMPACT	SIGNIFICANCE BEFORE MITIGATION	SIGNIFICANCE AFTER MITIGATION
Historic coal mine shafts and associated structures (PP 12, PP 13, PP 17, PP 33 and PP 36).	Low	Low
Chance finds of a potential grave during construction.	Low	Low
Accidental discovery of graves during construction.	Low	Low
Impact on paleontological (fossil) finds.	Medium	Low

23 OTHER MATTERS REQUIRED IN TERMS OF SECTIONS 24(4)(A) AND (B) OF THE ACT

No other matters required in terms of Sections 24(4)(a) and (b) apply.

24 UNDERTAKING

The EAP herewith confirms-

a) the correctness of the information provided in the reports ☑

b) the inclusion of comments and inputs from stakeholders and I&APs ☑

c) the inclusion of inputs and recommendations from the specialist reports where relevant; and ☑

d) the acceptability of the project in relation to the finding of the assessment and level of mitigation proposed. ☑

25 REFERENCES

25.1 Air Quality

BROOKS, K., SVANAS, N., and GLASSER, D. 1988. Evaluating the risk of spontaneous combustion in coal stockpiles. Fuel, Vol. 67, no. 5.

Chavalala, B. (2016), An assessment of South Africa's coal mining sector response to climate change adaptation demands, http://uir.unisa.ac.za/handle/10500/22834.

Cowherd C., Muleski G.E. and Kinsey J.S. (1988). Control of Open Fugitive Dust Sources, EPA-450/3-88-008, US Environmental Protection Agency, Research Triangle Park, North Carolina.

DME Western Australia (1999). Guidelines on the Safe Design and Operating Standards for Tailings Storage, Department of Minerals and Energy of Western Australia, May 1999.

DME Western Australia (1998). Guidelines on the Development of an Operating Manual for Tailings Storage, Department of Minerals and Energy of Western Australia, October 1998.

Dominici, F., Peng, R.D., Bell, M.L., Pham, L., McDermott, A., Zeger, S.L. and Samet, J.M. (2006). Fine particulate air pollution and hospital admission for cardiovascular and respiratory diseases. Journal of the American Medical Association, 295(10):1127–1134. [Online] Available at: http:/ / 0-jama.ama assn.org.innopac.up.ac.za/content/ 295/ 10/ 1127.full.pdf+html (accessed on 24 August 2011).

EPA (1987). PM10 SIP Development Guideline, EPA-450/2-86-001, US Environmental Protection Agency, Research Triangle Park, North Carolina.

Epstein, P.R., Buonocore, J.J., Eckerle, K., Hendryx, M., Stout III, B.M., Heinberg, R., Clapp, R.W., May, B., Reinhart, N.L., Ahern, M.M., Doshi, S.K. and Glustrom, L. (2011). Full cost accounting for the life cycle of coal. Annals of the New York Academy of Sciences, 1219(February):73–98. [Online] Available at: http:/ / 0- onlinelibrary.wiley.com.innopac.up.ac.za/doi/ 10.1111/ j.1749-6632.2010.05890.x/pdf (accessed on12 July 2011).

Fenger, J., 2002: Urban air quality, In J. Austin, P. Brimblecombe and W. Sturges (eds), Air pollution science for the 21st century, Elsevier, Oxford.

Harrison, R.M. and R.E. van Grieken, 1998: Atmospheric Aerosols. John Wiley: Great Britain.

Jewell R J and Newson T A (1997). Decommissioning of Gold Tailings Storage Facilities in Western Australia, in Bouazza A, Kodikara J and Parker R (Eds), Balkema, Environmental Geotechnics, Rotterdam.

Kaonga, B. And Kgabi, Nnensi. 2009: Atmospheric Particulate Matter in the Marikana Mining Area of Rustenburg, South Africa, European Journal of Scientific Research, 34, 271-279.

Kemp, David D. 1998. The environment dictionary. Routledge. London.

Kharecha P.A.; Hansen J.E. (2008). *"Implications of "peak oil" for atmospheric CO2 and climate". Global Biogeochem. Cycles.*

Manahan, S.E., 1991: Environmental Chemistry, Lewis Publishers Inc., United States of America.

Maeda, Y., Morioka, J., Tsujino, Y., Satoh, Y., Zhang, X., Mizoguchi, T. and Hatakeyama, S. 2001. Material Damage Caused by Acidic Air Pollution in East Asia. Water, Air & Soil Poll. 130(1-4), 141-150.

Newman, J.R. 1979. Effects of industrial air pollution on wildlife. Biol. Conserv., 15(3), 181-190.

Pope III, C.A., Ezzati, M. and Dockery, D.W. (2009). Fine-particulate air pollution and life expectancy in the United States. The New England Journal of Medicine, 360:376–86. [Online] Available at: http:/ / 0-www.nejm.org.innopac.up.ac.za/doi/pdf/ 10.1056/

Ritcey G M (1989). Tailings Management. Problems and Solutions in the Mining Industry, Eslevier, Amsterdam.

South African National Standards (SANS), 2011. South African National Standard, Ambient Air Quality – Limits for Common Pollutants. SANS 1929:2011. Standards South Africa, Pretoria.

Tyson, P.D. and R.A. Preston-Whyte, 2000. The Weather and Climate of Southern Africa. Oxford University Press, Cape Town.

Foster, Vivien, Bedrosyan, Daron, World Bank, 2014. Understanding CO2 emissions from the global energy sector.

Unearthing the Carbon Footprint, Australian Mining, March 2009.

U.S Environmental Protection Agency, (1996). Compilation of Air Pollution Emission Factors (AP-42), 6th Edition, Volume 1, as contained in the Air CHIEF (AIR Clearinghouse for Inventories and Emission Factors) CD-ROM (compact disk read only memory), US Environmental Protection Agency, Research Triangle Park, North Carolina. Also available at URL: http://www.epa.gov/ttn/chief/ap42/.

Van Horen, C. (1996). Counting the social costs: Electricity and externalities in South Africa. Cape Town: University of Cape Town Press and Elan Press.

World Health Organization. 2000, WHO Air Quality Guidelines for Europe, 2nd edition, WHO Regional Office for Europe, Copenhagen, Denmark (WHO Regional Publications, European Series, No 91).

World Health Organization (WHO), 2002, The World Health Report, Annex Table 9, 2002, http://www.who.int/whr/2002/en/whr2002_annex9_10.pdf.

Zunckel, M, Naicker, Y., Raghunandan, A., Fischer, T., Crouse, H., Ebrahim, A and Carter, W., 2011. The Highveld Priority Area Air Quality Management Plan, Department of Environmental Affairs, Pretoria.

25.2 Soils

ARC-ISCW, 2004. Overview of the status of the agricultural natural resources of South Africa (First Edition). ARC-Institute for Soil, Climate and Water, Pretoria.

Chamber of Mines/Coaltech, 2007. Guidelines for the rehabilitation of mined land. Coaltech Research Association, Johannesburg.

GCS, 2011. Paardeplaats sensitive receptor study. Project Number GCS 11-087. Groundwater Consulting Services, Rivonia, Johannesburg.

Geological Survey, 1986. 1:250 000 scale Geological Map of 2528 Pretoria. Department of Mineral and Energy Affairs, Pretoria.

Koch, F.G.L., 1987. Climate data. In: Land types of the maps 2526 Rustenburg and 2528 Pretoria. *Mem. Agric. nat. Res .S. Afr*. No.8. Department of Agriculture, Pretoria.

Non – Affiliated Soil Analysis Work Committee, 1990. Handbook of standard soil testing methods for advisory purposes. Soil Science Society of South Africa, Pretoria.

Soil Classification Working Group, 1991. Soil classification. A taxonomic system for South Africa. Institute for Soil, Climate & Water, Pretoria.

25.3 Terrestrial Biodiversity

Alexander, G. &. (2007). *A guide to the reptiles of Southern Africa .* Cape Town: Struik.

Barnes, K. N. (1998). *Important Bird Areas of South Africa. Pp. 25-280 in Barnes, K.N. (ed.) The Important Bird Areas of southern Africa.* Johannesburg: BirdLife South Africa.

Birdlife International. (2020, November 08). Retrieved from DataZone Birdlife International: http://datazone.birdlife.org/site/factsheet/steenkampsberg-iba-south-africa

BirdLife International. (2021, March 14). *Species factsheet: Balearica regulorum*. Retrieved from Birdlife: http://datazone.birdlife.org/species/factsheet/grey-crowned-crane-balearica-regulorum

Bromilow, C. (2010). *Problem Plants and Alien Weeds of South Africa.* Pretoria: Briza.

Dayaram, A. P. (2017). Vegetation Map of South Africa, Lesotho and Swaziland 2009 and 2012: A description of changes from 2006. *Bothalia (47)1*, 1-10.

Du Preez, L. H., & Carruthers, V. C. (2009). *A complete guide to the frogs of Southern Africa.* Cape Town.: Penguin Random House.

EkoInfo CC. (2012). *EIA Level Report: Ecological Assessment of the Proposed Paardeplaats Mining Area, Belfast, Mpumalanga.* Pretoria: EkoInfo CC & Associates.
Environmental Impact Management Services. (2014). *Final Integrated Management Programme Report for the Proposed Paardeplaats Coal Mine.* Randburg: EIMS (Pty) Ltd.

Fitzsimons, J. A. (2017). Rocky outcrops: A hard road in the conservation of critical habitats. *Biological Conservation* , 211:36-44.

Gerlanc, N. M. (2005). Habitat origin and changes in water chemistry influence developemnt of Westren Chorus Frogs. *Journal of Herpatology 39(2)*, 254-265.

Graham, A. (2013). *A guide to the reptiles of southern Africa.* Penguin Random House. South Africa.

Henning, G. A. (2009). South African Red Data Book: butterflies. *SANBI Biodiversity Series 13*.

Lötter, M. C. (2015). *Technical Reort for the Mpumalanga Biodiversity Sector Plan - MBSP.* Nelspruit: Mpumalanga Tourism & Parks Agency.

Minter, L. R. (2004). *Atlas and red data book of the frogs of South Africa, Lesotho, and Swaziland.* Cape Town: Avian Demography Unit, University of Cape Town.

Mucina, L., & Rutherford, M. C. (2012). *The Vegetation of South Africa, Lesotho and Swaziland.* Pretoria: South African National Biodiversity Institute.

NSS. (2011). *Biodiversity Baseline Assessment-Eerstelingfontein Mine.* Johannesburg: Natural Scientific Services.

25.4 Freshwater Ecosystems

Council for Geoscience (2005). Available at: geoscience.org.za/cgs/.

Darwall, W. R. T. *et al.* (2009) *The status and distribution of freshwater biodiversity in southern Africa*. Gland, Switzerland: IUCN and Grahamstown, South Africa: SAIAB.

Department of Water and Sanitation (2016a) *Classes and Resource Quality Objectives of Water Resources for the Olifants River catchment*. Pretoria, South Africa: Government Gazette No. 39943.
Department of Water and Sanitation (2016b) *Development of an Integrated Water Quality Management Plan for the Olifants River System: Water Quality Planning Limits Report.*

Study Report No. 3. Report No: P WMA 04/B50/00/8916/4. Pretoria, South Africa: Department of Water and Sanitation. doi: 10.1007/JHEP08(2014)165.

Hill, D. and Arnold, R. (2012) ‘Building the evidence base for ecological impact assessment and mitigation’, *Journal of Applied Ecology*, 49(1), pp. 6–9. doi: 10.1111/j.1365-2664.2011.02095.x.

Kemper, N. (1999) ‘Intermediate Habitat Integrity Assessment’, in *Resource Directed Measures for Protection of Water Resources, Volume 3: River Ecosystems, Version 1.0*. Pretoria, South Africa: Department of Water Affairs and Forestry.

Kleynhans, C. J. (1996) 'A qualitative procedure for the assessment of the habitat integrity status of the Luvuvhu River (Limpopo system, South Africa)', *Journal of Aquatic Ecosystem Health*. doi: 10.1007/BF00691728.

Kleynhans, C. J. *et al.* (2007) *A Level II River Ecoregion classification System for South Africa, Lesotho and Swaziland*. Report No. N/0000/00/REQ0104. Pretoria, South Africa: Department of Water Affairs and Forestry - Resource Quality Services.

Kleynhans, C. J., Louw, M. D. and Graham, M. (2008) *River Ecoclassification: Manual for Ecostatus Determination (Version 2). Module G: Index of Habitat Integrity. Section 1: Technical Manual.* WRC Report No. TT 377/08. Pretoria, South Africa: Water Research Commission.

Macfarlane, D. M. *et al.* (2008) *WET-Health: A technique for rapidly assessing wetland health*. WRC Report No. TT340/09. Water Research Commission.

Mbona, N., Job, N., Smith, J., Nel, J., Holness, S., Memani, S., and Dini, J. (2015) *Supporting better decision making around coal mining in the Mpumalanga Highveld through the development of mapping tools and refinement of spatial data on wetlands.* Pretoria.

McMillan, P. H. (1998) *An Integrated Habitat Assessment System (IHAS v2) for the Rapid Biological Assessment of Rivers and Streams*. CSIR Research Report No. ENV-P-I 98132. Pretoria, South Africa, South Africa: Water Resources Management Programme, Council for Scientific and Industrial Research.

Mucina, L. and Rutherford, M. C. (2012) *The vegetation of South Africa, Lesotho and Swaziland.Strelitzia 19.*, *Strelitzia*.

Nel, J. L. *et al.* (2004) *South African National Spatial Biodiversity Assessment 2004: Technical Report. Volume 2: River Component*. Stellenbosch: CSIR Report Number ENV-S-I-2004-063. Council for Scientific and Industrial Research.

Nel, J. L. *et al.* (2011) *Atlas of Freshwater Ecosystem Priority Areas in South Africa: Maps to support sustainable development of water resources.* WRC Report No. TT 500/11. Pretoria, South Africa: Water Research Commission.

Ollis, D. J. *et al.* (2006) 'Preliminary testing of the Integrated Habitat Assessment System (IHAS) for aquatic macroinvertebrates.', *African Journal of Aquatic Science*, 31(1), pp. 1–14.

Perlman, D. L. and Milder, J. C. (2004) *Practical Ecology for Planners, Developers, and Citizens*. Island Press. doi: 10.1111/j.1467-9787.2007.00539_5.x.

Scott, L. (2013) *Freshwater Ecoregions of the World: Southern Temperate Highveld*.

Thirion, C. (2008) *River Ecoclassification: Manual for Ecostatus Determination (Version 2).*

Module E: Volume 1 – Macroinvertebrate Response Assessment Index (MIRAI). WRC Report No. TT 332/08. Pretoria, South Africa: Water Research Commission.

van der Waals, J. (2016) *Wetland Assessment, Conservation, Management and Rehabilitation in Mining Environments on the Mpumalanga Highveld*.

Wofford, J. E. B., Gresswell, R. E. and Banks, M. A. (2005) 'Influence of barriers to movement on within-watershed genetic variation of coastal cutthroat trout', *Ecological Applications*, 15(2), pp. 628–637. doi: 10.1890/04-0095.

25.5 Surface Water

No references

25.6 Groundwater

Anderson, MP and Woessner, WW, 2002. Applied Groundwater Modeling, Simulation of flow and advective transport. Academic Press. New York.

Aqua Earth Consulting (2012). Paardeplaats Colliery EIA/EMPR Specialist Study. Geohydrology (DRAFT Final)

ASTM D5718-13, Standard Guide for Documenting a Groundwater Flow Model Application, ASTM International, West Conshohocken, PA, 2013,

Barnett, et al., 2012. Australian groundwater modelling guidelines, Waterlines report, National Water Commission, Canberra.

Council for Geoscience (1978). 1:250 000 Geological Map Series 2528 Pretoria

Council for Geoscience (1986). 1:250 000 Geological Map Series 2530 Barberton

Department of Water and Sanitation (DWS) (2012). Aquifer Classification Map of South Africa.

Department of Water and Sanitation (DWS) (2013). Aquifer Vulnerability Map of South Africa.

Department of Water and Sanitation (DWS) (2013). Groundwater Resource Directed Measures (GRDM). Version 2.3.2.

Doherty, J. and Hunt, R., 2010. Approaches to Highly Parameterized Inversion: A Guide to Using PEST for Groundwater-Model Calibration, U.S. Department of the Interior, U.S. Geological Survey, Scientific Investigations Report 2010–5169

Du Toit W.H., Du Toit A.J.I. and Jonck F. (1999). 1:500 000 Hydrogeological Map Series 2530 Nelspruit

FAO (2012). *ETo Calculator, Land and Water Digital Media Series no 36*, FAO, Rome, Italy.

GCS (2011). NBC Glisa Consolidated EMPR Groundwater Investigation (GCS Reference: 10-298).

GCS (2017). Hydrogeological Study - For inclusion in the Basic Assessment, Closure Environmental Management Plan, Final Land-Use Plan and Closure Costs Update for the Exxaro North Block Complex (GCS Reference: 16-0872).

GCS. (2002). Glisa Colliery Decant Evaluation. Groundwater Consulting Services, Johannesburg.

Golder Associates Africa (Pty) Ltd (2019). Glisa Mine Water Monitoring Results for April 2019

Harbaugh, A.W., Banta E.R., Hill M.C. and McDonald M.G., 2000. MODFLOW-2000, The U.S. Geological Survey modular ground-water model—user guide to modularisation concepts and the ground-water flow process. Open-File Report 00-92. U.S. GEOLOGICAL SURVEY. Reston, Virginia.

Hodgson, F. D. I. and Kranz, R. (1998). Investigation into groundwater quality deterioration in the Olifants River catchment above Loskop Dam with specialized investigations in the Witbank Dam Sub-Catchment.

Kresic, N, 2007, Hydrogeology and groundwater modelling; 2nd edition, CRC Press, Taylor & Francis Group, LLC, Florida.

Niswonger, RG, Panday, S and Ibaraki, M, 2011. MODFLOW-NWT, A Newton Formulation for MODFLOW-2005: USGS Techniques and Methods, Book 6. Virginia: USGS.

Parsons, R. and Conrad, J. 1998. Explanatory notes of the aquifer classification map of South Africa. Water Research Commission: Department of Water Affairs and Forestry. WRC Report No. KV 116/98. ISBN 1 8845 4568.

Parsons, R. and Wentzel, J. (2007). Groundwater Resource Directed Measures Manual. Department of Water Affairs and Forestry, Pretoria, 109pp

Rowe, R.K., 2012, Short- and long-term leakage through composite liners. The 7th Arthur Casagrande Lecture

South African Bureau of Standards (SABS) (2015). South African National Standard: Drinking Water Part 1: Microbiological, physical, aesthetic and chemical determinants: SANS 241-1:2015 2nd Ed. ISBN 978-0-626-29841-8

25.7 Heritage

BERGH, J.S. (ed.). 1999: Geskiedenis Atlas van Suid-Afrika: Die Vier Noordelike Provinsies. J.L. van Schaik. Pretoria.

CHAMBERLAIN, M. 2004. The action at Brakpan (Boer War, 1899-1902). Sabretache, v.45, no.3, 2004 Sept, p.41(6).

COLLETT, D.P. 1982. Excavations of Stone-Walled Ruin Types in the Badfontein Valley, Eastern Transvaal, South Africa. The South African Archaeological Bulletin Vol. 37, No. 135 (Jun., 1982), pp. 34-43 Published by: South African Archaeological Society. Article Stable URL: http://www.jstor.org/stable/3888578

DELIUS, P AND HAY, M. 2009. Mpumalanga: An Illustrated History. The Highveld Press

DELIUS, P. 2007. Mpumalanga: History and Heritage. University of Kwa-Zulu Natal Press.

ESTERHUYSEN, A and SMITH, J. 2007. Stories in Stone. Chapter 2 in Mpumalanga: History and Heritage.

EVERS, T.M. 1975. Recent Iron Age Research In The Eastern Transvaal, South Africa. In The South African Archaeological Bulletin, Vol. 30, No. 119/120 (Dec., 1975), pp. 71-83.

South African Archaeological Society Stable URL: http://www.jstor.org/stable/3888096 Accessed: 03/05/2012 08:54

HELME, N. 1974: Thomas Major Cullinan. Johannesburg, McGraw-Hill Book Company.
JOOSTE, C. P. ANGLO-BOER WAR BATTLES. The Battle of Bergendal. Military History Journal - Vol 12 No 4
JOOSTE, C.P. 2001. The Battle of Bergendal: the last organized battle of the Anglo-Boer War. (The forgotten battle of the Anglo-Boer War). Vista University, Distance Education Campus, Pretoria RSA

JOOSTE, C.P. 2002. Anglo-Boer War Battles: The Battle Of Bergendal - The Last Pitched Battle Of The Anglo-Boer War. Military History Journal Vol 12 No 4 – December

JOOSTE, C.P. 2008. Machadodorp tot en met dorpstigting in 1904 (Afrikaans), MA dissertation, University of Pretoria, Pretoria, viewed 120501 http://upetd.up.ac.za/thesis/available/etd-11132008-124230

MAGGS, TIM. 1995. Neglected Rock Art: The Rock Engravings of Agriculturist Communities in South Africa Reviewed work(s): Source: The South African Archaeological Bulletin, Vol. 50, No. 162 (Dec.), pp. 132-142 Published by: South African Archaeological Society Stable URL: http://www.jstor.org/stable/3889062. Accessed: 01/05/2012 01:40

MASON, R.J. 1968. Transvaal and Natal Iron Age settlement revealed by aerial photography and excavation. African Studies 27: 167-179.

MORRIS, DAVID. 2008. Archaeological and Heritage Impact Assessment on Remainder of Carter Block 458, near Lime Acres, Northern Cape. McGregor Museum.

O'NEIL, O.R. 1921: Adventures in Swaziland: the Story of a South African Boer. CenturyCompany, New York.

PAKENHAM, T. 1979. The Boer War, published by Weidenfeld and Nicolson.

VAN DER MERWE, A.P. 1952: 'n Kort Geskiedenis van Belfast en Distrik.

Unpublished Sources

ANGEL, J. 2017. Heritage Impact Assessment Umsimbithi eMakhazeni Mining Project.

BUTLER, E. 2021. Palaeontological Desktop Assessment For The Proposed Glisa Emp And Iwul Consolidated Project Near Emakhazeni (Belfast), In Mpumalanga.

CILLIERS, J.P. 2010. Phase 1 Archaeological Impact Assessment for Enpact Environmental Consultants concerning the proposed Elandshoek township development on portions 2 and 6 of the farm Lindenau 303 JT and portion 2 of Berlin 466 JT, Mpumalanga Province. Kudzala Antiquity.

COETZEE, F. 2008. Cultural Heritage Survey of the Proposed Eco-tourism Development on the farm Paardeplaats 512 JT, near Dullstroom, Emakhazeni Municipality, Mpumalanga.

FOURIE, WOUTER. 2008a. Archaeological Impact Assessment: Northern Coal Portion 15 and 16 of the farm Weltevreden 381 JT, Belfast, Mpumalanga. PGS.

FOURIE, WOUTER. 2008b. Archaeological Impact Assessments within South African Legislation. South African Archaeological Bulletin 63 (187): 77–85, 2008

FOURIE, W. 2009. Arnot Colliery Mine Project of Exxaro On Portions 4 and 5 of the farm Mooifontein 448 JS and Portions 3 And 4 of the farm Tweefontein 458 JS , District Middelburg, Mpumalanga.

FOURIE, W. 2016. Heritage Assessment - The Kwagga North Project, Optimum Coal, Arnot, Mpumalanga.

HIGGIT, N. 2014. Heritage Impact Assessment for the Weltevreden Open Cast Coal Mine, Weltevreden 381JT, Belfast, Mpumalanga Province.

KITTO, J. & FOURIE, W. 2012. Heritage Impact Assessment Report Exxaro Paardeplaats Project.

KUSEL, U. 2005. Cultural Heritage Resources Impact Assessment on the Farm De Suikerboschkop 361 JS Belfast.

PESLSER, A. 2012. A Report On A Heritage Assessment For The Proposed Arnot-Gumeni 400 Kv Powerline Project, In The Middelburg/Belfast Area, Mpumalanga Province.

PISTORIUS, J. C. C. 2013. A Revised Phase I Heritage Impact Assessment study for the proposed Wonderfontein Colliery near Belfast in the Mpumalanga Province of South Africa.

PISTORIUS, J. C. C. 2014. A Phase I Heritage Impact Assessment (HIA) study for the Consolidated Environmental Management Programme Report (consolidated EMPR) for Arnot Coal on the Eastern Highveld in the Mpumalanga Province.

PISTORIUS, J. C. C. 2014. A Revised Phase I Heritage Impact Assessment (HIA) study for the Proposed Rietvlei Open Cast Coal Mining Operation between Middelburg, Belfast and Stofberg in the Mpumalanga Province of South Africa.

VAN SCHALKWYK, J 2007. Heritage Impact Scoping Report for the Planned Hendrina-Marathon Power line, Mpumalanga Province.

25.8 Traffic

No References

25.9 Blast and Vibration

Siskind, D.E., V.J. Stachura, M.S. Stagg and J.W. Kopp, 1980a. Structure Response and Damage Produced by Air blast From Surface Mining. US Bureau of Mines RI 8485.

Persson, P. A., R. Holmberg and J. Lee, 1994, Rock Blasting and Explosives Engineering, Boca Raton, Florida: CRC Press.

Scott, A., Open Pit Blast Design, 1996, Julius Kruttschnitt Mineral Research Centre, The University of Queensland.

Client Report: Air Overpressure from Le Maitre Flash Report: Dr R. Farnfield, Technical Services Manager, Dated: 27 April 2007.

Chiapetta, F., A Van Vreden, 2000. Vibration/Air blast Controls, Damage Criteria, Record Keeping and Dealing with Complaints. 9th Annual BME Conference on Explosives, Drilling and Blasting Technology, CSIR Conference Centre, Pretoria, 2000.

Dowding, C.H., Construction Vibrations, 1996, Prentice Hall, Upper Saddle River, NJ 07458.

Mechanical vibration and shock – Vibration of buildings – Guidelines for the measurement and evaluation of their effects on buildings, SABS ISO 4886:1990.

Philip, R., Berger & Associates, Inc. Bradfordwoods, Pennsylvania, 15015, Nov 1980, Survey of Blasting Effects on Ground Water Supplies in Appalachia., Prepared for United States Department of Interior Bureau of Mines.

Hawkins, J., 9 May 2000, Impacts of Blasting on Domestic Water Wells, Workshop on Mountaintop Mining Effects on Groundwater.

James H. Rowland III, Richard Mainiero, and Donald A. Hurd Jr., Factors Affecting Fumes Production of an Emulsion and Anfo/Emulsion Blends.

Michael, Sapko., James Rowland, Richard Mainiero, Isaac Zlochower, Chemical and Physical Factors that Influence no Production during Blasting – Exploratory Study.

Alan B. Richards and Adrian J. Moore, Terrock Consulting Engineers Pty Ltd., 2002, Fly rock Control – By Chance or Design, Paper Presented at ISEE Conference – New Orleans.

BME Training Module – Vibration, air blast and fly rock, Module V, Dated 5 August 2001.

Larkin Ronald P., January 1996, Effects of Military noise on wildlife: a literature review, Centre for Wildlife and Plat Ecology, Illinois Natural History Survey, USA 61820.

Donald R. Richmond, Edward G. Damon, E. Royce Fletcher, I. Gerald Bowen and Clayton S. White, The Relationship between selected blast-wave parameters and the response of mammals exposed to air blast, November 1966.

25.10 Noise

BRITISH STANDARD BS 5228: 1997. *Noise and Vibration Control on Construction and Open Sites*.

CROCKER, MJ (ed.) (2007). *Handbook of Noise and Vibration Control*. John Wiley & Sons: Hoboken, NJ.

dBACOUSTICS cc. (2010): *Environmental Noise Impact Assessment for the Exxaro Glisa Colliery on the Farm Paardeplaats 380 JT, Belfast*. Project 196/2010.

NELSON, P (ed.) (1987). *Transportation Noise Reference Book*. Butterworths: London

SOUTH AFRICAN NATIONAL STANDARD SANS 10103:2008, *The Measurement and Rating of Environmental Noise with Respect to Annoyance and to Speech Communication*.

SOUTH AFRICAN NATIONAL STANDARD SANS 10210:2004, *Calculating and Predicting Road Traffic Noise*.

SOUTH AFRICAN NATIONAL STANDARD SANS 10328:2008, *Methods for Environmental Noise Impact Assessments*.

SOUTH AFRICAN NATIONAL STANDARD SANS 10357:2004, *The Calculation of Sound Propagation by the Concawe Method*.

SOUTH AFRICAN NATIONAL STANDARD SANS ISO 8297:1994, *Acoustics - Determination of sound power levels of multisource industrial plants for evaluation of sound pressure levels in the environment - Engineering method.*

SOUTH AFRICA. (1992). Noise control regulations in terms of Section 25 of the Environment Conservation Act, 1989 (Act 73 of 1989). (R154, 1992) Government Gazette 13717:14-22, January 10 (Regulation Gazette No. 4807).

SOUTH AFRICA. (1993). *Occupational Health and Safety Act* (Act 85 of 1993).

UK DEPARTMENT OF TRANSPORT. (1995). *Calculation of Railway Noise*, HMSO, London.

UK DEPARTMENT OF TRANSPORT (1995). *Calculation of Railway Noise (Supplement No. 1),* HMSO, London.

US DEPARTMENT OF TRANSPORTATION FEDERAL RAILROAD ADMINISTRATION. (1998). *High-speed Ground Transportation Noise and Vibration Impact Assessment.*
WORLD HEALTH ORGANIZATION (WHO) (1999). *Guidelines for Community Noise*. Birgitta Berglund, Thomas Lindvall & Dietrich H Schwela (Eds.)

25.11 Visual

Crawford, D., 1994. Using remotely sensed data in landscape visual quality assessment. Landscape and Urban Planning. 30: 71-81.

Hull, R.B. & Bishop, I.E., 1988. Scenic Impacts of Electricity Transmission Towers: The Influence of Landscape Type and Observer Distance. Journal of Environmental Management. 27: 99-108.

Institute of Environmental Assessment & The Landscape Institute, 1996. Guidelines for Landscape and Visual Impact Assessment, E & FN Spon, London (117)

Ittelson, W.H., Proshansky, H.M., Rivlin, L.g. and Winkel, G.H., 1974. An Introduction to Environmental Psychology. Holt, Rinehart and Winston, New York.

Lange, E., 1994. Integration of computerized visual simulation and visual assessment in environmental planning. Landscape and Environmental Planning. 30: 99-112.

Lynch, K., 1992. Good City Form, The MIT Press, London. (131)

Mucina, L. & Rutherford, M.C. (eds) 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Oberholzer, B., 2005. Guideline for involving visual & aesthetic specialists in EIA processes:mEdition 1. CSIR Report No ENV-S-C 2005 053 F. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town

Ramsay, J. (October 1993). Identification and assessment of aesthetic values in two Victorian forest regions. More than meets the eye: identifying and assessing aesthetic value. Report of the Aesthetic Value Workshop held at the University of Melbourne.

Schapper, J. (October 1993). The importance of aesthetic value in the assessment of landscape heritage. More than meets the eye: identifying and assessing aesthetic value. Report of the Aesthetic Value Workshop held at the University of Melbourne.

Warnock, S. & Brown, N., 1998. Putting Landscape First. Landscape Design. 268: 44-46.

Department of Rural development and Land Reform, 2011. Guidelines for the Development of Spatial Development Frameworks: Simplified Spatial Development Framework Guidelines. 14 – 15.

Mpumalanga Department of Economic Development, 2009. Mpumalanga Economic Profile: Vol 5. 16.

EIMS Terms of Reference, from Schedule 1 – Services (The Subcontracted Sevices) Scoping Level Report: Ecological Assessment Of The Proposed Paardeplaats Mining Area Commissioned by Groundwater Consulting Services Pty (Ltd) compiled by EkoInfo CC & Associates

25.12 Financial Provision

Digby Wells Environmental (a). (2019). *Glisa Colliery 2019 Financial Provision based on GN R1147 of the NEMA (Act No. 107 of 1998)*

Digby Wells Environmental (a). (2019). *Glisa Colliery Financial Provision Assessment GN R1147: Rehabilitation, Decommissioning and Closure Plan.*

Stats SA: *STATISTICAL RELEASE P0141, Consumer Price Index March 2020.*

Digby Wells Environmental (a). (2019). *Paardeplaats Colliery 2019 Financial Provision based on GN R1147 of the NEMA (Act No. 107 of 1998)*

Digby Wells Environmental (a). (2019). *Paardeplaats Colliery Financial Provision Assessment GN R1147: Rehabilitation, Decommisioning and Closure Plan.*

Appendix A: Qualifications of the EAP

Appendix B: Curriculum Vitae and Professional Registrations of the EAP

Appendix C: A3 Maps and Plans

Appendix D: Stakeholder Engagement Process Report

Appendix E: Specialist Assessments