2 Seam (Pty) Ltd

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT FOR THE PROPOSED VLAKLAAGTE MINE BLOCK OC6

(MP) 30/5/1/2/3/2/1 (405) EM

January 2019

Project No.: A0917

Report No.: JKC_0985

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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;

    (bb) may cause irreplaceable loss of resources, and

    (cc) 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.

PROJECT DETAILS

Name of Project:	Vlaklaagte Block OC6 Project Environmental Impact Report
Mining right:	(MP) 30/5/1/2/3/2/1 (405) EM
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EXECUTIVE SUMMARY

2 Seam (Pty) Ltd is the owner of the mineral rights over the properties Portions 6, 29, 31 and 50 of the Farm Vlaklaagte 45 IS and Portion RE of the Farm Lourens 472 IS. They are already in possession of an approved EMPr and an IWUL for the Vlaklaagte Mine but decided to include mining Block OC6 into the mining plan. This inclusion of the block will require an EIA/EMPr and WUL. This application focuses on the mining of this new block (OC6) and the associated activities.

The coal mined on from this block will form part of the bigger Vlaklaagte Mine and the coal mined will be transported to the existing licensed ROM stockpile located at Block 3 on a Portion of Portion 29 of the Farm Vlaklaagte 45 IS. No Pollution Control Dam (PCD) is planned at the 2 Seam Mine as the existing licenced PCD at Block 3 will be used.

The project will consist of haul roads, clean water cut–off berms and terraced opencast mining using conventional truck and shovel mining techniques. A Life of Mine (LOM) of ± 9 years is expected. The total project application area amounts to 102 ha. Rehabilitation will be conducted concurrently with mining; the method of mining used for this project is described as a roll-over method which is described in more detail later on in the report.

The operation will form part of the Vlaklaagte Mine and very limited additional infrastructure will be developed: -

- Opencast pit not exceeding 67 ha;
- Diesel storage;
- Workshops;
- Access and haul road;
- Clean water cut-off berm;
- Dirty water sumps;
- Overburden stockpiles;
- Topsoil stockpiles; and
- Storm water drainage.

Water for dust suppression will be obtained from mine area and Block 3 PCD and the volume to be used will not exceed the licence volume. Rehabilitation of this pit will form part of the rehabilitation of the all the approved mining areas. Key features that require management include the wetlands and water management regarding clean and dirty water. All these impacts can be controlled and mitigated.

Rehabilitation of the mine area will restore the area to the pre-mining state as close as possible. Some features such as wetlands already experienced negative impacts due to activities in the area prior to the mining application.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

ABA: Acid Base Accounting
AMD: Acid Mine Drainage
ARD: Acid Rock Drainage
BAP: Biodiversity Action Plan
BEE: Black Economic Empowerment
BID: Background Information Document
CEC: Cation Exchange Capacity
DAFF: Department of Agriculture, Forestry and Fisheries
DARDLEA: Department of Agriculture, Rural Development, Land and Environmental Affairs
DLA: Department of Land Affairs
DMR: Department of Mineral Resources
DPW: Department of Public Works
DSR: Draft Scoping Report
DWA: Department of Water Affairs
DWAF: Department of Water Affairs and Forestry
DWEA: Department of Water and Environmental Affairs
DWS: Department of Water and Sanitation
EAP: Environmental Assessment Practitioner
EC: Electrical Conductivity
ECSA: Engineering Council of South Africa
EIA: Environmental Impact Assessment
EIR: Environmental Impact Assessment Report
ELM: Emalahleni Local Municipality
EMC: Ecological Management Class
EMP: Environmental Management Plan
EMPPA: Environmental Management Programme Performance Assessment
EMPr: Environmental Management Programme
EMPR: Environmental Management Programme Report
ETAP: Environmental Training and Awareness Plan
FAII: Fish Assemblage Integrity Index
FEPA: Freshwater Ecosystem Priority Areas
HDSA: Historically Disadvantaged South Africans
HIA: Heritage Impact Assessment
IHAS: Habitat Assessment System
I&APs: Interested and Affected Parties
IDPs: Integrated Development Plans
IRR: Issues and Response Register
IWUL: Integrated Water Use Licence
IWULA: Integrated Water Use Licence Application

IWWMP: Integrated Water and Waste Management Plan
JKC: Jaco-K Consulting cc
JMA: Jasper Muller and Associates
LDV: Light Delivery Vehicle
LED: Local Economic Development Plan
LOM: Life of Mine
LOP: Life of Project
mamsl: metre above mean sea level
MAP: mean annual precipitation
MBCP: Mpumalanga Biodiversity Conservation Plan
mbs: metre below surface
MDEDET: Mpumalanga Department of Economic Development Environment and Tourism
ML: Million litres
MPRDA: Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
Mtpa: Million tonnes per annum
MTPA: Mpumalanga Tourism Parks Agency
NAAQS: Nation Ambient Air Quality Standards
NDCR: National Dust Control Regulation
NDM: Nkangala District Municipality
NEMA: National Environmental Management Act, 1998 (Act No. 108 of 1998)
NEMAQA: National Environmental Management: Air Quality Act, 2004 (Act 39 of 2004)
NEMBA: National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004)
NEMWA: National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)
NFEPA: National Freshwater Ecosystem Priority Areas
NHRA: National Heritage Resources Act, 1999 (Act 25 of 1999)
NSBA: National Spatial Biodiversity Assessment
NWA: National Water Act, 1998 (Act No 36 of 1998)
NWCS: National Wetland Classification System
OHS: Occupational Health & Safety
OREWRA: Olifants River Ecological Water Requirements Assessment
PM: Particulate matter
POC: Probability of occurrence
PES: Present Ecological State
PPP: Public Participation Process
PRECIS: Pretoria Computer Information Systems
RDL: Red Data Listed
RDSIS: Red Data Sensitivity Index Score
REC: Recommended Ecological Category
RHP: River Health Programme
ROM: Run of Mine
RWD: Return water dam

RWQO: Resource Water Quality Objectives
SAHRA: The South African Heritage Resources Agency
SANBI: South African National Biodiversity Institute
SANS: South African National Standard
SAS: Scientific Aquatic Services
SASS: South African Scoring System version 5
SD: Sustainable Development
SMME: Small, Medium and Micro Enterprise
STLM: Steve Tshwete Local Municipality
SO_4: Sulphate
S&EIA: Scoping and Environmental Impact Assessment
S&EIR: Scoping & Environmental Impact Reporting
VCI: Veld Condition Index
VOC: Volatile Organic Compounds
WMA: Water management area
WRC: Water Research Commission
WLA: Waste Licence Application
WL: Waste Licence
WUL: Water Use Licence
WULA: Water Use Licence Application

1. INTRODUCTION AND BACKGROUND

1.1. Background information

2 Seam (Pty) Ltd (2 Seam) is in possession of the mining rights ((**MP) 30/5/1/2/3/2/1 (405) EM**) over portions 6, 29, 31, and 50 of the Farm Vlaklaagte 45 IS and portion RE of the Farm Lourens 472 IS within the Emalahleni local municipality in the Mpumalanga Province. They are already in possession of an approved EMPr and an IWUL (Licence No.: **06/B11B/AICGJ/7070**, File no.: **27/2/2/B211/18/11**) for the Vlaklaagte Mine. There is however an in situ block of 1 and 4 seam coal (OC6) and pillars left of the 2 seam, on parts of RE of the Farm Lourens 472 IS that was not included in the previous environmental authorisation (EA) applications. Refer to **Figure 1** showing the locality of the application area.

This EA application will only focus on impacts and mitigation as a result of the mining of OC6 and associated infrastructure. The rest of the Vlaklaagte Mine mining operation, associated infrastructure and water uses were already covered and approved in the existing EIA/EMPr and IWUL.

Vlaklaagte Mine intends to conduct opencast mining on the above mentioned properties. The additional opencast mining area is approximately 69 ha, but the total mineral rights area for the Vlaklaagte Mine is approximately 712 ha. No coal processing will be conducted on site before being transported off site to the various customers.

2. LOCALITY OF THE PROJECT

2.1. Location

The project is situated in the Mpumalanga province of South Africa (**Figure 2**), which is governed locally by the Emalahleni Local Municipality and regionally by the Nkangala District Municipality. The mining rights area covers Portions 6, 29, 31 and 50 of the Farm Vlaklaagte 45 IS and the Remaining Extent of the Farm Lourens 472 IS.

The area of the Enviromental Impact Assessment and Water Use License Application (WULA) includes the following farms:

- Portion Remaining Extent of the Farm Lourens 472 IS, owned by Dorstfontein Coal Mines (Pty) Ltd.

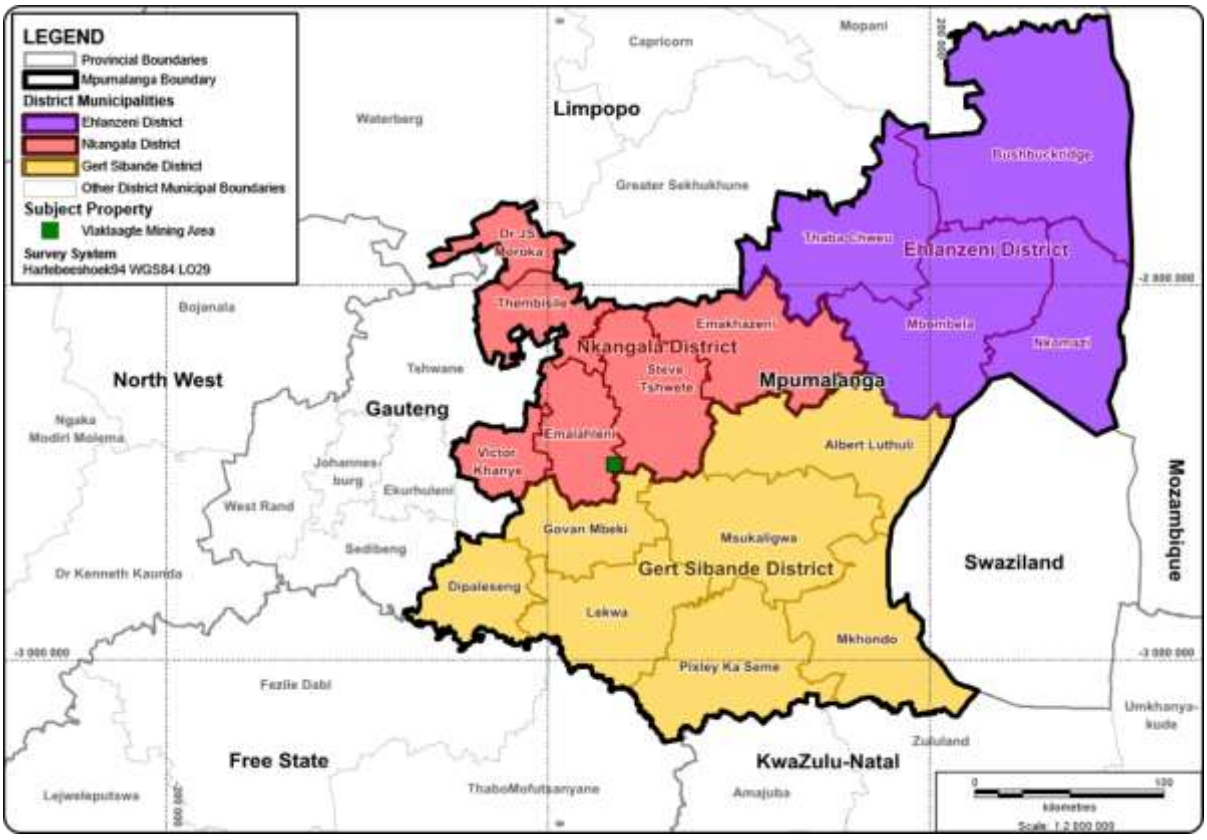


Figure 1: Locality map of the proposed Vlaklaagte Block OC6 project

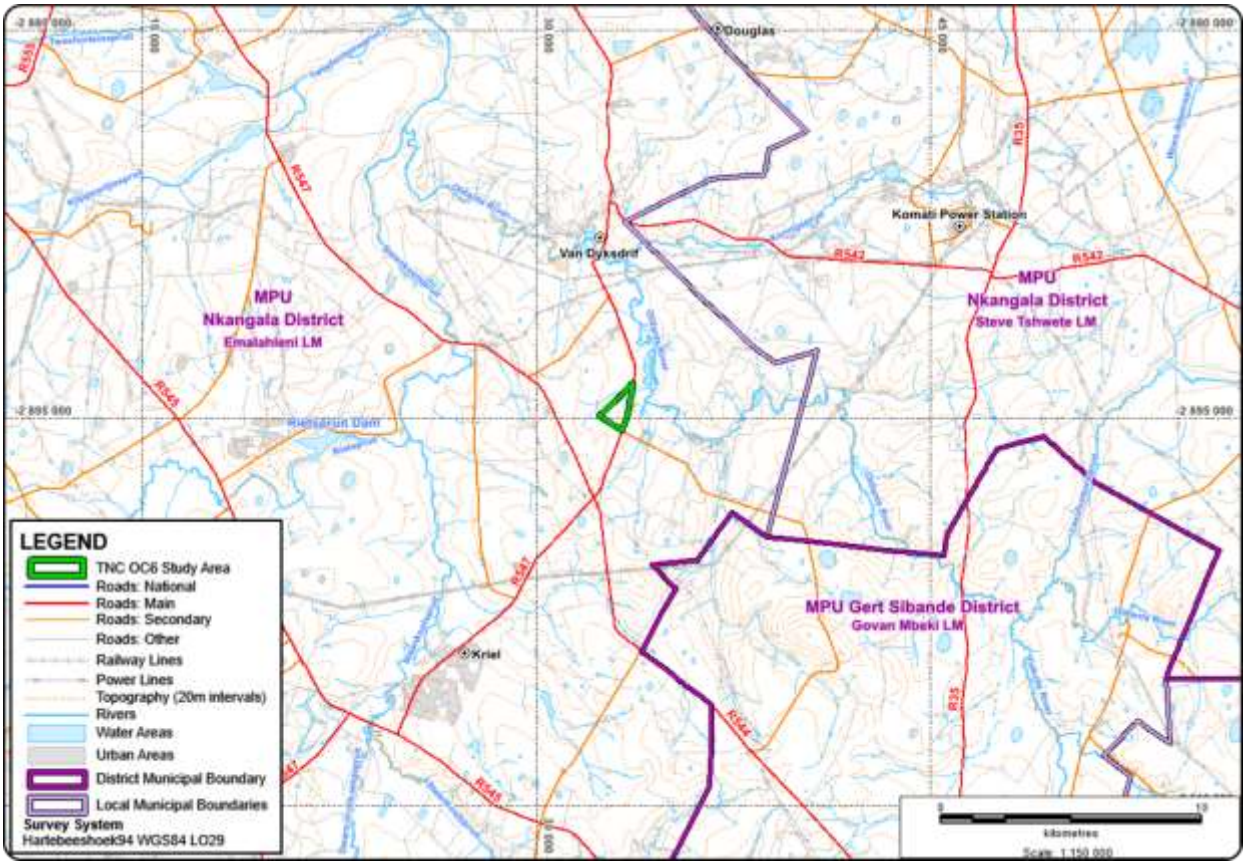


Figure 2: Regional locality map in relation with municipal jurisdictional areas

The closest town to the project is Kriel (approximately 10 km southwest of the 2 Seam Mine) and the R547 provincial road provide access to the town.

2.2. Properties

The list of farm portions applicable to Vlaklaagte Mine Block OC6 Project is listed in **Table 1**, with details of land ownership and the 21-digit Surveyor General code for each cadastral land parcel. The title deeds (Windeed) are attached in **Annexure 3**. **Table 1** indicates the property owners.

Table 1: Project area, farm portions and land owners

Farm Name	Portion	21 Digit Surveyor General Code	Registered Owner
Lourens 472 IS	RE	T0IS00000000047200000	Dorstfontein Coal Mines (Pty) Ltd

The adjacent properties are currently utilised for agricultural and mining activities. Refer to **Table 2** and **Figure 3** for the adjacent farm portions and the land owners.

Table 2: Surface owners of immediately adjacent land

Farm Name	Portion	Registered Owner
Lourens 472 IS	RE	Dorstfontein Coal Mines (Pty) Ltd
Vlaklaagte 45 IS	29	South32 SA Coal Holdings Pty Ltd
Clydesdale 483 IS	RE	Universal Coal Dev VIII Pty Ltd (66.66%) & South32 SA Coal Holdings Pty Ltd (33.33%)
Rietfontein 43 IS	RE	Universal Coal Dev VIII Pty Ltd (66.66%)
Welstand 55 IS	7	Dorstfontein Coal Mines (Pty) Ltd
Welstand 55 IS	14	Dorstfontein Coal Mines (Pty) Ltd
Welstand 55 IS	15	Dorstfontein Coal Mines (Pty) Ltd

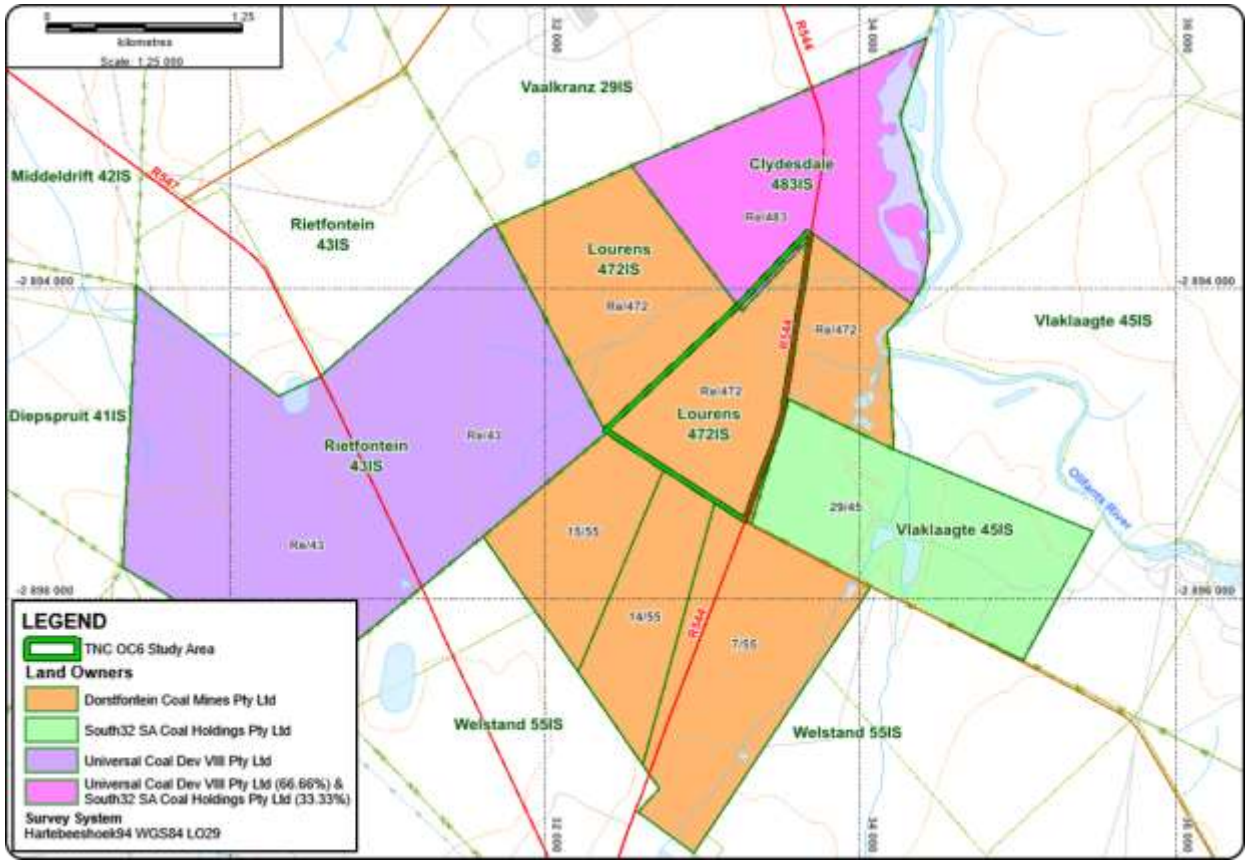


Figure 3: Land owner map of the Block OC6 Project area

As far as is known, no land claims have been made for the properties included in the application. No traditional authority is present in this area and none was identified in close proximity of Vlaklaagte Mine.

2.3. Site layout

The only infrastructure on site is the farm stead that will be utilized for offices and workshops. Infrastructure to be developed include haul roads, wash bay, weigh bridge and water management systems. The infrastructure layout is discussed in more detail in Section 7 of this report. Refer to **Figure 4** for the proposed site layout.

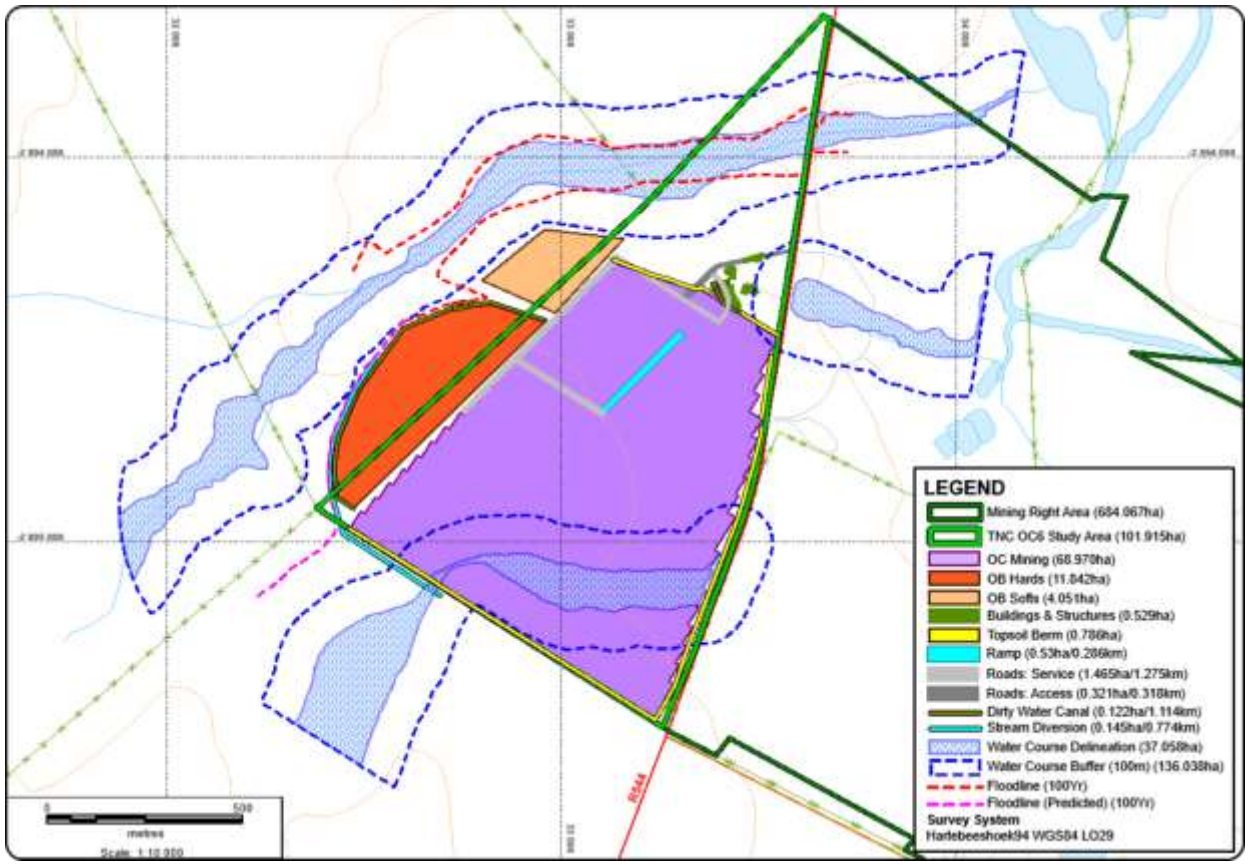


Figure 4: Proposed mining and infrastructure layout

2.4. Servitudes

Two servitudes are relevant on the property. The ESCOM pipeline runs next to the R544 road and a Transnet servitude cross the property. The railway line is not in use anymore and was removed.

3. APPLICABLE LEGISLATION

3.1. Listed and Specified Activities

Various listed activities as defined in terms of Regulation 983 (Listing Notice 1), 984 (Listing Notice 2) and 985 (Listing Notice 3) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) (published on 4 December 2014 as amended on 7 April 2017) were identified for Vlaklaagte Block OC6, refer to **Table 3** below.

Table 3: Listed and specified activities

LISTED AND SPECIFIED ACTIVITIES TO BE AUTHORISED				
Name of Activity	**Aerial Extent of the Activity ha or m^2**	**Listed Activity**	**Applicable Listing Notice**	**Waste Management Authorisation**
Opencast mining	67 ha	**X**	Listing Notice 1, Activities: 12 & 19 Listing Notice 2, Activities: 6, 15, 17 (a) & 17 (b)	
Washbay and workshops	0.24 ha	**X**	Listing Notice 1, Activities: 14	
Diesel storage	35000 l			
Storm water management (berms / canals)	3 ha – Clean water berms and drains 1.5 ha – Dirty water berms and drains	**X**	Listing Notice 1, Activities: 9 (i), 10 (i), 12 &13 Listing Notice 2, Activities: 6 & 15	
Overburden stockpiles	2.43 ha – Overburden (All estimates)	**X**	Listing Notice 1, Activities: 12 (ii) Listing Notice 2, Activities: 6, 15 & 17 (a)	Residue deposits and residue stockpiles GN. 921 Category B - 4 (11) GNR 636 (3)(c)
Dewatering pipelines <360mm diameter	Pipelines Ø <360mm			
Rehabilitation of the surface	100 ha	**X**	Listing Notice 1, Activities: 22 (i)	

4. POLICY AND LEGISLATIVE CONTEXT

This report has been compiled in accordance with requirements from the NEMA and the applicable regulations, as well as some of the requirements as set by the Mineral and Petroleum Resources Development Act (No 28 of 2002) (MPRDA), the National Environment:

Waste Management Act (No 59 of 2008) (NEMWA) and the National Water Act (Act No. 36 of 1998) (NWA).

The compilation of an Environmental Management Programme (EMPr) and environmental authorisations including the Water Use Licence (WUL) application will all form part of the scope of the project as a whole.

Various activities that require environmental authorisation were identified. An application for authorisation in terms of Section 24 of the NEMA was submitted to the Department of Mineral Resources (DMR) during September 2018. The said activities as defined in terms of Regulation 983, 984 and 985 of NEMA were published on 4 December 2014 as amended in April 2017. This Final Scoping Report was submitted on 4 December 2018 and accepted on 14 March 2019. An EIA was conducted and an EMPr formulated for the associated activities at Vlaklaagte Block OC6. The results of the EIA and the formulated EMPr was compiled in the format as outlined in Regulation 982 of NEMA.

Table 4 provides a description of the policy and legislative context that are or might be applicable to the proposed activity(-ies) and are to be considered in the assessment process for the proposed development. More detail is provided for each policy/guideline/act in **Table 5.**

Table 4: Applicable legislation and guidelines used to compile the report

Applicable legislation and guidelines used to compile the report	Reference where applied
Environmental authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and Government Notice Regulations 982 to 985 (4 December 2014).	The S&EIA Process is based on the principles of the NEMA and the EIA Regulations. The whole EIAR/EMPr Report layout is done according to the requirements and as set out in R. 982. Refer to **Table 5** for more detail.
Environmental Management Programme (EMPr) Amendment, in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA).	Activities will have to be approved for WP in terms of the MPRDA. Refer to **Table 5** for more detail.
Issuing of an Integrated Water Use Licence (IWUL) and an Integrated Water and Waste Management Plan (IWWMP), in terms of the National Water Act, 1998 (Act No. 36 of 1998).	Section 21 of the Act. Lists water uses that require a licence prior to commencement. Application for a water use licence must be submitted to DWS for triggered activities.
Other applicable Government Notice Regulations:	
Government Notice 704 of 4 June 1999	GN 704: Regulations on use of water for mining and related activities aimed at the protection of water resources. Hence, application for the exemption from the requirements of the regulations where applicable.
General Notice 509 of 26 August 2016	GenN 509: General authorisation in terms of section 39 of the NWA for water uses as defined in Section 21(c) or section 21(i).

Applicable legislation and guidelines used to compile the report	Reference where applied
Government Notice Regulation 267 of 24 March 2017	GNR 267: Regulations regarding the procedural requirements for water use licence applications and appeals. Refer to **Table 5** for more detail.
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004), the Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998) and the National Forests Act, 1998 (Act No. 84 of 1998). Mining and Biodiversity Guideline, 2013	Should protected plant species be affected, permits will have to be obtained from the Mpumalanga Tourism and Parks Board Agency (MTPA) for their removal, relocation or destruction. Refer to **Table 5** for more detail.
Government Notice 921 of 29 November 2013 as amended on 11 October 2017	GN 921: Lists waste management activities that require a waste management licence prior to construction and operation.
Government Notice Regulation 632 of 24 July 2015	GNR 632: Regulations regarding the planning and management of residue stockpiles and residue deposits from mining activities.
National Heritage Resources Act, Act No. 25 of 1999; Removal of Graves and Dead Bodies Ordinance (Ordinance No.7 of 1925); and MEC Local Government - Human Tissue Act 65 of 1983 and the Exhumation Ordinance 12 of 1980. The South African Heritage Resources Agency needs to approve a heritage assessment, to be conducted as part of the overall EIA process, in terms of the National Heritage Resources Act (No 25 of 1999).	Permits will be required for the destruction or removal of any heritage resources affected by the development; this will include all buildings and graves that will be impacted by this project.
National Environmental Management: Air Quality Act, 2004 (Act 39 of 2004)	Section 32, 34, 35 refers to noise, dust and offensive odour control.
National Veld and Forest Fire Act, 1998 (Act No. 10 of 1998).	Chapter 4 Section 12: Places a duty on owners to prepare and maintain firebreaks. Will be applied in EIA and EMPr.
Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983).	Regulation 280 of 2001: Requires the landowner to manage agricultural resources i.e. the removal of invasive species, protection of soils against water and wind erosion and the management of water resources. An alien invasive species plan and a land use and soil management plan must be developed for the mine. This will form part of the EMPr.

The required Public Participation Process (PPP) will follow a single integrated process complying with the requirements of the above listed acts. **Table 5** provides a more detailed list of the applicable legislation and guidelines that have been or will be consulted throughout the entire project, as well as the applicability to the project.

Table 5: List of Applicable Legislation and Guidelines Consulted

	Legislation	Regulations / Guidelines	Description / Requirement	Project Implication
EIA Process and Listed Activities	**National Environmental Management Act, Act 107 of 1998**	Chapter 1 of NEMA	Sets out the principles of environmental management	Chapter 1 principles are to be considered during the environmental impact assessment process.
		Chapter 5 of NEMA	Integrated environmental management, provides information on environmental management tools that promote the implementation of principles set out in Chapter 1 of NEMA	Environmental management tools are to be considered during the EIA process for the project.
		GNR 982 of 2014 (Amended 7 April 2017)	Chapter 2: Timeframes Chapter 3: General requirements for applications Chapter 4: Application for environmental authorisation Chapter 5: Amendment, suspension, withdrawal and auditing of compliance with environmental authorisation and environmental management programme. Chapter 6: Public participation process Chapter 8: Transitional arrangements and commencement.	Scoping and Environmental Impact Assessment must be undertaken in accordance to Regulation 982.
		GNR 983 of 2014 Listing Notice 1 (Amended 7 April 2017)	Lists activities requiring a basic environmental assessment	Environmental authorisation must be obtained prior to commencement with listed activities. Activities listed in Appendix 1.
		GNR 984 of 2014 Listing Notice 2 (Amended 7 April 2017)	Lists Activities requiring an environmental impact assessment	Environmental authorisation must be obtained prior to commencement with listed activities. Activities listed in Appendix 1.
		GNR 985 of 2014 Listing Notice 3 (Amended 7 April 2017)	Lists activities that require a basic environmental assessment at specific identified geographical areas only.	Environmental authorisation must be obtained prior to commencement with listed activity. Activities listed in Appendix 1, but none of Listing Notice 3 applies to this project.
		GNR 805 of 2012	Integrated Environmental Management Guideline Series (Guideline 5) - Companion to the NEMA EIA Regulation, 2010.	Although based on the 2010 EIA regulations, the process to be followed still applies.
		GNR 806 of 2012	Integrated Environmental Management Guideline Series (Guideline 6) – Environmental Management Framework Regulations, 2010.	Although based on the 2010 EIA regulations, the process to be followed still applies.
		GNR 807 of 2012	Integrated Environmental Management Guideline Series (Guideline 7) – Public Participation in the Environmental Impact Assessment Process, 2010.	Although based on the 2010 EIA regulations, the process to be followed for public participation still applies.
Water Uses and protection of water resource	**National Water Act, 36 of 1998**	Section 21 of NWA	Lists water uses that require a licence prior to commencement.	Water use licence will be applied for.
		GN 704 of 4 June 1999	Regulations on use of water for mining and related activities aimed at the protection of water resources.	Water use licence will be applied for.

	Legislation	Regulations / Guidelines	Description / Requirement	Project Implication
		General Notice 509 of 26 August 2016	General Authorisation in terms of Section 39 of the National Water Act, 1998 (Act No. 36 of 1998) for water uses as defined in section 21(c) or section 21(i).	Water use licence will be applied for.
		Government Notice 1198 of 18 December 2009	General Authorisation in terms of Section 39 of the National Water Act, 1998 (Act No 36 of 1998) in terms of Section 21(c) and (i) for the purpose of rehabilitating a wetland for conservation purposes	N/A
		General Notice 538 of 2 March 2017	Revision of General Authorisations (GA) in terms of Section 39 of the NWA.	Water use licence will be applied for.
		GN R139 of 24 February 2012	Regulations regarding the safety of dams in terms of Section 123(1) of the National Water Act, 1998 (Act No. 36 of 1998). Application for a licence to construct and impound for a dam with safety risk.	Water use licence will be applied for.
Biodiversity	**National Environmental Management: Biodiversity Act, Act 10 of 2004**	GNR 151 published on 14 December 20o7	Publication of critically endangered, vulnerable and protected species: No person may carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit.	A permit will be required prior to removal of endangered, vulnerable and protected species that might be identified and impacted within the study area.

	Legislation	Regulations / Guidelines	Description / Requirement	Project Implication
	National Forests Act, Act 84 of 1998	GN 835 published on 23 September 2010	List of Protected tree species under the Act: No person may carry out a restricted activity on any protected tree except if there is a licence granted by the minister.	A licence must be obtained prior to removing any protected trees on site.
	Mpumalanga Nature Conservation Act, Act 10 of 1998	Chapter 7	82 (1). No person shall remove an endangered species or rare species unless he or she is the holder of a permit which authorises him or her to do so.	A permit will be required for the removal of protected plants if any are identified within the application area.
Waste Management	National Environmental Management: Waste Act, Act 59 of 2008	GNR 921 of 29 November 2013 (as amended 11 October 2017)	Lists waste management activities that require a waste management licence prior to construction and operation.	Waste management activities are included in the document. Water use licence will be applied for.
		Government Notice Regulation 632 of 24 July 2015	Regulations regarding the planning and management of residue stockpiles and residue deposits from prospecting, mining, exploration or production operation.	Waste management activities are included in the document. Water use licence will be applied for.

	Legislation	Regulations / Guidelines	Description / Requirement	Project Implication
Heritage Resources	National Heritage Resources Act, Act No. 25 of 1999.	Section 35 & 36	35. (4) No person may, without a permit issued by the responsible heritage resources authority - (a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite; (b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite; (c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or (d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites. 36. (3)(a): No person may, without a permit issued by SAHRA or a provincial heritage resources authority: (a): destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of 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	Permission to be obtained from the South African Heritage Resources Agency (SAHRA) for any proposed destruction, damaging, alteration, exhumation or removal of graves. Permits will be obtained if required.
		Section 34	No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority.	Permission to be obtained from the South African Heritage Resources Agency (SAHRA) for any proposed alteration or demolishing of any structure that is older than 60 years. Permits will be obtained if required.
	Removal of Graves and Dead Bodies Ordinance (Ordinance No.7 of 1925)	Section 2(1)	Relocation of graves	Permits will be obtained if required.

	Legislation	Regulations / Guidelines	Description / Requirement	Project Implication
	MEC Local Government - Human Tissue Act 65 of 1983 and the Exhumation Ordinance 12 of 1980		Exhumation of graves	Permits will be obtained if required.

	Legislation	Regulations / Guidelines	Description / Requirement	Project Implication
Air and Noise	National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)	Section 32, 33, 34 and 35	Measures for the control of dust in specified places or areas, either in general or by specified machinery or in specified instances; Steps that must be taken to prevent nuisance by dust; or Other measures aimed at the control of dust. If it is determined that a mine, having regard to its known ore reserves, is likely to cease mining operations within a period of five years, the owner of that mine must promptly notify the Minister in writing— (b) of any plans that are in place or in contemplation for— (i) the rehabilitation of the area where the mining operations were conducted after mining operations have stopped; and (ii) the prevention of pollution of the atmosphere by dust after those operations have stopped. Control noise in general, by specific machinery, activities or in specified places or areas; For determining definition for noise and maximum levels of noise. The Minister or MEC may prescribe measures for the control of offensive odours emanating from specified activities.	Applicant is to adhere to the national standards for dust, PM and noise.
		General Notice 275 of 3 April 2017	National Greenhouse Gas Emissions Reporting Regulations, 2016.	Adhere to reporting conditions and national standards regarding greenhouse gas emissions.
Veld Fires	National Veld and Forest Act , 1998 (Act No. 84 of 1998)	Chapter 4, Section 12	Places a duty on owners to prepare and maintain firebreaks. The procedure in this regard and the role of adjoining owners and the fire protection association are dealt with.	Current fire break plan must be maintained around the perimeter fence.

	Legislation	Regulations / Guidelines	Description / Requirement	Project Implication
Land Use Management	Conservation of Agricultural Resources Act,1983 (Act No 43 of 1983)	GNR 1048 published on 25 May 1984 (as amended on 30 March 2001)	Requires the landowner to manage agricultural resources i.e. the removal of invasive species, protection of soils against water and wind erosion and the management of water resources.	An alien invasive species plan must be maintained for the processing plant; and the land use and soil management plan must also be maintained.
Traffic Management	Mpumalanga Roads Department & National Roads Agency / Roads Ordinance, 22 of 1957, and National Roads Act, 54 of 1972	Section 29	Permission (wayleave application) to establish new access road.	N/A to this project, access already constructed.

5. NEED AND DESIRABILITY OF THE PROJECT

The Overview chapter of the National Development Plan 2030 (NDP) states 10 critical success factors for the road to a worthy future for South Africa. They are:

1. A social compact to reduce poverty and inequality, and raise employment and investment.
2. A strategy to address poverty and its impacts by broadening access to employment, strengthening the social wage, improving public transport and raising rural incomes.
3. Steps by the state to professionalise the public service, strengthen accountability, improve coordination and prosecute corruption.
4. Boost private investment in labour-intensive areas, competitiveness and exports, with adjustments to lower the risk of hiring younger workers.
5. An education accountability chain, with lines of responsibility from state to classroom.
6. Phase in national health insurance, with a focus on upgrading public health facilities, producing more health professionals and reducing the relative cost of private health care.
7. Public infrastructure investment at 10 percent of gross domestic product (GDP), financed through tariffs, public-private partnerships, taxes and loans and focused on transport, energy and water.
8. Interventions to ensure environmental sustainability and resilience to future shocks
9. New spatial norms and standards – densifying cities, improving transport, locating jobs where people live, upgrading informal settlements and fixing housing market gaps.
10. Reduce crime by strengthening criminal justice and improving community environments.

2 Seam (Pty) Ltd works closely with provincial government structures in support of the NDP, and is committed to the above actions in the form of:

- Creation of employment opportunities;
- Creation of short term employment opportunities during construction;
- Human resource development;
- Human and community development;
- Strategic infrastructure;
- Environmental sustainability;
- Governance and policy; and
- Spatial equity.

The Guidelines on Need and Desirability published by Department of Environmental Affairs (DEA, 2017) require the need for a development to be sustainable, in other words is should be ecologically sustainable as well as socially and economically justifiable.

Ecological sustainability:

The small opencast operation will have a minimal impact on air quality after mitigation. The ecological disturbances will be limited to the surface infrastructure development areas and the opencast section.

Social and economic justification:

A social and labour plan was developed and submitted to the DMR and will be implemented by the mine. Community development, workforce development and job creation forms some of the key aspects of the SLP. The focus of the mine is to continue providing job opportunities to local communities.

There will also be an economic benefit at the local, provincial and national level in terms of multi-generational employment and contribution to the GDP.

6. PROJECT ALTERNATIVES

6.1. Alternatives Considered

Vlaklaagte Block OC6 project is part of an existing mining area and is only planning to change the approved mining method from the historical underground mining to an opencast mine.

6.1.1. The property on which or location where the proposed activity is to be undertaken

The coal resource available for mining is located on Lourens 472 IS. No other alternative properties can be considered for the mining as the rest of the reserve is mined out or being mined by other companies. The remainder of the viable resources are restricted to these properties.

Figure 5 in **Section 5.2.1** indicates the planned mining areas that form part of the Block OC6 Project. The areas identified for the open pit has been selected as such because of geological and topographical parameters and are the most optimum methods for extracting the resource.

6.1.2. The type of activity to be undertaken

As described in **Section 1.1** and **Section 5.2** with the relevant subsections, the proposed activities that will be applied for will relate to the mining of the coal resources situated on the

specified properties (**Table 2**) by means of opencast mining methods. All other activities that will be applied for is to support the main activity, namely mining.

6.1.3. The design or layout of the activity

Refer to **Figure 5** in **Section 5.2.1** for the Vlaklaagte Block OC6 Mine Plan (also attached on larger scale in **Appendix 4**). The designs of the associated infrastructure as described in **Section 5.2.7**.

6.1.4. The technology to be used in the activity

6.1.4.1. Mining method alternatives

The 4 seam reserve in the OC6 block is relative shallow and the 2 seam was mined by underground method. Opencast mining is the only alternative that can be considered to get access to the in situ 4 and 1 seam and the remaining pillars on the 2 seam.

2 Seam (Pty) Ltd does have the equipment and expertise to execute this operation successful with minimum disturbance and impact to the surface environment.

Furthermore is the impact on the wetland system identified in the northern portion if mined by opencast mining method, unfeasible. As per request from Mpumalanga Tourism and Parks Agency to preferable use underground mining method in freshwater sensitive areas, opencast mining was not further considered in this area.

Underground mining of the 1 seam was considered in the northern area but due to the thin parting between the 2 and 1 seam this option was not considered as been feasible. No further mining will be conducted in the northern portion of the OC6 block.

6.1.4.2. Production tonnage alternatives

The tonnage profile for the open pit is driven by the pit size and the equipment available for the operation.

6.1.4.3. Processing alternatives

No processing will take place on site, the coal will be transported off site to the client as a raw product.

6.1.4.4. Coal transport alternatives

Due to the time that the operation will be active (9 years) only road transport seem to feasible. The conveyor option that was considered was the construction of a conveyor system from the OC6 pit to the current Vlaklaagte mine, crossing the provincial road (R544). This is however no longer be considered due to the cost and the additional environmental impact that the infrastructure will create. Therefore coal will have to be transported via road.

6.1.4.5. Infrastructure alternatives

The placement of the infrastructure is mainly dictated by the layout of the mining operation. Haul road placement was optimised to enable effective hauling operation with a minimised impact on the environment.

As an alternative to utilising the existing farm buildings, the construction of a new office block and associated infrastructure was considered. Due to the additional dirty footprint, limited space and additional cost, the construction of new office buildings was discarded.

Consideration was given to the wetland specialist recommendation that the overburden dumps should be constructed outside the interflow soils of the Channelled Bottom Valley Wetland (SAS Hydropedology Report, **Annexure 11**) in order to minimise the impact on the recharge to wetland system.

These recommendations in conjunction with the topography led to the optimised placement and size of the sump. **Figure 5** indicates the original placement of the stockpiles and **Figure 6** indicates the adjusted layout plan.

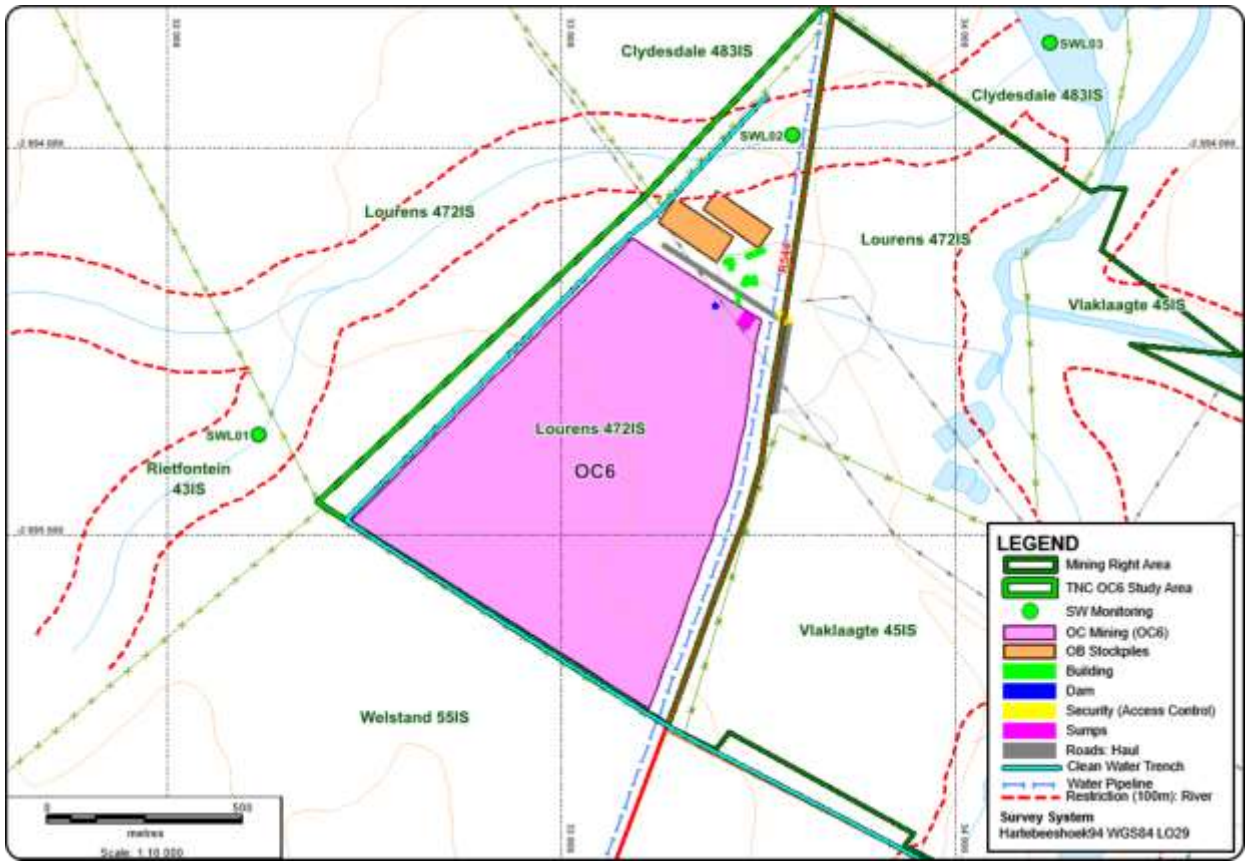


Figure 5: Original mining and infrastructure layout

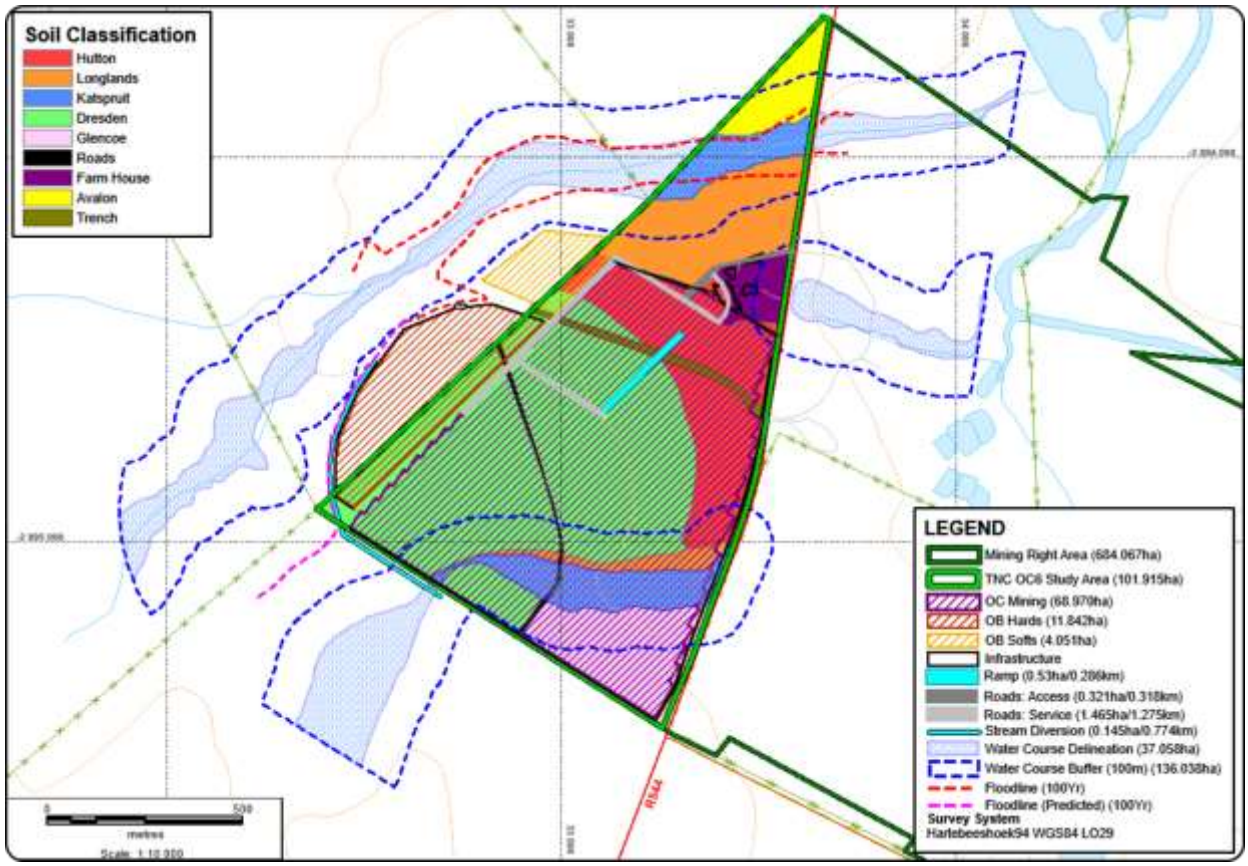


Figure 6: Adjusted mining and infrastructure layout

All run-off from office, hard park, workshops and stockpile area, will drain into sumps. The water from the opencast operation and sumps will be pumped to the PCD.

6.1.5. The operational aspects of the activity

6.1.5.1. Owner-contractor alternatives

The reserve is owned by 2 Seam and mining is already been conducted on the rest of the reserve. The mining equipment and personnel will be moved from the existing Vlaklaagte Mine operation as part of the life extension of 2 Seam (Pty) Ltd.

6.1.5.2. Environmental consideration alternatives

Key aspects like the presence of wetlands, the 1:100 floodline and heritage structures were considered during the process and the design of the mine was accordingly confirmed.

The opencast area was located and sized to stay out of the 100m buffer area from the identified wetland areas except for the seriously modified Unchannelled Bottom Valley Wetland, which will be mined out and the existing disturbed footprint of the farm home stead that will be upgraded to cater for the office and workshop requirements.

Neither slurry disposal facility, Pollution Control dam nor discard facility will be constructed on the Block OC6 area, leading to a decrease in possible groundwater and surface water impacts.

6.1.6. Land Use Alternatives

The project alternatives listed below were considered by 2 Seam for the Block OC6 project.

6.1.6.1. Tourism

The land is current utilised for agricultural purposes and no potential for tourism was identified.

6.1.6.2. Residential

eMalahleni is located only 49 km north of the planned mine and other towns in close proximity includes Kriel, Bethal and Ogies residential areas. There is no need to use this proposed mining area for housing.

6.1.6.3. Agriculture

Maize and livestock farming are conducted and is an alternative.

6.1.6.4. Mining

The Block OC6 reserve adds to the current 2 Seam coal profile and will ensure that current customer requirements are met.

People in the area have also been employed by the mining industries and therefore have the skills to perform mining related activities. The mine is therefore important to ensure that employment suited to the skills of the people in the area will still be available.

6.1.7. The option of not implementing the activity

The “no go” option means that the Block OC6 reserve will not be mined and it will not contribute towards the optimisation of the use of natural resources. It will also mean that other mining areas will have to be obtained by 2 Seam to ensure that customer requirements can be met.

Implications associated with the no go alternative include:

- If the proposed project is not approved, 2 Seam will not be able to continue with its mining operations at the Vlaklaagte Mine Block OC6 project which implies that the client requirements cannot be realised;
- The “no go” option will result in a loss of economically viable and mineable reserves;
- An opportunity to ensure sustainable job creation will be lost; and

Loss of opportunity to update and improve the current environmental commitments

7. PROJECT DESCRIPTION

Some of the information in this section was obtained from the Preliminary Surface Water Management Plan Design and Floodline Report as well as the Methods Statements compiled by Onno Fortuin Consulting (2019). Refer to **Annexure 9**.

7.1. Overview of the Project

The Vlaklaagte Block OC6 project forms part of 2 Seam (Pty) Ltd. 2 Seam has an existing mining right. Opencast mining is planned to mine coal at the Block OC6 project over a period of 9 years.

The Vlaklaagte Block OC6 project falls within the footprint of historical underground mining operation known as Transvaal Navigation Colliery (TNC) as indicated in **Figure 6.** The 2 seam was mined from TNC applying underground board-and pillar-method. These workings are now earmarked for mining (remaining pillars, in situ 1 & 4 seam) of block OC6. However areas of the old 2 seam workings are now flooded and dewatering is therefore needed to enable the open pit development of the OC6 block.

7.2. Activities

7.2.1. Activity 1: Opencast Mining

The mining will commence with opencast operation and is based on a truck and shovel operation with drill and blasting operations on the more competent burdens and coal. Details related to the schedule and method is discussed in the section below. An area of 68.97 ha is planned to be mined opencast.

7.2.2. Activity 2: Office, Change House and Workshop

The current farm house complex will be upgraded as offices, change houses, workshops, parking and security access. Some of the additional buildings that will be constructed during the construction phase are a wash bay and a weighbridge.

7.2.3. Activity 3: Water Management Facilities

Water management facilities will be constructed which includes berms, channels and sumps. These water management facilities will be utilised throughout the life of the project. Details regarding the designs are discussed in more detail in the sections below.

7.2.4. Activity 4: Stockpiles

The project will require overburden stockpiles. The design and details of the stockpiles will be discussed in the sections below.

7.2.5. Activity 5: Waste Management

Domestic, hazardous and non-hazardous industrial waste will be generated on site and will have to be disposed of. Details regarding the waste management on site will be discussed in the sections below.

7.2.6. Activity 6: Roads

Movement of machinery and vehicles will occur during all the phases of the project. Existing roads will be utilised as far as possible.

7.2.7. Activity 7: Stockpiles

Overburden and midburden will be stockpiled on two separate stockpiles. The soft clean material is approximately 441 130 m^3 and hards contaminated material amounts to approximately 1 511 380 m^3. The Hards stockpile is situated along the western boundary of the mining area. The dirty water run-off from the hards stockpile will be conveyed with canals to a sump structure from where it will be pumped to the Vlaklaagte PC Dam on the opposite side of the R544 road. The hards stockpile will be built on an Alternative Class C barrier.

7.2.8. Activity 8: Rehabilitation

Surface rehabilitation will be conducted continuously during the operation and will be concluded after cessation of mining activities. The mining related infrastructure will be removed, affected footprints will be rehabilitated and; the area will be restored to pre-mining topography and environmental status as close as possible.

7.3. Mineral Resource and Expected Project Life

Coal is scheduled to be mined at Vlaklaagte Mine Block OC6 and the target market is mainly Eskom. The estimated reserves within the planned mining area amount to **9.290 million** ROM tonnes via opencast methods.

Opencast mining will be conducted at a rate of 100 000 tonnes per month once the mine is established. Refer to **Figure 7** for the mining schedule.

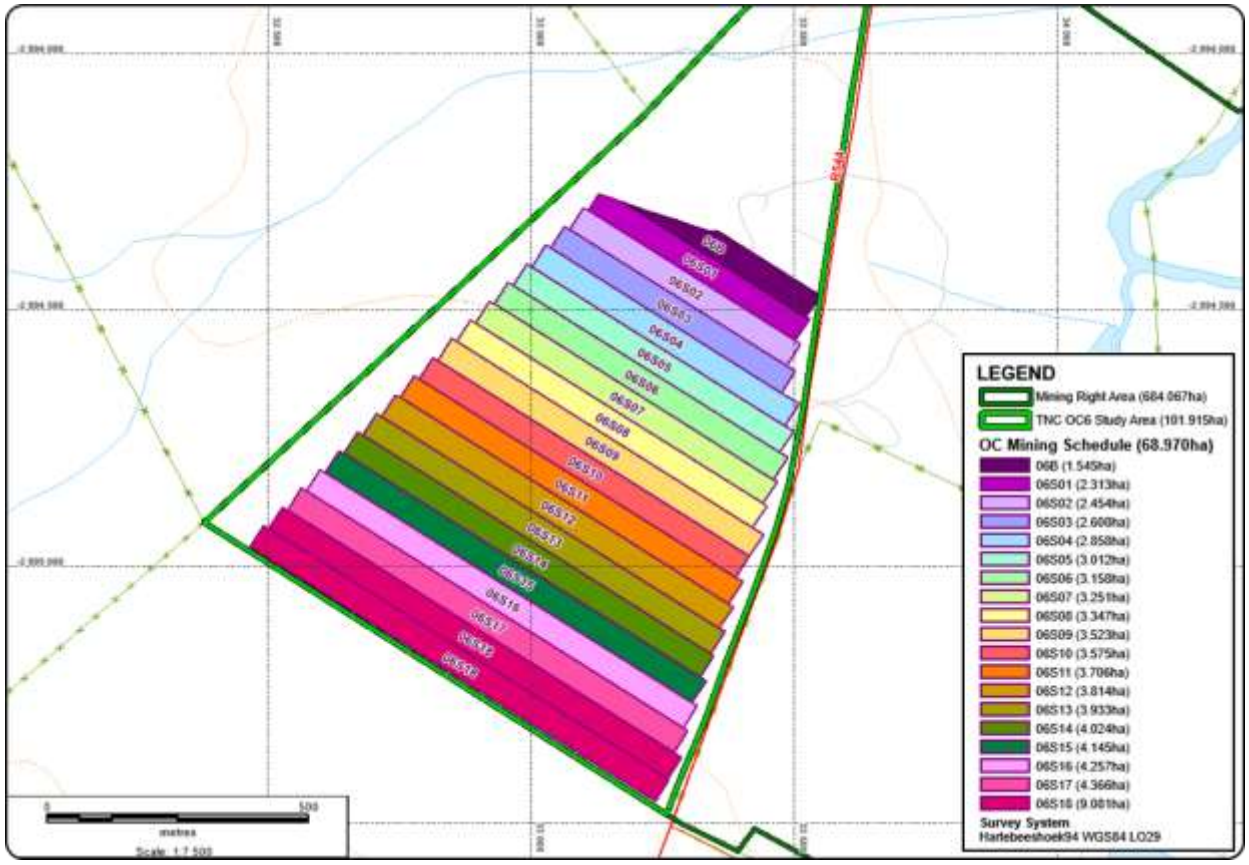


Figure 7: Mining Schedule (Opencast)

7.4. Mining

Coal will be mined via opencast mining method with associated infrastructure. The opencast mining areas will be mined using the truck and shovel, roll-over mining method. Refer to **Figure 8** for a schematic presentation of the opencast mining process. Thus, the opencast area will be backfilled with overburden material and levelled concurrently. Once backfilled to the correct level, topsoil will be replaced and the area will be vegetated. Refer to **Figure 9** for a schematic presentation of the rehabilitation process.

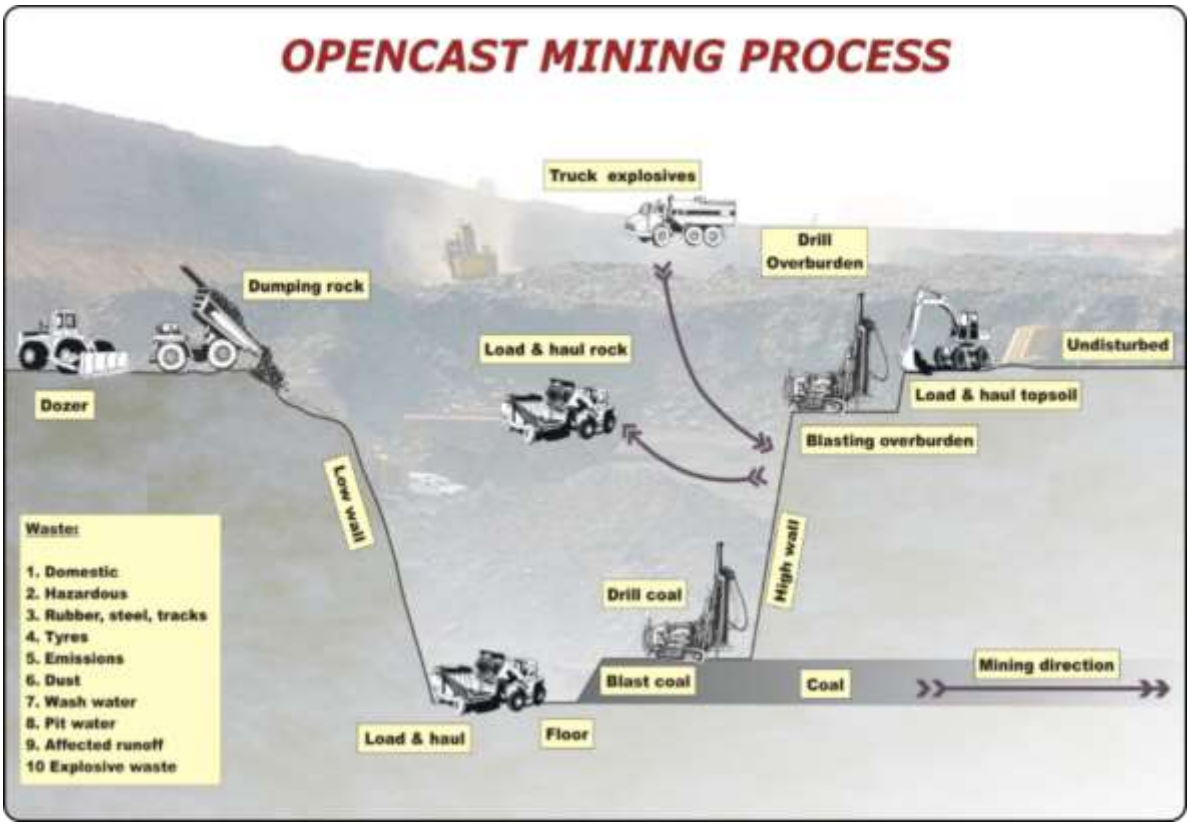


Figure 8: Schematic presentation of opencast mining

Figure 9: Schematic presentation of opencast mining rehabilitation process

Access

The access ramp for the opencast block will be utilised for access. The coal will be transported from the pit along the access ramp to the surface ROM stockpile.

Development

The boxcut will be constructed in the northern portion of the block and mining will progress towards the south.

7.5. Mineral Processing

No processing of coal will be conducted on site and all ROM will be transported to the existing Vlaklaagte Mine ROM stockpile.

7.6. Transport of Product

Coal mined will be loaded and transported via trucks to the Vlaklaagte mine ROM stockpile. From there the coal will be distributed to the various clients. The existing road infrastructure will be upgraded and utilised.

7.7. Infrastructure

The operation will be very small and limited infrastructure will be developed. It will include the following: -

- Security access;
- Washbay;
- Upgrade of the access road;
- Offices;
- Hard Park Area;
- Diesel tanks;
- Haul roads;
- Overburden waste dumps;
- Dirty water management;
- Potable water tank;
- Storm water management;

Refer to **Figure 10** for the infrastructure layout.

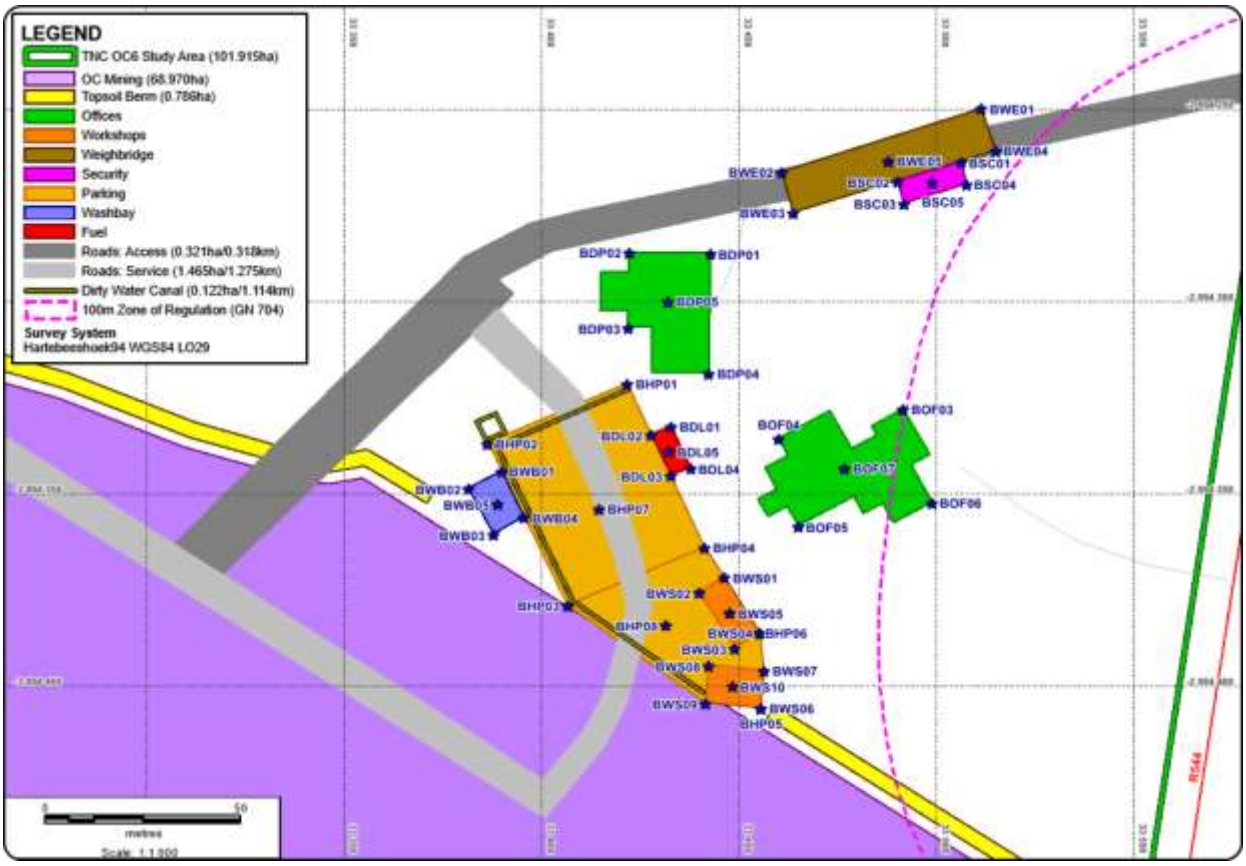


Figure 10: Infrastructure Layout

7.8. Overburden Stockpiles

The Overburden Stockpile is regarded a dirty water area and an alternative Class C barrier design is proposed. This Class C platform is built where the topsoil removed from the footprint will be used in the noise berm placed all along the mining infrastructure perimeter. The unsuitable material below the topsoil horizon is removed from the footprint and replaced with better quality material where this platform is built in layers of maximum 150 mm thickness. These layers are then compacted to ensure that a stable and solid platform is built before the area is used as an overburden stockpile. The platform has a uniform slope to ensure that any surface or seepage water is diverted to side canals all along the edge of the platforms.

Due to the short LOM period (9 years) of Vlaklaagte Block OC6, the dirty water canals at the Overburden Stockpile are recommended as HDPE lined canals.

Any seepage water collected from this Overburden Stockpile is then diverted to a lined concrete sump via the HDPE lined canals. Water collected in this sump is then pumped to the Vlaklaagte Mine PCD. In addition, special flo-drains are installed along the perimeter of the Overburden Stockpile to ensure that all impacted water from this Overburden Stockpile is captured. The flo-drains decant into the sump where this water is then also managed as part of the dirty water system of the Mine. The dirty water run-off from the overburden stockpile will be

conveyed with concrete canals to a large sump structure from where it will be pumped to the Vlaklaagte Mine PCD. The overburden stockpile will be built on an alternative Class C barrier.

7.9. Roads

Existing roads will be utilised and only a haul road is planned to link Block OC6 and Vlaklaagte Mine ROM stockpile area.

The haul roads are 12 m wide and have been designed with a single cross-fall of 3%. The haul roads are classified as clean water areas and surface water draining from the road surface are drained via v drains back into the environment.

7.10. Fencing

Fences will be erected around the mine to control and manage access to the mine.

7.11. Mineral processing plant

No processing will be conducted on site.

7.12. Workshop, administration and other buildings

As mentioned, the current farm buildings on RE of Lourens 472 IS will be utilised as offices and the current workshop will be upgraded to fit the purpose of the operation. Additional infrastructure like the washbay and weighbridge will be constructed.

Refer to **Section 7.7** and **Figure 10**, indicating the location where the infrastructure such as weighbridge will be constructed.

Employees and construction workers commute to the site daily. No housing or recreational facilities will be constructed on the proposed site.

7.13. Water use and resources

Potable water supply

Potable water will be obtained from the current borehole on site. On average 500 m^3 will be required monthly.

Process water supply

Only water for dust suppression is needed and this water will be obtained from the proposed opencast pit.

Disturbances of water courses

An unchannelled valley bottom (UCVB) wetland is located within the southeastern corner of the study area. This wetland seems to have historically formed part of a larger wetland system which ultimately drains into the Olifants River. Due to the recent mining activities (2012 - 2013), the downstream portion thereof (outside of the study area) has been cut off from the upstream portion.

The proposed open cast mining pit would entail complete removal of the portion of the UCVB within the study area.

A clean water cut-off drain will be constructed upstream of the opencast area to divert run-off from the upstream portion of the UCVB to the west into the tributary to the Olifants river.

7.14. Water management infrastructure

For the dewatering of the underground workings and water that accumulates in the opencast the current pollution control dam at the Vlaklaagte mine will be utilised. A pipeline will be constructed from the block OC6 opencast area to the current PCD. Mechanical evaporators will be utilised at the Vlaklaagte mine area to control the waterlevel in the PCD. The pollution dam is authorised in the current IWUL for the Vlaklaagte mine.

Sewage disposal systems

Chemical toilets will be used at the mining area and the current system at the farm house will be utilised at the offices. A conservancy tank will be installed to cater for the offices and replacing the current French drain system.

Pollution control dams

No new pollution control dam (PCD) will be built at Block OC6. The current PCD at the Vlaklaagte mine will be utilised to store the affected water from Block OC6. Mechanical evaporators will be installed to control the water level in the PCD. Details for the PCD are contained in the approved water use licence.

Dirty water management system

All dirty water canals are lined (concrete or HDPE) and have been designed for the 1:50 year, 1-day storm event. Contaminated water from the overburden stockpile will be collected and pumped to the PCD.

Clean water management system

Clean and dirty water separation measures will be constructed at the opencast operation to prevent clean water entering the pit.

7.15. Storm water management plan

Clean water diversion berms have been placed strategically throughout the mining area where the clean water is diverted to the natural environment.

The clean diversion berms are designed at gradients in the order of 1:200 slope to limit the design velocity between 0.8 m/s (maximum) and 0.3 m/s (minimum). For a gravel drain, the standard is that velocities higher than 0.8 m/s limit will result in erosion of the diversion berm, whereas velocities lower than 0.3 m/s will result in the silting of the diversion berm.

To ensure compliance to Regulation GN704, the clean water berms must be able to drain the 1:50 year storm event from the area.

The stream diversion canal will divert the clean water from the eastern wetland system into the western wetland/watercourse system and will be set out at a slope of 1:200 to limit the flow velocities in the canal. The contributing area at the point of the stream diversion is 0.87 km^2. The stream diversion canal is designed for the 1:100 storm with a design flow of 4.965m^3/s. The 1:50 storm has a design flow of 3.69 m^3/s. The stream diversion canal will be a gravel canal and it is therefore of critical importance that the canal be grassed after construction to prevent erosion during high flow periods. This impacted stream is non-perennial where it is recommended that the stream diversion canal be built in the winter period when little-to-no rain can be expected.

The detail for these Structures is included in **Annexure 9**.

7.15.1. Water balance

The water balance was developed utilising the mine schedules and meteorological data available for the area. The water balance is presented in the table presented in **Figure 12.**

Facility Name	Water In		Water Out		Balance
	Water Circuit/stream	Quantity (m3/annum)	Water Circuit/stream	Quantity (m3/annum)	
Vlaklaagte PCD	Runoff from OB North dump	28,516	Evaporation	30,783	
	Water from OC	664,126	Dust suppression	50,735	
	Direct rain water	13,664	Mechanical evaporation	625,592	
	Runoff from hard park area	782			
	Runoff from product stockpile	-			
	Runoff from workshop area	22			
	Total	**707,110**		**707,110**	**-**
OC Y9	Open pit area	55,095.00	Water pumped to Vlaklaagte PCD	664,126	
	OC spoils	10,595.00			
	OC area topsoiled	5,298.00			
	Rehabilitated area	57,318.00			
	Groundwater inflow	535,820.00			
		664,126.00		**664,126**	**-**
Sewage	Sewage generated	1,883	Conservancy tank emptied	1,883	
	Total	**1,883**		**1,883**	**-**
Potable water tank	Potable water supply	2,354	Potable use losses	471	
			Sewage generated	1,883	
	Total	**2,354**		**2,354**	**-**
Total Water Balance		**711,347**		**711,347**	**-**

Figure 11: Operational water balance – Average Annual

7.15.2. Waste management

In-pit waste dumping will be utilised as far as practically possible, and the remaining waste to be accommodated on surface in close proximity to proposed final void.

Domestic waste

All waste from the site will be managed as part of the Vlaklaagte mine's overall domestic waste management system. Domestic waste (e.g. paper, cardboard, organic waste) generated at the mine will be collected by an appointed contractor and disposed of at an authorised site.

Hazardous waste

Oil and greases that are generated during maintenance will be disposed into sealed in drums and returned for recycling to an approved vendor at regular intervals. Any contaminated waste (i.e. brake pads, filters) will be collected by a contractor and disposed of at an approved hazardous waste facility.

Non-hazardous industrial waste

It is not expected to generate any scrap metal at Block OC6, if it is generated the scrap metal will be temporarily stored before being sold to scrap dealers. Old tyres are recycled by approved vendors.

Discard stockpile

There will be no discard stockpile as no coal processing will be conducted on site.

Over/Midburden stockpiles

A waste classification was done on the total expected geological sequence. Two waste rock samples (sandstone and shale) as well as the coal were included in the waste classification.

Both of the waste samples classify as a Waste Type 3, based on the findings of the TC and LC results. The required containment barrier according to Regulation 636 as listed in Government Gazette No 36784 for a Waste Type 3 waste is a Class C containment barrier.

7.16. Energy Supply

The operation will make use of the current ESCOM electricity reticulation system.

7.17. Motivation of Project

Expenditure

The Vlaklaagte Block OC6 project forms part of the Life of Asset (LOA) plan of 2 Seam and is critical to the future of the company. Expenditure to extend the life of Vlaklaagte Mine and to obtain the required legal approvals was approved during the annual budget process.

Employment

The open pit mining operation will be done by a mostly own employees that will be moved from the current Vlaklaagte Mine operation on the eastern side of the R544 under management of 2 Seam employees. The estimated amount of personnel is as follows:

- Own Employees : 10
- Open Pit Contractors ; 100

Environment

Any type of development will have an impact on the physical environment and the planned activities are expected to have impacts on the environment. Various legislation including NEMA, the Water Act and the associated regulations set principles, standards and norms depicting how developments should be conducted in a responsible manner. The aim of this process is to quantify and qualify measures and practices that can be implemented and maintained to ensure that the activity is conducted in such a manner that it will have the least possible impact on the environment. The management, implementation and measurement of those identified measures and practices throughout all the phases are crucial in achieving the aim/objectives that will be set. No impacts have been identified to date that cannot be managed or controlled to achieve the objective of responsible environmental management.

8. BASELINE ENVIRONMENT

Specialist studies for the Vlaklaagte Mine project was done during 2016 - 2017, and these detail are been used in the EIA process except where more updated detail was required. During the EIA process the environmental sensitive parameters/issues on which the proposed activity can/may have an impact will be considered. Key factors to be considered when identifying significant impacts include:

- The nature of the proposed mining activity;
- The nature of the receiving environment;
- The legal, policy and planning context for the proposed activity; and
- The environmental and social priorities of the affected population.

8.1. Geographical Character – Visual Aspects

The following is noted when considering the target mining area in isolation:

- The site forms part of a natural landscape.
- The landscape is uniform, has limited topographic ruggedness and shows minor variation in vegetation patterns.
- Land use compatibility and land use edge diversity are considered to be low due to the extensive agricultural activities.

Overall, the landscape offers an average aesthetic value.

8.2. Physical Character - Geology

Regionally, the Springs-Witbank Coalfield, comprise sediments of the Dwyka Group and the central lithostratigraphic coal-bearing unit of the Ecca Group, namely the Vryheid Formation:

- Together they represent part of the Karoo Supergroup, which were deposited on an undulating pre-Karoo floor comprising primarily felsites of the Bushveld Complex and other ancient strata such as the Waterberg Group and Transvaal Supergroup sedimentary rocks.
    - These strata had a significant influence on the nature, distribution and thickness of many of the Karoo Supergroup sedimentary formations, including the coal seams. The sequence typically comprises, from the base upwards a diamictite of probable glacial origin, pro-glacial varved siltstone and pebbly mudstone, and paraglacial gravel and conglomerate, overlain by swamp, fluviodeltaic and shoreline deposits;
    - The 5 classically recognized coal seams of the Witbank Coalfield, numbered from the base up as numbers 1, 2, 3, 4 and 5 respectively.

Site Geology

The coal reserves located at the project site form part of the Springs-Witbank Coalfield. The Karoo sediments at the Project site comprise of the coal bearing Vryheid Formation (Ecca Group) and consists predominantly of fine grained sandstone, platy shale and coal (No. 4, No. 2 and No. 1 seams). Combinations of these rock types are often found in the form of interbedded shale, coal and sandstone.

The Ecca group at the project site is relatively thin and thicknesses range between ~30 mbgl to near surface. No evidence of large scale intrusions of dykes or sills have been encountered at the site. The undulating nature of the pre-Karoo formations has resulted in suboutcropping occurring in the south-southeastern portion of the Project site.

The coal seams (and strata) at the site are generally flat-lying to gently undulating with a regional dip to the south southeast.

Due to the varied depositional environments (e.g. basement topography) and the present day erosional surface not all of the seams are present at any one locality. At the site the No. 4, No. 2 and No. 1 seam are present. At the most south western end of the site coal seams are absent as the basement rocks are close to surface. The seams targeted at the 2 Seam Mine are mainly the No. 2 and No. 4 seams. The No. 1 seam will be locally targeted only where this is feasible.

The five monitoring and test boreholes constructed in the area show mainly fine grained sandstone and/or platy shale with several coal seams.

Presence of Dykes, Sills and Faults

The 2016 groundwater impact assessment did not identify any lineaments in the vicinity of OC-6 proposed mining block.

8.3. Physical Character - Climate

8.3.1. Regional climate

Data was obtained from the Weather Bureau and the Department of Water and Environmental Affairs (DWEA) for the recording station at Bethal. Bethal is about 25 km south east of the Farm Vlaklaagte. Refer to the tables in the sections below for the relevant climate data.

The proposed mining site is in the summer rainfall region of southern Africa. The climate is temperate with hot summers and dry cold winters. Summer precipitation occurs in the form of mist, drizzle, hail and thunderstorms.

8.3.2. Mean monthly and annual rainfall

The highest rainfall usually occurs between October and March. The average annual rainfall is 711 mm with a monthly maximum and minimum of 146 mm (January) and 6 mm (July) respectively. The highest 24 hour rainfall recorded was 88 mm in February. Refer to **Table 6.**

Table 6: Mean monthly rainfall

Month	Average Rainfall (mm)	Maximum Rainfall in 24 hours (mm)
Jan	146	71
Feb	75	88
March	61	55
Apr	48	64
May	14	54
Jun	7	19
Jul	6	25
Aug	13	29
Sept	28	48
Oct	78	61
Nov	129	58
Dec	106	87
Annual	711	-

8.3.3. Mean monthly maximum and minimum temperatures and extreme conditions

At Bethal, the mean daily maximum exceeds 24°C between November and March, the hottest months. Average daily maximum temperatures in the winter months (May-August) range from 16.5°C to 19.9°C. The mean minimum summer temperatures range from 11.8°C (November and March) to 13.8°C (January) with winter mean minima ranging from 0.8°C to 4.4°C. See **Table 7** for maximum and minimum temperatures.

Table 7: Mean monthly evaporation

Month	Average daily maximum temperature (ºC)	Average daily minimum temperature (ºC)	Mean daily temperature (ºC)
Jan	25.6	13.8	19.7
Feb	25.2	13.2	19.2
March	24.6	11.8	18.2
Apr	21.8	8.6	15.1
May	19.5	4.4	11.9
Jun	16.5	0.8	8.7
Jul	17.1	1.0	9.0
Aug	19.9	3.8	11.9
Sept	23.2	7.5	15.3
Oct	23.9	9.9	17.0
Nov	24	11.8	17.9
Dec	25.3	13.1	19.2

8.3.4. Mean monthly evaporation

The average annual A-pan evaporation is 1702 mm measured at Station 0478/867 in Bethal. Evaporation data used for this site is based on the 1 541 mm per annum S-Pan evaporation and Evaporation Zone 4A (GCS, 2016). Refer to **Table 8**.

Table 8: Mean monthly evaporation

Month	Mean Monthly Evaporation (mm) for A-pan	Mean Monthly Evaporation (mm) for S-pan
Jan	180	169.5
Feb	151	141.3
March	148	139.5
Apr	111	107.3
May	94	90.3
Jun	79	73.4
Jul	89	80.3
Aug	132	106.3
Sept	167	137.8
Oct	186	166.1

Month	Mean Monthly Evaporation (mm) for A-pan	Mean Monthly Evaporation (mm) for S-pan
Nov	167	156.7
Dec	195	172.6
Annual	1702	1541

8.3.5. Wind direction and intensity

The prevailing wind direction at Bethal throughout the year is from the north-west. The storm winds, however, usually blow from the south-east, with the strongest winds in the late winter and early spring.

Average wind speeds have not been recorded greater than 5.7 m/s with only about 8% to 12% of the monthly average frequency exceeding the 3.4 - 5.4 speed intervals. This increases to 15 - 25% during spring and early summer (August to December). Refer to **Table 9.**

Table 9: Mean monthly wind direction and speed

Month	N		NE		E		SE		S		SW		W		NW	
	n	v	n	v	n	v	n	v	n	v	n	v	n	v	n	v
Jan	67	4.3	124	4.0	119	4.5	92	5.1	40	4.6	47	4.3	45	3.8	149	3.8
Feb	48	4.1	108	3.8	139	4.1	135	4.9	61	4.5	48	3.9	41	3.5	91	3.7
March	53	3.9	99	3.7	126	3.7	99	4.5	50	4.1	56	4.1	43	3.5	111	3.9
Apr	50	4.0	88	3.5	94	4.0	55	4.2	45	4.3	71	4.4	71	4.5	129	4.0
May	54	4.4	66	3.7	61	3.9	62	4.5	47	4.2	79	4.5	67	4.7	116	4.1
Jun	48	4.1	47	3.7	59	4.1	42	4.8	46	4.7	99	4.5	76	4.3	115	4.3
Jul	43	4.1	66	3.7	64	4.1	62	4.9	54	4.6	84	4.5	57	4.2	121	4.1
Aug	80	4.9	96	4.4	97	4.3	33	5.6	35	4.9	75	4.9	65	4.9	192	4.7
Sept	115	4.8	134	4.8	101	5.0	48	5.7	32	4.1	53	5.1	59	5.0	203	4.8
Oct	115	4.5	139	4.7	116	5.4	58	5.6	41	4.9	54	4.7	47	4.8	223	4.8
Nov	105	4.4	135	4.4	110	5.0	56	5.3	37	4.9	45	4.6	55	4.3	229	4.7
Dec	91	4.2	138	4.1	102	4.8	55	4.9	35	4.5	47	4.9	55	4.2	194	4.2
Average	72	4.4	103	4.1	98	4.4	66	4.9	44	4.5	64	4.5	57	4.4	156	4.4

8.3.6. Incidences of extreme weather conditions

Thunderstorms occur often during the summer (rainy season), usually accompanied by lightning, heavy rain, strong winds and occasionally hail. Storms are localised and rainfall can vary markedly over short distances.

No records of hail, snow, thunderstorms or fog are available for Emalahleni or Kriel. At Bethal hail occurs about six times annually, mainly during summer, while frost occurs between May and mid-September, with an average of 58 frost days per year.

8.4. Physical Character – Topography

The project is located within the Highveld region of the Mpumalanga Province. It is characterised by a gentle undulating topography, comprised of flat to slightly convex crest areas and gentle convex side slopes which terminate in broad flat alluvial plains. There are no pronounced geomorphological features.

The area lies at an altitude of between 1 530 m and 1 560 m above sea level. The project area slopes towards the northeast to a stream that flow to the east.

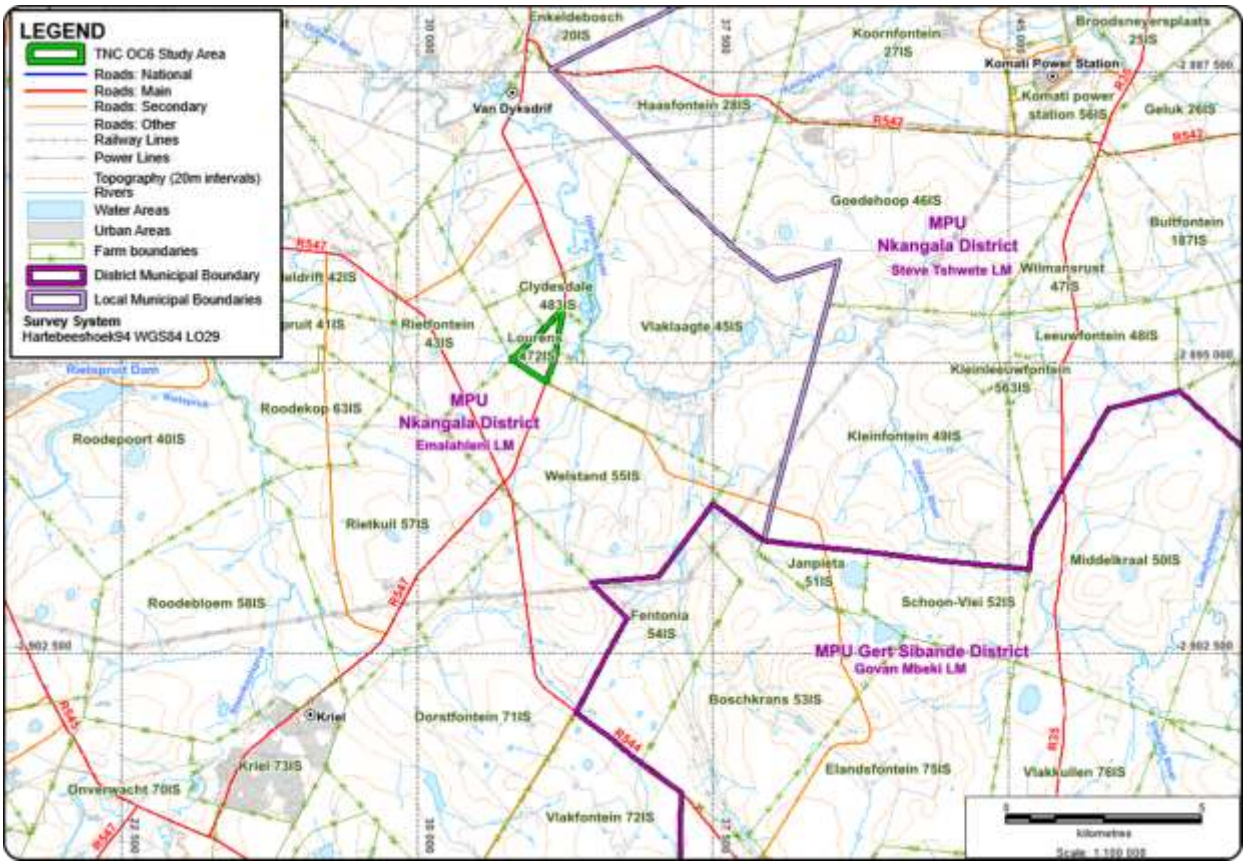


Figure 12: Topographical Plan

8.5. Physical Character – Soils

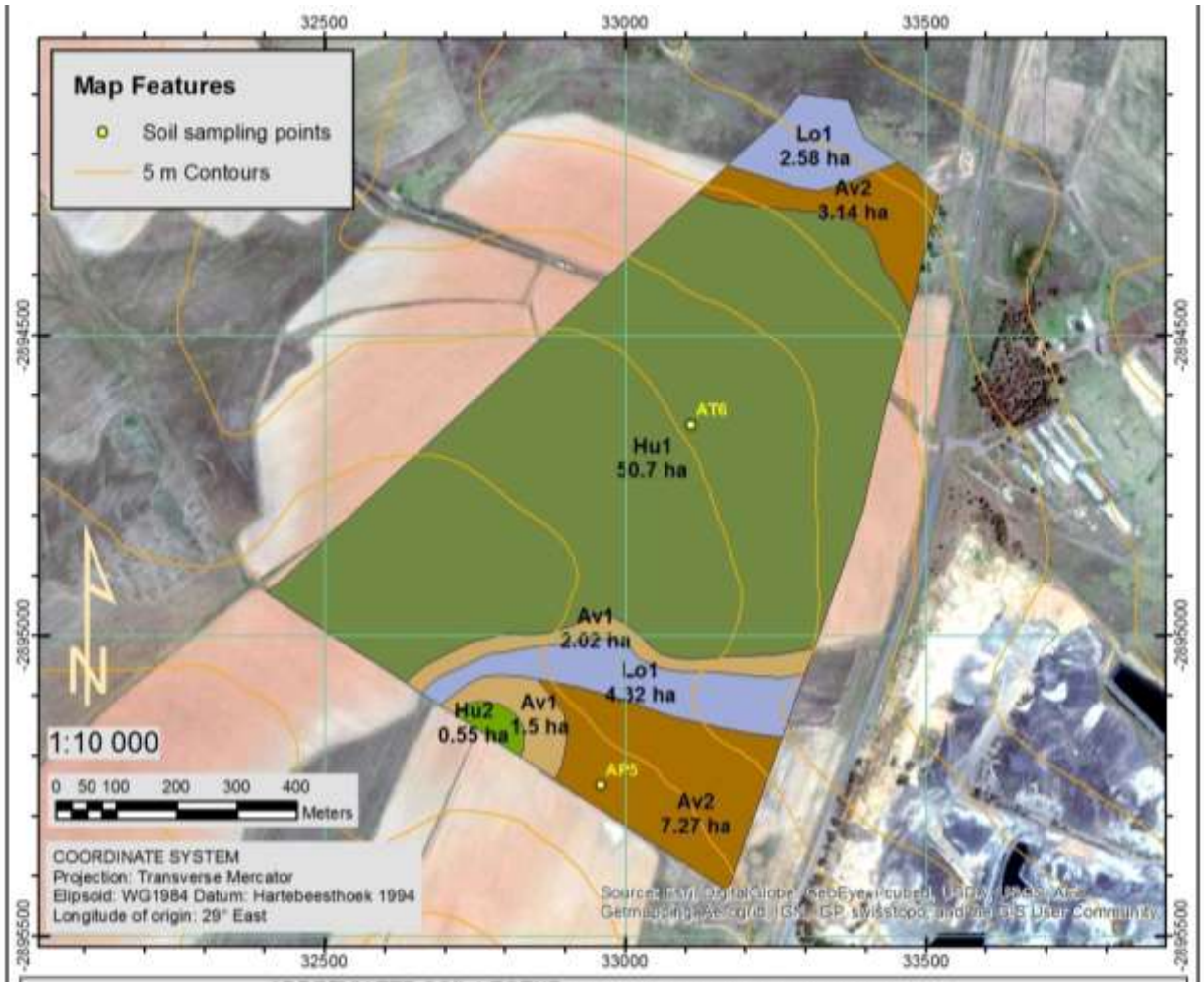
Rehab Green conducted a Soil, land capability, land use and hydropedology Assessment of the proposed Vlaklaagte Block OC6 Project. The information below reflects some of the information included in the assessment. The report is included in **Annexure 7.**

8.5.1. Dominant Soil Types

The survey was conducted during September 2016. Soil types within the proposed mining area were mapped based on soil information gathered by means of auger observations at a grid density of 150 x 150 meter. A total of 41 auger observations were made at pre-determined grid points in order to locate and accurately map soil boundaries.

A total of 5 homogeneous soil units, based on dominant soil form, effective soil depth, internal drainage, terrain unit and slope percentage were identified during field observations and were symbolised as Hu1, Hu2, Av1, Av2 and Lo1. The homogeneous units are referred to as soil types and are shown in **Figure 17**, which contains an abbreviated soil legend. A comprehensive soil legend is provided in **Table 10**, which described the soils in terms of the following aspects.

- Dominant soil forms and families and subdominant soil forms;
- The estimated clay content of the A and B horizons;
- A broad description of the dominant soil form and terrain in terms of the effective soil depth, internal drainage, soil colour, soil texture class, terrain unit and average slope percentage range;
- A description of the soil horizon sequence;
- The derived erodibility class and dry land crop production potential;
- The land capability, wetland zone and hydropedology zone classification; and
- The area and percentage comprised by each soil type.



ABBREVIATED SOIL LEGEND (for full legend refer to Table 1 of the soil report)

Soil Type Code	Dominant & subdominant Soil Form and Family	Summarized Description of Dominant Soil Forms in terms of effective depth, soil colour, soil texture and terrain unit	Land Capability	Hydro-pedology zone	Area (ha)	Area (%)
Hu1	*Hutton 2100 Bloemdal, Bainsvley, Avalon	Deep to very deep (1000-1500 mm), red, well-drained, sandy loam to sandy clay loam soils underlain by weathered rock; Situated on gently sloping crests and midslopes (1-3% slopes).	Arable	Recharge	50.70	70.34
Hu2	*Hutton 2100 Bloemdal, Bainsvley, Avalon	Moderately deep (600-900 mm), red well-drained, sandy loam to sandy clay loam soils underlain by weathered rock often via a B2 horizon containing 5-10% sesquioxide concretions; Situated on gently sloping crests and midslopes (1-3% slopes).	Arable	Recharge	0.55	0.76
Av1	*Avalon 2100, Glencoe, Bloemdal, Longlands	Deep (900-1200 mm), yellow brown, moderately well-drained, loamy sand to sandy loam soils underlain by weathered rock via soft plinthic B2 horizons; Situated on gentle midslopes and footslopes (1-3% slopes).	Arable	Recharge	3.52	4.88
Av2	*Avalon 2100, Glencoe, Longlands, Wasbank	Moderately deep (600-1000 mm), yellow brown, moderately well-drained, sandy to sandy loam soils underlain by weathered rock via soft plinthic B2 horizons; Situated on gentle to moderate midslopes (2-6% slopes).	Arable	Recharge	10.41	14.45
Lo1	*Longlands 1000, Wasbank, Kroonstad, Dresden, Katspruit, Westleigh	Grey to greyish yellow, imperfectly to poorly drained sandy soils, characterized by lateral flow in the E-horizon, underlain by soft or hard plinthic or G-horizons; Seepage zones on gentle footslopes and valley bottoms (1-3% slopes).	Wetland	Interflow	6.90	9.57
* Dominant soil form and family				Total	72.08	100.0

Figure 13: Soil map of the proposed Vlaklaagte Block OC6

Table 10: Soil map legend

SOIL LEGEND										
Soil Type Code	**Dominant & subdominant Soil Form and Family**	**% Clay per horizon A, E, G, B**	**Summarized Description of Dominant Soil Forms in terms of effective depth, soil colour, soil texture and terrain unit**	**Erodibility**	**Dry land crop production potential**	**Land Capability**	**Terrestrial / Wetland zone**	**Hydro-pedology zone**	**Area (ha)**	**Area (%)**
Hu1	***Hutton 2100** Bloemdal, Bainsvley, Avalon	A: 15-20 B: 20-30	Deep to very deep (1000-1500 mm), red, well-drained, sandy loam to sandy clay loam soils underlain by weathered rock; Situated on gently sloping crests and midslopes (1-3% slopes).	Low	High	Arable	Terrestrial	Recharge	50.70	70.34
Hu2	***Hutton 2100** Bloemdal, Bainsvley, Avalon	A: 15-20 B: 20-30	Moderately deep (600-900 mm), red well-drained, sandy loam to sandy clay loam soils underlain by weathered rock often via a B2 horizon containing 5-10% sesquioxide concretions; Situated on gently sloping crests and midslopes (1-3% slopes).	Low	Moderate to high	Arable	Terrestrial	Recharge	0.55	0.76
Av1	***Avalon 2100,** Glencoe, Bloemdal, Longlands	A: 10-18 B: 15-20	Deep (900-1200 mm), yellow brown, moderately well-drained, loamy sand to sandy loam soils underlain by weathered rock via soft plinthic B2 horizons; Situated on gentle midslopes and footslopes (1-3% slopes).	Low	Moderate to high	Arable	Terrestrial	Recharge	3.52	4.88
Av2	***Avalon 2100,** Glencoe, Longlands, Wasbank	A: 8-12 B: 10-18	Moderately deep (600-1000 mm), yellow brown, moderately well-drained, sandy to sandy loam soils underlain by weathered rock via soft plinthic B2 horizons; Situated on gentle to moderate midslopes (2-6% slopes).	Low	Moderate	Arable	Terrestrial	Recharge	10.41	14.45
Lo1	***Longlands 1000,** Wasbank, Kroonstad, Dresden, Katspruit, Westleigh	A: 8-12 E: 2-10	Grey to greyish yellow, imperfectly to poorly drained sandy soils, characterized by lateral flow in the E-horizon, underlain by soft or hard plinthic or G-horizons; Seepage zones on gentle footslopes and valley bottoms (1-3% slopes).	Moderate	Low to none	Wetland	Temporary/ Seasonal wetland	Interflow	6.90	9.57
* **Dominant soil form and family**								**TOTAL**	**72.08**	**100.0**

8.5.2. Soil chemistry

A sample of the A-horizon of the dominant soil types was taken at 2 localities and the analytical results are shown in **Table 11**. The average values of the cations, potassium (K), calcium (Ca), magnesium (Mg) and sodium (Na) as well as phosphorus (P), pH and resistance (RS) were calculated and highlighted in green.

Table 11: Soil analysis results

Samp Point	Soil Form	Hor	Depth	K	Ca	Mg	Na	*Titr.Acid	*Acid saturat.	R_S (resistance)	P (Bray1) mg/kg	pH (H_2O)
				mg/kg	mg/kg	mg/kg	mg/kg					
				Ammonium acetate				cmol(+)/kg	%	ohm		
Sampling points in cultivated land												
AP5	Avalon 1200	A	0-250	61	357	100	1.8	-	-	3210	1.8	6.28
AT6	Hutton 1200	A	0-250	90	326	60	0.2	-	-	2270	34.4	6.08
Average				**75.5**	**341**	**80**	**1.0**			**2740**	****1.8/34**	**6.18**

*****Analyses done when pH is below 5.5
** A sensible average could not be calculated

8.5.3. Soil fertility status

The average concentration values of the cations (K, Ca, Mg and Na) as well as phosphorus, pH and resistance (highlighted in green, **Table 11**) were compared to general fertility guidelines in **Table 12**.

Table 12: Soil fertility compared to broad fertility guidelines

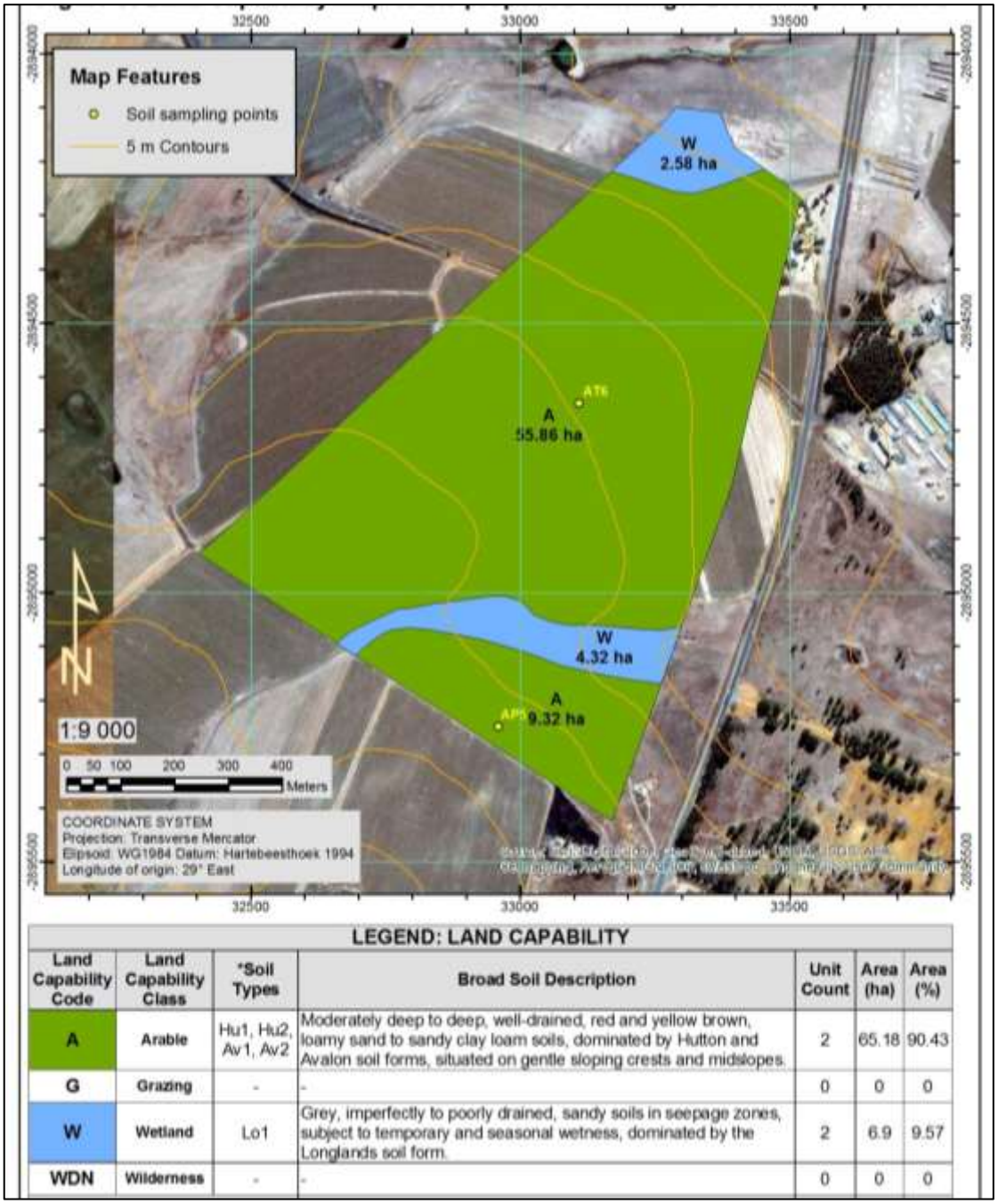
Element or measurement	Unit	Guidelines Low	Guidelines High	Current status rating Averagevalue	Current status rating Rating	Optimum status
Potassium (K)	mg/kg	<40	>250	**75**	Moderate	80-150
Calcium (Ca)	mg/kg	<200	>3000	**341**	Moderate	600-1000
Magnesium (Mg)	mg/kg	<50	>250	**80**	Moderate	80-150
Ca:Mg (cmol(+)/kg)	Ratio	<2	>4	**2.7**	Moderate (good)	2-4
Acid saturation	%	<10	>30	**-**		<20
Sodium (Na)	mg/kg	<50	>200	**1.0**	Low (positive in terms of sodicity)	<50
Resistance	ohm	<200	>300	**2740**	High (positive in terms of salinity)	>300
Phosphorus (P)	mg/kg	<5	>35	**1.8** (Pasture)	Very low	10-20
				34 (Fields)	Moderately high	30-40
pH(H_2O)	Very acid		<4.5	**6.18**	Moderately acid	5.8-6.8
	Acid		4.5-5.5			
	Moderately acid		5.5-6.5			
	Slightly acid – slightly alkaline		6.5-7.5			
	Moderately alkaline		7.5-8.5			
	Strong alkaline		>8.5			

The average K, Ca and Mg concentrations are moderate and indicate a fairly build-up soil chemical status. The low average Na concentration of 1.0 mg/kg is positive and indicates no

accumulation of sodium and implies an absence of sodic soil conditions. The high resistance value of 2740 ohm confirm low salt concentrations and subsequent the absence of saline soil conditions. The P concentration of 1.8 mg/kg in pasture is very low while 34 mg/kg in fields indicate a well build-up status. The average ration of Ca to Mg is 2.7 which is good and indicate that Ca concentrations are sufficient to buffer the destabilization effect of Mg on soil structure.

8.6. Pre-mining land capability

Pre-mining land capability for all the map units was determined, by Rehab Green (January 2019), and the location and extent of land capability classes within the proposed mining area, which include a wetland category, is shown in **Figure 14**.



LEGEND: LAND CAPABILITY

Land Capability Code	Land Capability Class	*Soil Types	Broad Soil Description	Unit Count	Area (ha)	Area (%)
A	Arable	Hu1, Hu2, Av1, Av2	Moderately deep to deep, well-drained, red and yellow brown, loamy sand to sandy clay loam soils, dominated by Hutton and Avalon soil forms, situated on gentle sloping crests and midslopes.	2	65.18	90.43
G	Grazing	-	-	0	0	0
W	Wetland	Lo1	Grey, imperfectly to poorly drained, sandy soils in seepage zones, subject to temporary and seasonal wetness, dominated by the Longlands soil form.	2	6.9	9.57
WDN	Wilderness	-	-	0	0	0

Figure 14: Soil map of the proposed Vlaklaagte Block OC6

The land capability of the mining area is summarized in **Table 13**, which shows the soil types grouped into each land capability class, a broad description of the soil group, the number of units per land capability class, and the area and percentage comprised by each land capability class.

Table 13: Pre-mining land capability classes

LEGEND: LAND CAPABILITY						
Land Capability Code	**Land Capability Class**	***Soil Types**	**Broad Soil Description**	**Unit Count**	**Area (ha)**	**Area (%)**
A	**Arable**	Hu1, Hu2, Av1, Av2	Moderately deep to deep, well-drained, red and yellow brown, loamy sand to sandy clay loam soils, dominated by Hutton and Avalon soil forms, situated on gentle sloping crests and midslopes.	2	65.18	90.43
G	**Grazing**	-	-	0	0	0
W	**Wetland**	Lo1	Grey, imperfectly to poorly drained, sandy soils in seepage zones, subject to temporary and seasonal wetness, dominated by the Longlands soil form.	2	6.9	9.57
WDN	**Wilderness**	-	-	0	0	0
***See soil map, Figure 14			**Total**	**4**	**72.08**	**100.0**

8.7. Physical Character - Surface Water

A Hydrological Assessment was done for 2 Seam by Ground Water Consulting Services (Pty) Ltd (GCS) and a report containing the information and outcomes, dated 7 December 2016, was utilised to compile this section of the report.

The mining site area falls within the Olifants River Catchment, and within Quaternary Catchment Area B11B. The tributary to the Olifants River flows on the north western boundary of the proposed opencast operations at Lourens 472 IS. The confluence of the tributary and the Olifants River is on RE of the farm Clydesdale 483 IS northeast of the mining area.

The effective catchment in terms of surface runoff is approximately 490 km^2.

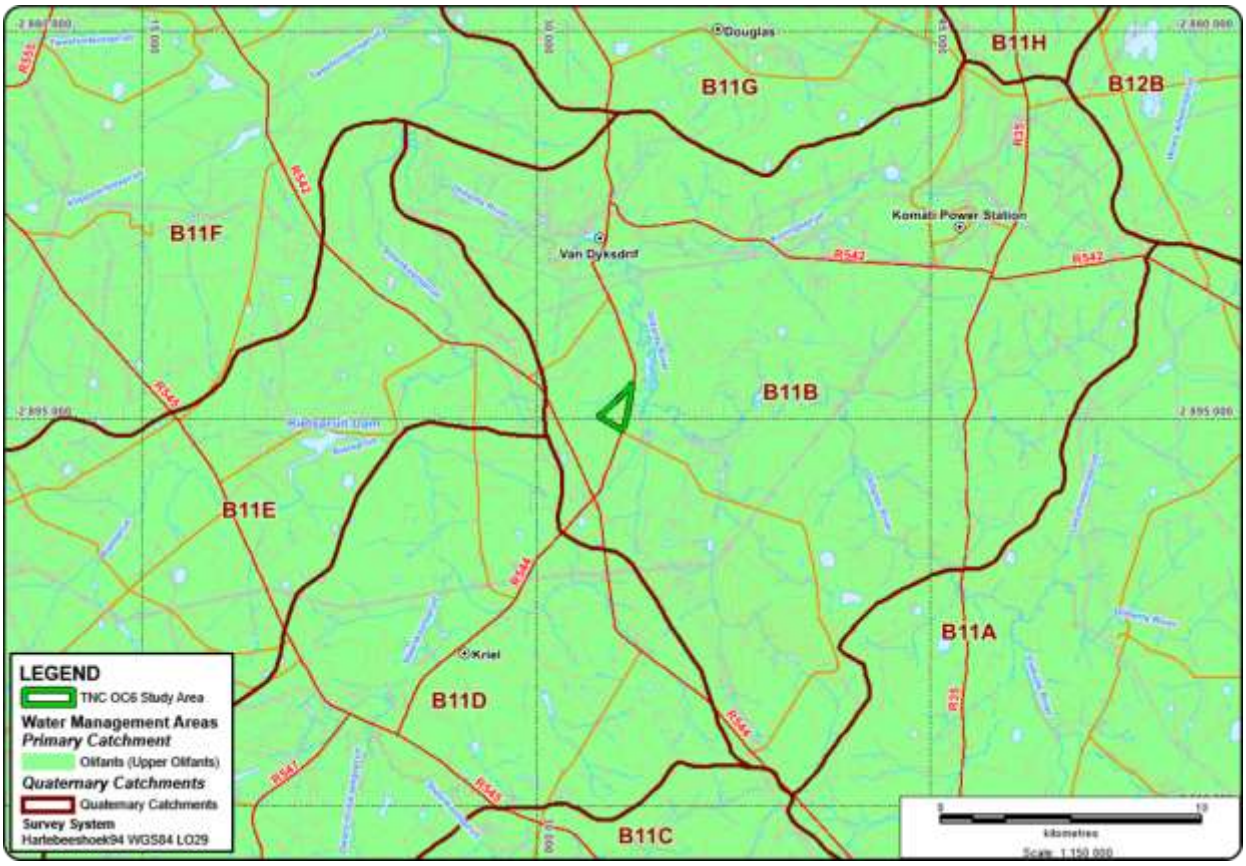


Figure 15: Quaternary catchment areas

Surface Water Quantity

The Mean Annual Runoff (MAR) of the B11B catchment is 13.8 million m^3 per year based on average rainfall.

Water authority

Department of Water and Sanitation: Mpumalanga Regional Office, Bronkhorstspruit.

Surface Water Quality

Surface water monitoring points were identified during the scoping process and are reflected in **Figure 16**. Monitoring only commenced during November 2018 and qualities are presented in **Table 14**. SWL 1 and SWL 2 were dry during the November and December 2018 sampling runs.

The in-stream water quality of SWL 3 is within most of the limits set for the Upper Olifants River Management Unit 3, as per the Resource Quality Objectives as required by the DWS. Fluoride and Aluminium concentrations were slightly higher during one of the sampling runs. Alkalinity

exceeded the WQL during the March 2019 sample run. The monitoring point SWL 3 represents the downstream point in the Olifants River for the Vlaklaagte OC6 Project.

Only one monitoring point data is reflected as the other 2 points were dry during all the sample runs.

Table 14: Background surface water quality profile – evaluated against the SANS 241 – 2015 Domestic Use guidelines

	Background Water Quality (Nov '18 – Mar '19)			WQPL - Upper Olifants MU3	SANS 241 - 2015 Domestic Water
	SWL 1	SWL 2	SWL 3		Limit
pH	DRY	DRY	8.08-8.41	6.5 - 8.5	5 – 9.7
EC (mS/m)			≤75	<90	170 (Aesthetic)
TDS (mg/L)			≤576	<500	120 (Aesthetic)
Ca (mg/L)			≤60.1	<110	
Mg (mg/L)			≤42.2	<70	
Na (mg/L)			≤43.4	<70	200 (Aesthetic)
K (mg/L)			≤7.72	<25	
Cl (mg/L)			≤18.6	<50	300 (Aesthetic)
T.Alk. (mg/L)			155-205	120	
SO_4 (mg/L)			≤228	<300	250 (Aesthetic), 500 (Acute health)
NO_3 - N (mg/L)			≤0.1	<0.2	<11 (Acute health)
F (mg/L)			≤0.77	<0.75	1.5 (Chronic health)
Fe (mg/L)			≤0.05	< 0.3	<0.3 (Aesthetic), 2 (Chronic health)
Mn (mg/L)			≤0.06	< 0.15	0.1 (Aesthetic), 0.4 (Chronic health)
Al (mg/L)			≤0.04	<0.02	<0.3 (Operational)

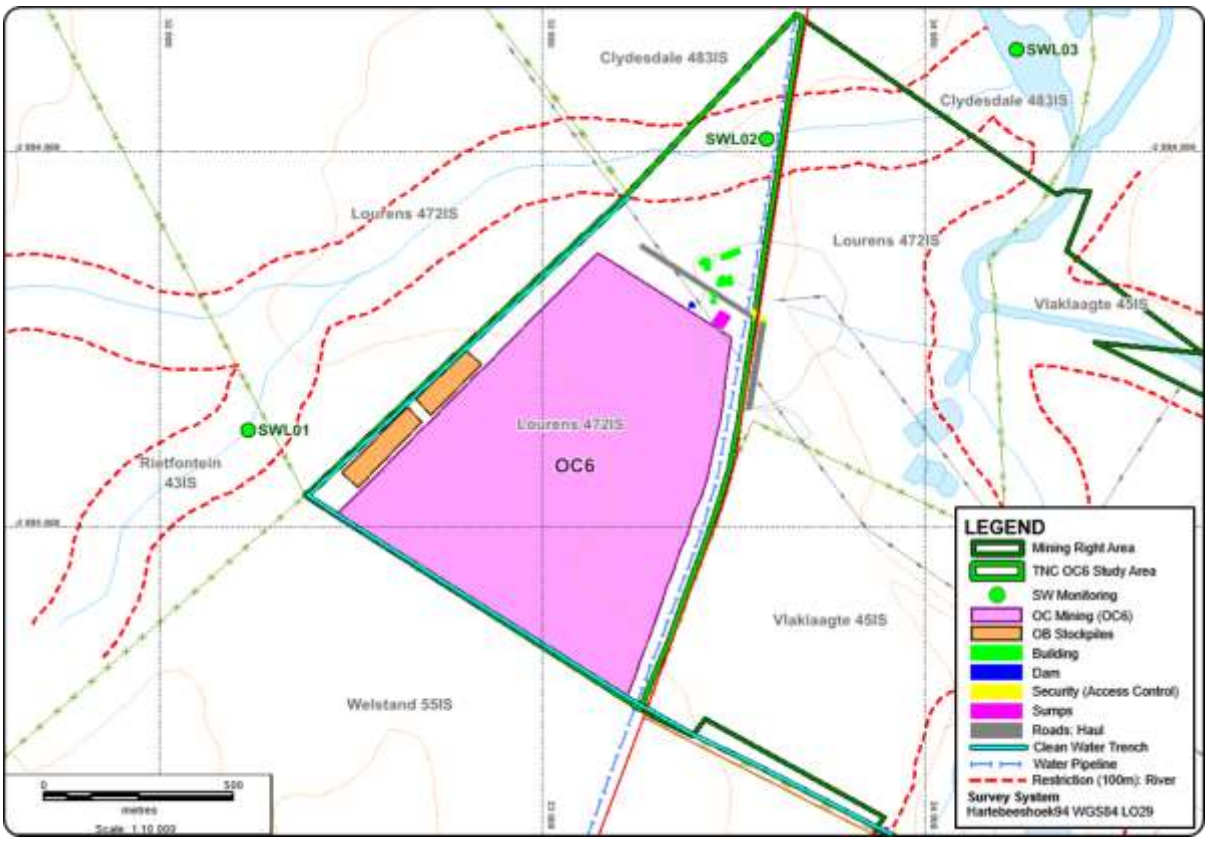


Figure 16: OC6 Surface Water Monitoring points

8.7.1. Floodlines for the tributary of the Olifants river in the vicinity of the Vlaklaagte OC6 Project

The OC6 project falls within the Olifants River Water Management Area (WMA 4) and more specifically within Quaternary Catchment B11B.

The TNC OC6 Project is in close proximity to the Olifants River and the western wetland system is a small tributary of the Olifants River and flows from south-west to north-east.

The Western stream of the TNC OC6 Project has a catchment area of ±6.69 km².

The 1:100 floodlines for the tributary, in the vicinity of the OC6 project area are illustrated on **Figure 17**. The red line represents the 1:100 flood line with blue line the 100m buffer line.

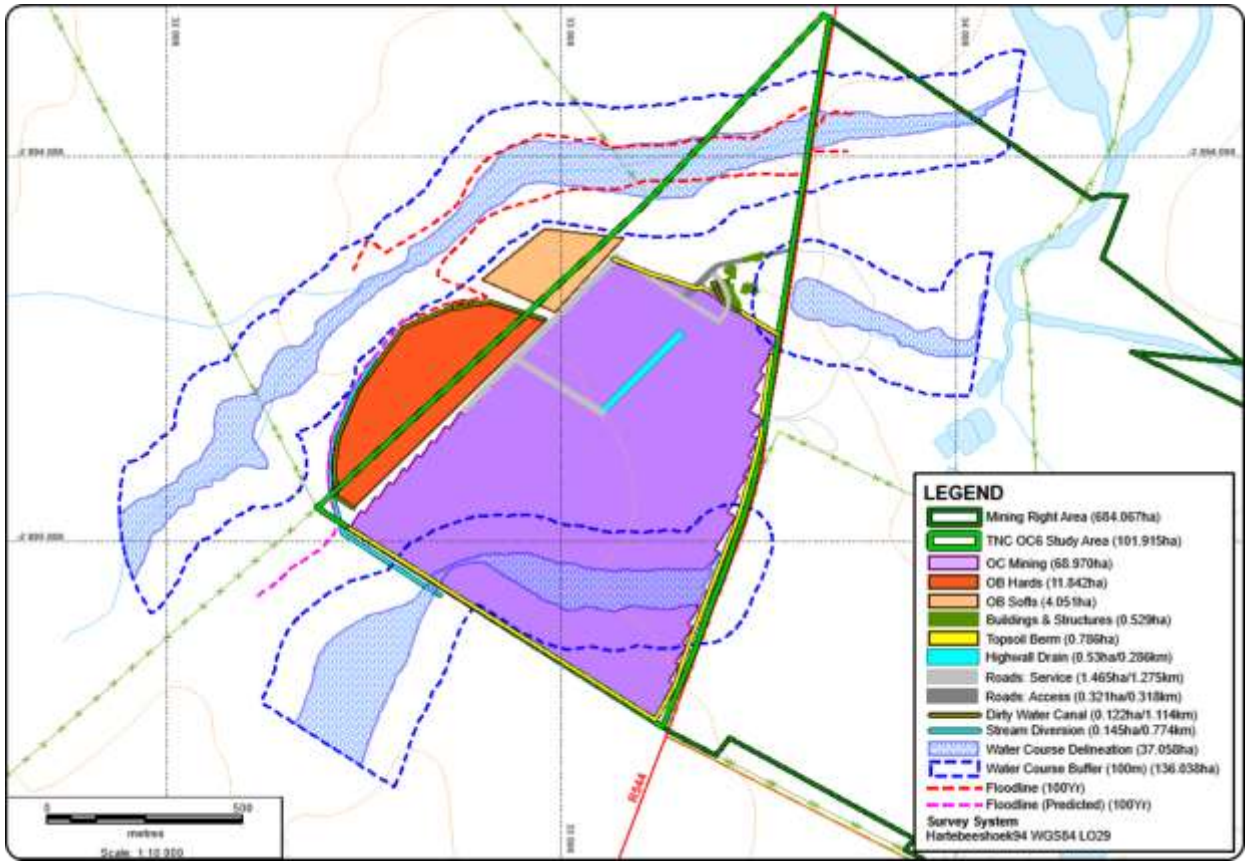


Figure 17: Floodlines within close proximity to the OC6 Project site

8.7.2. River Diversions

The clean-water areas are diverted away from the impacted mining areas including the small stream diversion to the south of the mining area.

A stream diversion of the eastern stream to the western stream is planned via a gravel canal which is designed for a 1:100 flood event. The canal will be set out a 1:200 slope.

8.8. Physical Character - Ground Water

The Hydrogeological Assessment was conducted by GCS Water and Environmental Consultants as part of the EIA for the Vlaklaagte Mine. An update of the report, to include the Block OC6 mining, was concluded in April 2019. The report is attached as **Annexure 10.**

8.8.1. Aquifer Types

The conceptual geohydrological model of the area is based on the generally accepted model for the Mpumalanga coal fields. Three principal aquifers are identified: the weathered aquifer; the fractured Karoo aquifer; and the fractured pre-Karoo aquifer (Hodgson & Krantz, 1998). The Karoo rocks are not known for the development of aquifers but occasional high-yielding boreholes may be present. The aquifers that occur in the area can therefore be classified as minor aquifers (low yielding), but of high importance (Parsons, 1995).

According to WRC report 291/1/98, three distinct superimposed groundwater systems are present within the Olifants River Catchment. They can be classified as:
The upper weathered Ecca aquifer (shallow aquifer formed in the weathered zone of the Karoo sediments and which is locally perched on the fresh bedrock);
The fractured aquifers within the unweathered Ecca sediments; and
The aquifer below the Ecca sediments consisting of low yielding Dwyka and/or basement rocks.

These types of groundwater systems are common to the groundwater regime that characterises a Karoo environment. The systems do not necessarily occur in isolation of one another, more often than not forming a composite groundwater regime that is comprised of one, some, or all of the systems. Good hydraulic connectivity often exists between the two top aquifers and they have consequently been treated as a single unit in the modelling of groundwater flow-related systems.

The weathered aquifer is perched and occurs at depths of 0 – 15 metres below ground level (mbgl). The lower 5 to 10 meters of the perched aquifer is saturated due to the impervious nature of the competent, horizontally stratified lithologies of the underlying fractured aquifers. The saturated depth of this aquifer is dependent on rainfall recharge thus influx of water into an opencast mining operation is expected to vary seasonally. Highly variable recharge occurs over

the area, but generally values are between 1 and 3% of the Mean Annual precipitation (MAP) based on work by Kirchner etal. (1991) and Bredenkamp (1978) in other parts of the country.

Shallow Weathered Aquifer:

The Ecca sediments consist of in-situ weathered material and transported material with a thickness which varies between 5 to 15 meters below surface in the Project area. The upper aquifer is associated with this weathered zone and water is often found within a few meters below surface. This aquifer is recharged by rainfall.

Rainfall that infiltrates the weathered rock reaches an impermeable layer of shale underlying the weathered zone. The movement of groundwater on top of this shale is lateral and in the direction of the surface slope. This water reappears on surface at fountains where the flow paths are obstructed by a barrier, such as a dolerite dyke, paleo-topographic highs in the bedrock, or where the surface topography cuts into the groundwater level at streams.

The aquifer within the weathered zone is generally low-yielding (range 100 – 2000 l/h) because of its insignificant thickness. Few farmers therefore tap this aquifer by borehole. Wells or trenches dug into the upper aquifer are often sufficient to secure a constant water supply of excellent quality.

Fractured Karoo rock Aquifer:

The pores within the Ecca sediments are too well cemented to allow any significant permeation of water. All groundwater movement is therefore along secondary structures, such as fractures, cracks and joints in the sediments. These structures are better developed in competent rocks such as sandstone, hence the better water-yielding properties of the latter rock type..

8.8.2. Groundwater levels

Groundwater levels were sourced from several projects in the vicinity of the project site. A summary of the data points used in this study are presented in **Table 15**. Groundwater levels in the vicinity of the Project site show groundwater levels in the range of 0.4 mbgl to 21.9 mbgl with an average depth of ~9 mbgl. Groundwater levels deeper than 25 mbgl were not taken into account as these likely do not represent natural static groundwater levels but are influenced by active pumping, mining activities or other anthropogenic activities. Groundwater levels at the Project site indicate groundwater levels in the range of 1.3 mbgl and 20.3 mbgl, with an average of ~10 mbgl.

Table 15: Summary of groundwater monitoring data points in the vicinity of the study area

Source	Year measurements	No. of measurements
On-site monitoring boreholes	2016	5
Information from client	2016	10
2 Seam Pty Ltd Mine hydrocensus	2016	20
Dorstfontein West groundwater monitoring boreholes	2014	18
Groundwater Square hydrocensus TNC Village	2009/2011	11
GCS NCC colliery hydrocensus	2011/2012	6
2 Seam Pty Ltd Mine monitoring boreholes	2014/2016	13

The groundwater levels of boreholes in **Table 15** were compared to the existing topography and used as input into the numerical groundwater model. A linear correlation was observed between groundwater levels and surface topography elevations. As is evident in **Figure 18** a good correlation of groundwater levels was found in the 2 Seam Pty Ltd Mine study area (R2 = 98%). The correlation therefore suggests that the groundwater levels within the study area generally follow topographical gradients.

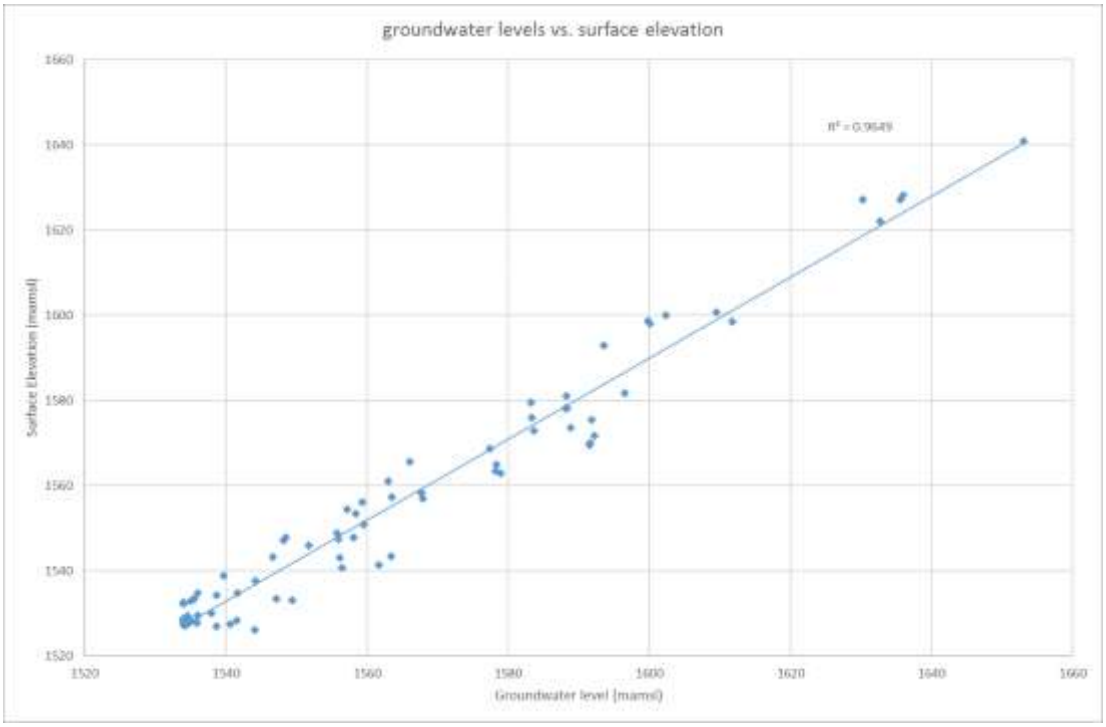


Figure 18: Correlation between surface elevation and groundwater level

Groundwater use

The groundwater is used mainly for mining, agriculture (stock watering) and domestic purposes.

8.8.3. Groundwater quantity

The depth to groundwater in this area (BH1) is less than 6m deep. The hydraulic conductivity is typical of the Karoo Aquifers and was calculated by fitting the results of the Falling-Head Slug with the Bouwer-Rice curve. The value calculated came to 0.025 m/day with the other boreholes in the broader area between 0.025 and 0.7 m/d. The transmissivity values range between 0.7 and 2.8 m^2/d.

The average rainfall for the area is 711 mm/a. The rate of recharge of rainwater to the underlying aquifers is approximately 2% of the mean annual precipitation (MAP).

8.8.4. Groundwater quality

A total of ten (10) groundwater samples were assessed including five (5) hydrocensus and five (5) mine monitoring boreholes (existing and newly drilled). The analytical results were compared to the South Africa National Standard (SANS 241-1:2011) Class 1 water quality standards for drinking water in order to evaluate the groundwater quality.

GCS conducted a hydrocensus in the project area within an approximate 2 km radius of the proposed mining activities. **Table 16** and **Figure 19** present all of the boreholes visited during the GCS 2016 hydrocensus investigation.

The analytical results can be seen in **Table 16**. The weathered and upper fractured Karoo lithologies are considered the main aquifer in the study area.

Monitoring borehole BH5 shows exceedance over the SANS limits for Electrical conductivity, sulphate and nitrate, and shows elevated sodium not exceeding the SANS limit. BH3 and NBH5A show elevated Electrical conductivity, sulphate and sodium. This is likely related to the old underground mining at the Project site. The pH range between 7.2 – 8.1 indicates no Acid Rock Drainage (ARD) is currently forming in the underground voids. In NBH5A the manganese concentration of 0.83 mg/l exceeded the SANS standard of 0.4 mg/l. Manganese concentrations can be elevated in reducing conditions, which could be caused by the borehole's close proximity to the river.

It can be concluded that the overall groundwater quality measured in third party boreholes is of good to moderate quality when compared to drinking water standards. However, boreholes NBH5A, BH2, BH3 and BH5, all located at the Vlaklaagte Mine site, show a potential impact by the historic mining activities.

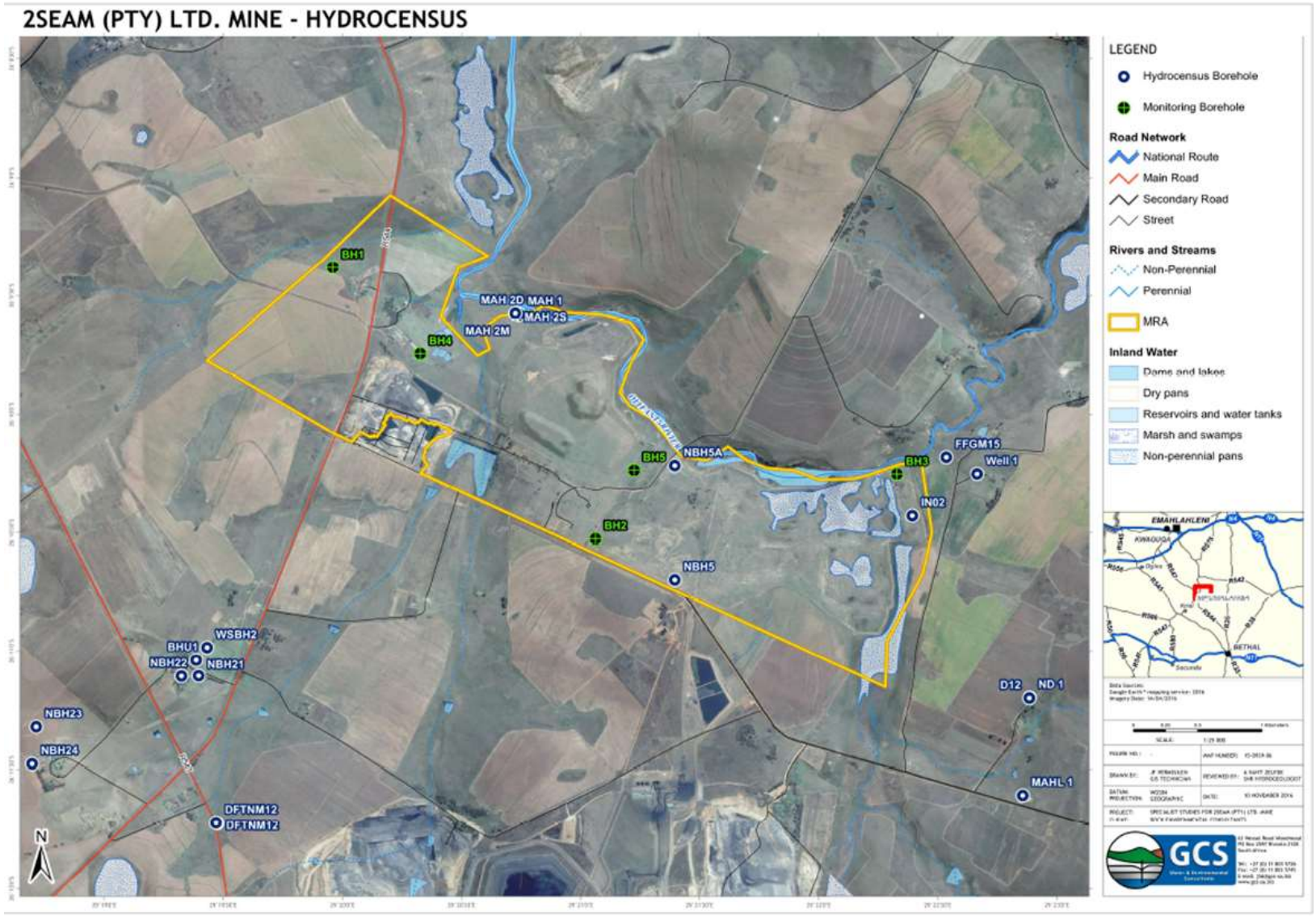


Figure 19: Hydrocensus points and hydrogeological exploration borehole locations

Table 16: Background groundwater quality profile – evaluated against the SANS 241 – 2011 Domestic Use guidelines

Parameters (units in mg/l unless otherwise stated)	South Africa National Standard (SANS 241-1:2011)	Hydrocensus boreholes					2 Seam Pty Ltd Mine Monitoring Boreholes				
		D12	NBH5	NBH5A	NBH23	NBH24	BH1	BH2	BH3	BH4	BH5
pH in water at 25ºC	5-9.7	8	8.1	7.5	7.8	8	8.1	7.2	7.61	7.21	8.05
Conductivity in mS/m @ 25ºC	<170	42	19.8	75.1	40.2	33	24.4	27.6	117	14.7	297
Total Alkalinity as CaCO3	NS	233	110	208	186	85.6	115	98.8	303	59.3	357
Calcium	NS	34.7	14.5	61.2	15.2	18.4	17.3	28	93.1	9.59	284
Magnesium	NS	31.2	12.2	50.7	7	9.9	13.3	10.9	63	5.18	167
Sodium	<200	13.5	9.4	44.2	71.8	24.8	13.7	17.5	89.3	11.6	181
Potassium	NS	2	5.5	4.8	4.2	9.3	9.21	3.87	4.36	3.65	13.6
Chloride	<300	4.3	4.8	7	29.9	20.3	11.2	8.02	18.2	5.49	97.6
Sulphate	<500	11.2	3.8	244	2.9	4.3	11.4	52.4	410	1.79	1172
Nitrate as N	<11	0.3	1.1	0.5	2.7	10.9	0.198	0.448	0.197	1.48	75.5
Orthophosphate as P	NS	0.06	0.06	0.06	0.08	0.15	0.03	0.032	0.031	0.03	0.031
Aluminium	0.3	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.206	<0.002	<0.002	<0.002
Barium	0.7	0.1	<0.001	<0.001	0.13	0.105	0.265	0.014	0.027	0.234	<0.001
Iron	2	<0.004	0.11	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Manganese	0.4	<0.001	<0.001	0.83	<0.001	<0.001	0.13	0.15	0.1	0.054	0.352
Zinc	5	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Ammonium (NH4 as N)	<1.5	0.223	0.396	0.784	0.252	0.466	0.067	0.12	0.62	0.064	0.33
Fluoride	<1.5	0.275	<0.263	0.566	0.603	<0.263	0.398	0.269	0.586	0.385	0.603
Strontium	NS	0.013	<0.001	0.316	0.118	0.04	0.077	0.009	1.68	0.004	1.18
Chrome	0.05	-	-	-	-	-	<0.003	<0.003	<0.003	<0.003	<0.003
Copper	2	-	-	-	-	-	<0.002	<0.002	<0.002	<0.002	<0.002
Nickel	0.07	-	-	-	-	-	<0.002	<0.002	<0.002	<0.002	<0.002
Cobalt	NS	-	-	-	-	-	<0.003	<0.003	<0.003	<0.003	<0.003
Cadmium	<0.003	-	-	-	-	-	<0.002	<0.002	<0.002	<0.002	<0.002
Lead	0.01	-	-	-	-	-	<0.004	<0.004	<0.004	<0.004	<0.004
Arsenic	<0.01	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01
Selenium	NS	-	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005
Beryllium	NS	-	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	NS	-	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001

For most samples Magnesium is the dominant cation and in most cases exceeds Calcium.in NBH23 sodium is the dominant cation, with low calcium and magnesium concentrations. Bicarbonate is the most dominant anion for most samples with exception of NBH5A, BH2, BH3 and BH5, for which sulphate is the dominant cation.

Based on these results the dominant groundwater type in the area is of a Mg-Ca-HCO3 type, indicating of an aquifer that has recently been recharged, with most constituents in groundwater derived from rock-water interaction. This would be consistent with the weathered and upper fractured lithologies being the main aquifer.

BH1 shows results of an aquifer recently recharged with a slight elevation in Manganese concentration. The results for 2018 are presented in **Table 17**.

Table 17: Background groundwater quality profile (BH1) – evaluated against the SANS 241 – 2015 Domestic Use guidelines

Parameters (units in mg/l unless otherwise stated)	South Africa National Standard (SANS 241-1:2015)	2 Seam Pty Ltd Mine Monitoring Borehole BH1				
		Aug 2018	Sept 2018	Oct 2018	Nov 2018	Dec 2018
pH in water at 25ºC	5-9.7	7.95	8.17	7.93	7.91	8.23
Conductivity in mS/m @ 25ºC	<170	29.8	33.9	31.7	31.2	33.6
Total Alkalinity as CaCO3	NS	83	87	85	83	59
Calcium	NS	15.3	15.6	16.0	15.6	16.7
Magnesium	NS	10.20	10.80	10.70	11.00	10.50
Sodium	<200	27.9	28.6	29.5	28.6	30.8
Potassium	NS	7.05	7.10	6.81	6.75	7.90
Chloride	<300	33.40	33.20	32.60	35.00	34.40
Sulphate	<250	31.60	32.20	34.60	32.70	34.20
Nitrate as N	<11	0.10	0.10	0.10	0.10	0.21
Aluminium	0.3	0.03	0.02	0.02	0.01	
Iron	0.3	0.090	0.040	0.070	0.030	0.070
Manganese	0.1	0.14	0.14	0.12	0.12	0.12
Fluoride	<1.5	0.93	0.86	0.91	0.85	0.89

8.9. Physical Character - Air Quality

8.9.1. Baseline Air Quality

Activities at the Vlaklaagte OC6 project area took place underground, but opencast mining is conducted on the rest of the Vlaklaagte mine area. Potential sources of pollutants which may be of importance in terms of impact potentials include:

- Cultivation of agricultural for annual crop production (economic);
- Coal mining on the eastern boundary of the project site;
- Fugitive emissions from industrial, mining commercial and miscellaneous operations (wind erosion of open areas, vehicle-movement of dust along paved and unpaved) roads; and
- Vehicle Exhaust emissions.

No dust buckets were installed on the OC6 area as yet but the closest to the project area as part of the Vlaklaagte Mine monitoring programme is Vlak D4 and Vlak D5 and the results are presented in the graph in **Figure 20** below. No mining commenced on the OC6 area yet and

D4 dust fall-out results is below the SANS Residential guideline with D5 frequently straying above the Industrial guideline.

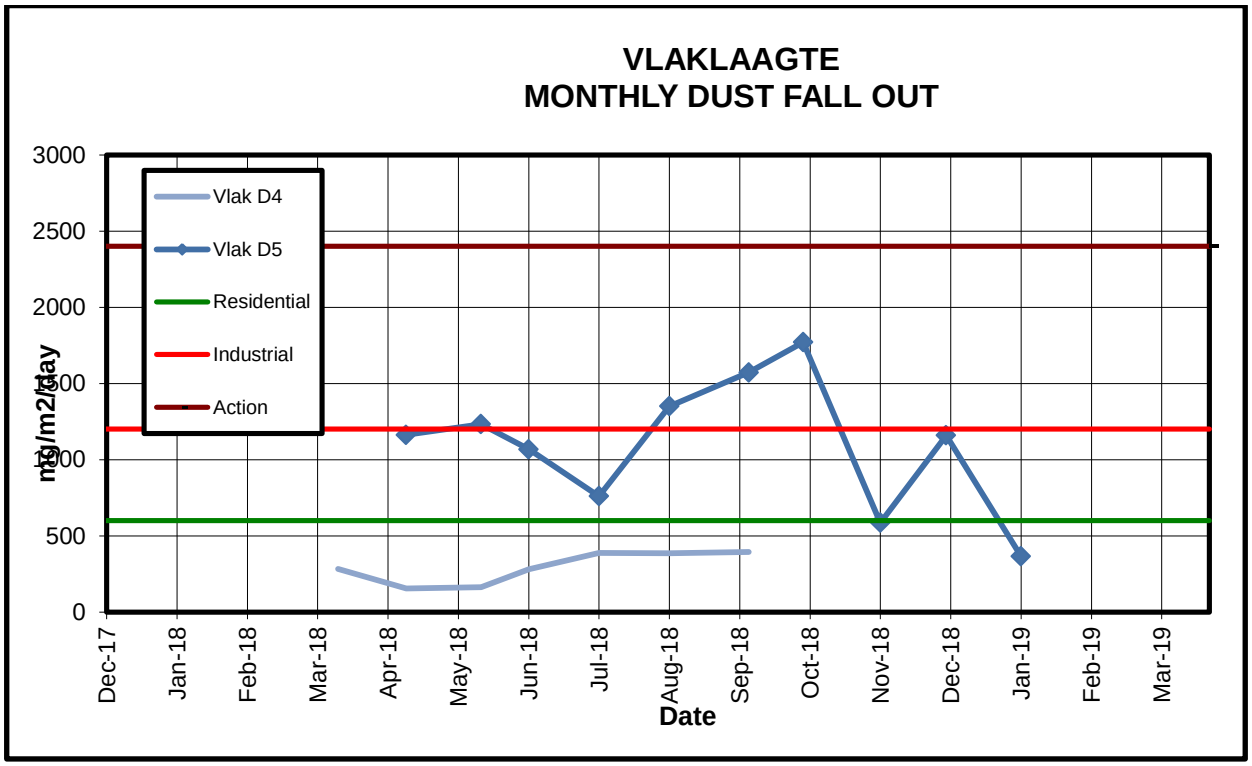


Figure 20: Vlaklaagte Monthly dust fall out for D4 & D5

8.9.2. Air quality monitoring

Dust fall-out at Vlaklaagte Mine is monitored on a monthly basis via dust buckets at the monitoring points closest to OC6 is indicated on **Figure 21**. No Dust monitoring commenced on the Block OC6 area yet. Latest results for Vlak D4 and Vlak D5 is presented in **Figure 20** and monitoring plan will be adjusted to include monitoring points at the new project area when activities commence. Monitoring will continue during the Life of Mine (LOM).

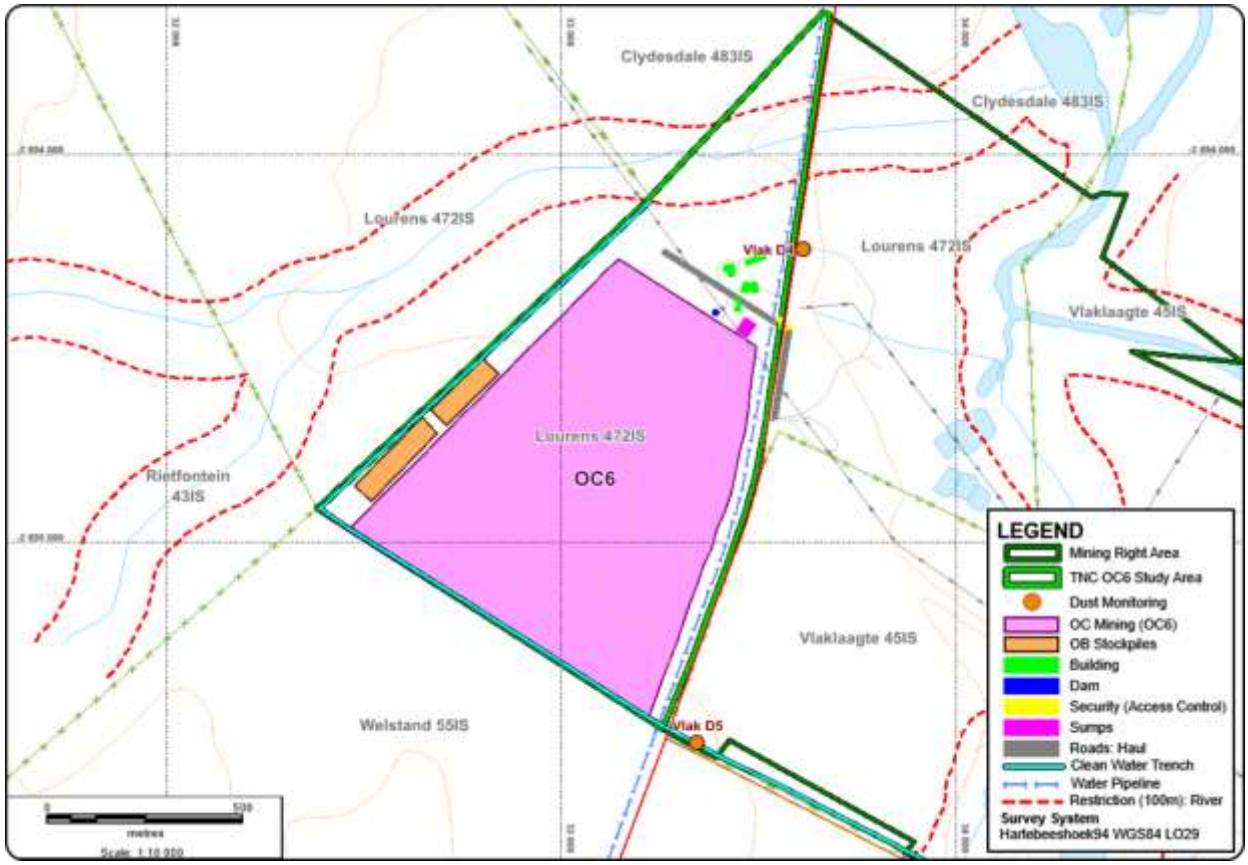


Figure 21: Dust fall-out monitoring points close to the study area

8.9.3. Dust sensitive environments

No dust sensitive environments were identified that might be impacted by these activities.

8.10. Physical Character - Noise

The proposed activities will contribute to noise levels due to blasting operations, and operation of heavy machinery and coal trucks. Other noise sources include agricultural activities. Agricultural noise is more seasonal however, whereas mining activities generate noise levels all year round. Excessive noise from mining activities can be highly disruptive to persons and fauna living in close proximity to them.

The ambient sound levels at the receiver points surrounding Vlaklaagte OC6 are expected to be typical of a rural setting. According to the SABS (1983), the ambient daytime sound level for rural residential areas (outdoors) is approximately 45 dBA. The expected outdoor ambient sound level is approximately 40 dBA during the evenings or on weekends, and, 35 dBA during the night (**Table 18**).

Table 18: Ambient Sound levels (dBA) for rural residential areas (SABS:1983)

Time of Day	Outdoor Spaces	Indoor Spaces

Time of Day	Outdoor Spaces	Indoor Spaces
Day	45	35
Evenings / Weekends	40	30
Night	35	25

Source: South African Bureau of Standards, 1983

Current sources of noise in the proposed area include the following:

- Traffic noise on the R544;
- Existing neighbouring mining operations and associated infrastructure; and
- Existing agricultural activities.

The Vlaklaagte OC6 project is not expected to have a significant impact on noise levels in the area.

8.11. Physical Character - Sensitive landscapes

Scientific Aquatic Services (SAS) was appointed to conduct a freshwater resource assessment as part of the environmental assessment and authorisation for the proposed Vlaklaagte OC6 mining expansion activities in Mpumalanga. The following information was sourced from this assessment.

A field assessment was undertaken in July 2018 during the winter period, during which the presence of any freshwater characteristics as defined by DWAF (2008) and by the NWA, were noted. In addition to the delineation process, detailed assessment of the delineated watercourses was undertaken, at which time factors affecting the integrity of the watercourses were taken into consideration and aided in the determination of the functioning and the ecological and socio-cultural services provided by the watercourses.

The delineation of the watercourses was verified in the field, and this delineation took place according to the method presented in the “Updated manual for the identification and delineation of wetland and riparian resources” (DWAF, 2008). The foundation of the method is based on the fact that watercourses have several distinguishing factors including the following:

- Landscape position;
- The presence of water at or near the ground surface;
- Distinctive hydromorphic soils;
- Vegetation adapted to saturated soils; and
- The presence of alluvial soils in stream systems.

During the field assessment, two valley bottom wetlands were identified within the study area and are described below:

- A channelled valley bottom (CVB) system is located within the northern portion of the study area. This wetland flows in a south-west to north-east direction and drains into the Olifants River, located outside of the study area; and
- An unchannelled valley bottom (UCVB) wetland is located within the southeastern corner of the study area. This wetland seems to have historically formed part of a larger wetland system which ultimately drains into the Olifants River. Due to the recent mining activities (2012 - 2013) opposite the eastern boundary of the study area, the downstream portion thereof (outside of the study area) has been cut off from the upstream portion. Nevertheless, the upstream portion within the study area is still hydrologically functional.

Table 19 below presents the classification from level 1 to 4 of the Wetland Classification System.

Table 19: Characterisation of the wetland resources

Resource	Level 1: System	Level 2: Regional Setting	Level 3: Landscape unit	Level 4: HGM Type
Watercourses within the study area	**Inland:** An ecosystem that has no existing connection to the ocean but which is inundated or saturated with water, either permanently or periodically.	**Highveld Ecoregion:** The subject property falls within the Highveld Ecoregion. **NFEPA WetVeg Group:** Mesic Highveld Grassland Group 4.	**Valley:** The typically gently sloping, lowest surface of a valley.	**Channelled Valley Bottom:** A valley bottom wetland with a river channel running through it. **Unchannelled Valley Bottom:** A valley bottom wetland without a river channel running through it.

The surrounding area of these wetlands consists mainly of agricultural activities and mining activities (outside of the study area). Agricultural fields are within very close proximity to the wetland temporary boundaries, specifically surrounding the most southern portion of the UCVB wetland.

Figure 22: The location of the delineated resources identified during site assessment.

8.12. Biological Character - Ecology and Biodiversity: Sensitive Area

Scientific Aquatic Services (SAS) was appointed to conduct a freshwater ecological assessment associated with the proposed Vlaklaagte OC6 open cast mining operation, October 2018. The report is included in **Appendix 11**.

The objective of the study was to identify areas of increased aquatic Ecological Importance and Sensitivity (EIS) and to define the Present Ecological State (PES) of the aquatic resource in the vicinity of the proposed development. Objectives were addressed based on assessment of available databases, visual and habitat assessments as well as assessments of the fish and aquatic macro-invertebrate communities of the system according to the relevant indices and ecostatus models. All work was undertaken by South African River Health Program (SARHP) accredited assessors.

Table 20: Aquatic ecostatus (Kleynhans 1999):

Freshwater Resource	PES	Ecoservices	EIS	REC
Channelled Valley Bottom Wetland	C (Moderately Modified)	Intermediate	B (High)	C (Moderately Modified)
Unchannelled Valley Bottom Wetland	D (Largely Modified)	Intermediate	C (Moderate)	D (Largely modified)

EIS = Ecological Importance and Sensitivity;
PES = Present Ecological Status;

Table 21: Summary of the ecological status of the sub-quaternary catchment (SQ) reach Olifants River (B11B-01327) based on the DWS RQS PES/EIS database

Synopsis (SQ reach Olifants River, B11B-01327)					
PES category median	**Mean EI class**	**Mean ES class**	**Length**	**Stream order**	**Default EC**
C (Moderately modified)	High	High	36	3	B (High)
PES details					
Instream habitat continuity MOD	Small	Riparian/wetland zone MOD	Small	Instream habitat continuity MOD	Small
RIP/wetland zone continuity MOD	Small	Potential flow MOD activities	Moderated	RIP/wetland zone continuity MOD	Small
Potential instream habitat MOD activities	Moderate	Potential physico-chemical MOD activities	Large	Potential instream habitat MOD activities	Moderate
EI details					
Fish spp/SQ	7	Fish average confidence	3,57	Fish spp/SQ	7
Fish representativity per secondary class	Low	Fish rarity per secondary class	Moderate	Fish representativity per secondary class	Low
Invertebrate taxa/SQ	45	Invertebrate average confidence	3,71	Invertebrate taxa/SQ	45
Invertebrate representativity per secondary class	High	Invertebrate rarity per secondary class	Very high	Invertebrate representativity per secondary class	High
EI importance: riparian-wetland-instream vertebrates (excluding fish) rating	High	Habitat diversity class	Low	EI importance: riparian-wetland-instream vertebrates (excluding fish) rating	High
Habitat size (length) class	High	Instream migration link class	Very high	Habitat size (length) class	High
Riparian-wetland zone migration link	Very high	Riparian-wetland zone habitat integrity class	Very high	Riparian-wetland zone migration link	Very high

Synopsis (SQ reach Olifants River, B11B-01327)					
Instream habitat integrity class	High	Riparian-wetland natural vegetation rating based on percentage natural vegetation in 500m	N/A	Instream habitat integrity class	High
Riparian-wetland natural vegetation rating based on expert rating					N/A
ES details					
Fish physical-chemical sensitivity description	High	Fish no-flow sensitivity	High	Fish physical-chemical sensitivity description	High
Invertebrates physical-chemical sensitivity description	Very high	Invertebrates velocity sensitivity	Very high	Invertebrates physical-chemical sensitivity description	Very high
Riparian-wetland-instream vertebrates (excluding fish) intolerance water level/flow changes description					High
Stream size sensitivity to modified flow/water level changes description					Low
Riparian-wetland vegetation intolerance to water level changes description					High

PES = Present Ecological State; confirmed in the database that assessments were performed by expert assessors;
EI = Ecological Importance;
ES = Ecological Sensitivity
EC = Ecological Category; default based on median PES and highest of EI or ES mean.

Following the field assessment, various assessments were undertaken to determine the following:

- PES, incorporating aspects such as hydrology, vegetation, and geomorphology;
- Service provision of the watercourses, which incorporates biodiversity maintenance, flood attenuation, streamflow regulation, and assimilation, to name a few;
- The EIS is guided by the results obtained from the assessment of PES and service provision of the watercourses;
- An appropriate REC to guide the management of the resources with the intent of enhancing the ecological integrity of the resources where feasible; and
- The assessment of impacts of the construction and operation of the study area on the freshwater system.

The results of the assessments are presented below:

The channelled valley bottom (CVB) wetland

PES Category: C (Moderately modified)

Alterations to the habitat of this wetland have occurred, primarily due to disturbances relating to the construction of instream dams (for agricultural purposes - upstream), vegetation disturbance and clearing (however not extensive) due to the grazing and trampling of livestock, and the construction of road infrastructure crossing the wetland (the R544). Incision and erosion of the active channel were evident along the embankment of the wetland, which is

likely to result in increased sedimentation of the system; however, this is not considered extensive at this time.

Ecoservice provision: Intermediate

Despite this wetland having an overall reduced ecological integrity, functioning remains at an intermediate level, particularly regarding eco-services such as flood attenuation and streamflow regulation and cultivated foods (mainly because of the surrounding agricultural activities). This wetland is not considered important for education and research, or tourism and recreation, mainly due to the distance these resources are from residential areas.

EIS Category: B (High).

The EIS of this wetland falls within Category B, which are wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications. This wetland is considered of high ecological importance based on its hydro-functional importance assessment (i.e. flood attenuation and stream flow regulation) and not necessarily on its ecological sensitivity. Though, it is considered to form part of an ESA as per the MBSP Aquatic Database (2014), which area wetlands that, although not considered FEPA wetlands, still maintain the hydrological functioning of rivers, water tables, and freshwater biodiversity, as well as offer various ecosystem services.

REC Category: C (Moderately modified)

Despite the ecological functioning of this wetland being impacted to a certain degree, it is still considered to be of intermediate ecological importance. As it also provides habitat to small mammal and avifaunal species, no further degradation thereof should be permitted. Mitigation measures should be implemented during all phases of the proposed development to minimise the risk of negative impacts to this wetland, and wherever possible, to improve the condition of the portion of the wetland associated with the development.

Watercourse drivers: Hydrology

As per the hydropedological study (SAS, 2018), groundwater recharge of the wetlands within the study area is anticipated to be low. Typically, wetland recharge mechanisms include precipitation (rainfall), surface flow (runoff), subsurface flow (interflow) through the vadose zone of the surrounding soils (SAS, 2018). An instream dam is located within the upstream portion of this wetland, which reduces the water inputs into the downstream portion of the wetland but also aids in attenuating flood peaks during heavy rainfall events. Due to the surrounding agricultural activities, high-velocity flood peaks into the wetland is expected (especially if the fields are bare after harvesting), which is concentrated in the wetland channel.

Watercourse drivers: Water quality

The surface water quality of this wetland is fair (pH: 6.85; EC: 54 mS/m; and TDS: 351 mg/l), mainly due to this wetland being located upstream of any mining activities (although mining activities are located within the catchment of this wetland). However, runoff from the adjacent agricultural fields is expected to enrich the surface water within the wetland and lead to some degree of salinisation.

Watercourse drivers: Topography – Geomorphology and sediment balance

The historical construction of the R544 crossing the wetland has created more concentrated flow into the downstream portion of the wetland, leading to incision of the channel (at a more rapid pace than the natural erosion regime would) and influencing the stability of the channel embankments. Areas where trampling on the edge of the channel was noted, is also associated with erosion (where vegetation has been removed); however, this was not significant. The upstream dam traps sediments that would have previously naturally replenished the downstream wetland. Nevertheless, increased sediment into the wetland is also anticipated when the surrounding agricultural fields are bare after harvesting.

Watercourse drivers: Habitat and biota

Some loss of habitat has occurred as a result of changes to the geomorphology (affecting the instream habitat of the channel) as well as transformed vegetation communities due to agricultural activities surrounding the wetland. Habitat provision is therefore considered moderately altered (especially due to the invasion of some alien vegetation species and terrestrial grass species encroaching on the wetland), resulting in a lowered species diversity. Nevertheless, this wetland does still provide habitat to some avifaunal species and is still connected to other natural areas in the upper and lower reaches of the wetland system allowing the wetland to be used as a migratory corridor.

The unchannelled valley bottom (UCVB) wetland

PES Category: D (Largely modified)

Ecological modifications to this wetland can mainly be attributed to the historical cultivation of this wetland. This wetland has also undergone significant erosion due to two downstream gullies that have drained and considerably reduced the size of the wetland. These gullies are hypothesised to have also developed due to overgrazing within the wetland and surrounding areas that caused a reduction in vegetation cover, leading to wetland erosion.

These gullies have a large impact on the hydrological functioning of this wetland and its geomorphology. During the time of the field assessment, the wetland was burnt (within the southeastern portion) making it difficult to assess the wetland vegetation. Nevertheless, the

information collected on site is considered sufficient to provide an accurate evaluation of the ecological condition of this wetland.

Ecoservice provision: Intermediate

The functioning of the ecosystem services provided by this wetland is considered to be at an intermediate level. Of specific mention is the flood attenuation and streamflow regulation services, due to stormflows being spread across the wetland (prior to it being concentrated within the erosion gullies), the high surface roughness of the wetland and the reduction of evapotranspiration through frosting back of the wetland vegetation. This wetland is not considered important for education and research, or tourism and recreation, mainly due to the locality of this wetland being within a rural setting.

EIS Category: C (Moderate).

The EIS of this wetland falls within Category C, which are wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications.

This wetland is considered important for its hydro-functionality rather than for its ecological sensitivity, although, according to the Mining and Biodiversity Guidelines (2013), the area in which this wetland is situated, is classified as an area of Highest Biodiversity Importance, which are areas where mining is not legally prohibited, as there is a very high risk that due to their potential biodiversity significance and importance to ecosystem services (e.g. water flow regulation and water provisioning) that mining projects will be significantly constrained or may not receive necessary authorisations.

REC Category: D (Largely modified)

The Present Ecological State of this wetland is considered relatively low, mainly due to the heavily incised gullies present within the downstream portion thereof. However, it does still provide intermediate hydrological ecoservice provisioning. Despite this low management class being awarded to the wetland (Category D – Largely Modified), if implemented, it would still ensure marginal maintenance of sustainability of the upstream portion of the wetland. However, as per the proposed mining activities layout, the downstream portion of this wetland would be lost as part of the proposed mine development.

Watercourse drivers: Hydrology

Runoff from the surrounding agricultural fields enters this wetland, but the wetland is also considered to be recharged by subsurface flows (SAS, 2018). The surrounding agricultural fields supply sediment to the valley wetland through surface run-off (specifically when the crops

have been harvested, and the fields are bare). The accumulation of these sediments results in localised over-steepening of certain sections of the valley floor with raised gradients at the two head cuts, relative to the upper non-eroding sections with lower gradients. These localised steep sections increase the flow velocity of the surface runoff and therefore stream erosivity, thus triggering gully erosion. These gullies have created concentrated flow in a particular section of the wetland, resulting in shrinkage of the downstream width of the wetland.

Watercourse drivers: Water quality

The surface water quality of this wetland is considered to be impacted upon (pH: 7.39, EC: 97 mS/m; and TDS: 630.5 mg/l). This could be attributed to enriched runoff entering the wetland from the surrounding agricultural fields (due to fertilizers) and trampling by livestock within the wetland. Mining activities are not likely to have a large impact upon this wetland as yet, as the wetland is located upstream of such mining activities.

Watercourse drivers: Topography – Geomorphology and sediment balance

The surrounding agricultural fields and informal road crossing allows for sediment to be deposited within the wetland through surface runoff. Sediment deposition is extensive where there is a change in the slope of the wetland (as discussed in the Hydrology aspect), which has resulted in the development of the two large gullies. These gullies are characterised by bank slumping and side wall collapse, which contributes to the sediment load of the downstream portion of the wetland.

Due to the surrounding agricultural activities, changes to the topography have occurred (i.e. in order to accommodate cultivation fields), therefore a larger load of sediment is available to be collected (especially after harvesting of crops, when the fields are bare).

Watercourse drivers: Habitat and biota

The surrounding agricultural activities have resulted in the removal of natural wetland vegetation, specifically where the agricultural fields are adjacent to the wetland boundary. Large areas of disturbance were noted within the central portion of this wetland, along the informal road crossing this wetland. Here, despite this portion being burnt, a large abundance of invasive alien vegetation species was noted, which have replaced the natural wetland vegetation. It is expected that if the reed species (*Typha capensis*) re-establish again in the spring (as remnants thereof were evident within the gullies) within the gullies, it can be assumed that the downstream wetland does provide habitat to some faunal species.

8.13. Biological Character - Ecology and Biodiversity: Floral Assessment

A detailed ecological assessment was conducted by Galago Environmental for the bigger Vlaklaagte Mine Project. The Block OC6 was included in the assessment and in this section only the information applicable to the Block OC6 is discussed.

The study site was a 712 ha area whereof the Block OC6 project was a 120 ha area to the west of the R544. Five vegetation study units were identified on the total study site with four applicable to Block OC6:

- Wetland vegetation;
- Cultivated fields;
- Eragrostis – Helichrysum grassland; and
- Mixed vegetation of farming area.

Habitat unit 1: Wetland vegetation

This study unit included the tributary to the Olifants River drainage line and the wetlands formed in and along the drainage lines. The species diversity of this study unit is high. Of the 172 plant species recorded on the total Vlaklaagte Mine site 87 were recorded in the Wetland vegetation study unit. Of these 61 are indigenous.

Habitat unit 2: Cultivated fields

This study unit comprises of regular cultivated fields mostly planted with maize. Of the 172 plant species recorded on the total Vlaklaagte Mine site 20 were recorded in the Wetland vegetation study unit. Of these 9 are indigenous.

***Habitat unit 3: Eragrostis – Helichrysum* Grassland**

This study unit comprises areas of primary grassland along drainage lines where disturbance was not attempted. The species diversity of this study unit is high. Connectivity with natural grassland does not exist. Of the 172 plant species recorded on the site 83 were recorded in the Eragrostis – Helichrysum grassland study unit. Of these 79 are indigenous species.

Habitat unit 5: Mixed vegetation of farming and mining areas

This study unit consists of the vegetation at the farming homestead and adjacent area. Of the 172 plant species recorded on the site 30 were recorded in themixed vegetation of farming and mining areas. Of these 12 are indigenous species.

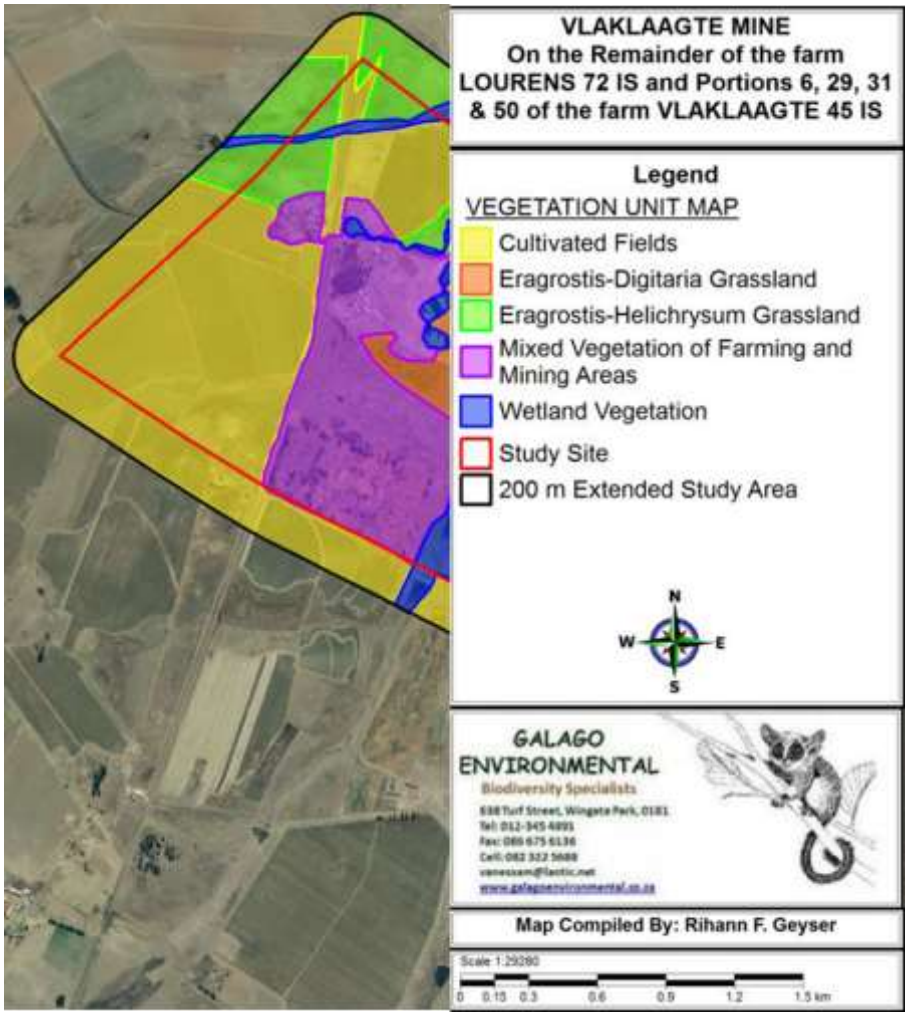


Figure 23: Map showing Vegetation Communities on the farms Lourens 472 IS

Alien weeds and invader species

During the floral study of the total Vlaklaagte Mine site, 38 exotic and weed species were identified. These were not necessarily encountered on the Block OC6 area. These include the species included in **Table 22** below.

Table 22: List of some alien invasive plant species encountered on the Vlaklaagte Mine site

Species	Common name	Category
Agrimonia procera	Agrimony	1b
Cirsium vulgare	Scotch thistle	1b
Datura ferox	Large thorn apple	1b
Datura stramonium	Common thorn apple	1b
Eichhornia crassipes	Water hyacinth	1b
Eucalyptus sp.	Gum tree	2

Species	Common name	Category
Pennisetum clandestinum	Kikuyu	1b
Pinus sp.	Pine tree	2
Solanum sisymbriifolium	Wild tomato	1b
Verbena bonariensis	Purple top	1b
Verbena brasiliensis	Brazilian verbena	1b
Xanthium spinosum	Spiny cocklebur	1b

The Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983) (CARA), have divided declared weeds and invaders into three (3) categories, which determines the actions that are required against these weeds.

- Category 1 plants are prohibited plants that will no longer be tolerated in rural or urban areas, except with the permission of the executive officer. These plants may not be planted or propagated, nor be transported or be allowed to disperse.
- Category 2 plants have proven potential to become invasive, but due to their beneficial properties CARA have made certain provisions for Category 2 plants to be retained in special areas demarcated for that purpose.

  They may not occur within 30m from the 1:50 year flood line of water courses or wetlands. Seeds or propagative material may only be sold to, and acquired by, land users of areas demarcated for the growing of that species or for the establishment of a bio-control reserve.
- Category 3 plants have proven potential of becoming invasive, but most of them are popular ornamental or shade trees that will take a long time to replace. Category 3 plants will not be allowed anywhere, except in biological control reserves, unless they here there before the CARA regulations came into effect. They may not occur within 30 m from the 1:50 year flood line of water courses or wetlands. Cuttings or seeds of these plants may not be planted, propagated, imported, bought, sold or traded in any way.

Endangered and rare species

An assessment considering the presence of any plant species of concern, as well as suitable habitat to support any such species, was undertaken. The complete PRECIS (Pretoria Computer Information Systems) red data plant list for the grid reference (2629AB) was enquired from SANBI (South African National Biodiversity Institute). The PRECIS red data plant list indicated that no RDL floral species or other floral species of concern occur in this grid. In addition, during the field assessments, no RDL or other sensitive species were encountered.

However, the most likely habitat for any RDL floral species, should they be present, will be encountered within the wetland area.

8.14. Biological Character - Ecology and Biodiversity: Faunal Life

Mammals

Of the 31 mammal species expected to occur on the study site (**Table 23**), only three were confirmed during the site visit (**Table 24**). None of these were confirmed on the Block OC6 area but in the wider Vlaklaagte Mine area. It should be noted that potential occurrences is interpreted as to be possible over a period of time as a result of environmentally induced expansion and contractions of population densities and ranges which stimulate migration. It is also emphasized that if it were not for the river, riparian zones and buffer zones, the species richness would have been significantly less.

Table 23 lists the mammals that were observed or deduced to presently occupy the area or to be occasional visitors. All feral mammal species expected to occur on the study site (e.g. house mice, house rats, dogs and cats) were omitted from the assessment since these cannot be considered when estimating the conservation value of the site.

Most of the species of the resident diversity are common and widespread. With the exception of the two dwarf shrews, otters and white-tailed mongooses all the species listed in **Table 23** are robust (some with strong pioneering capabilities). The reason for their survival success is predominantly seated in their remarkable reproduction potential (viz. multimammate mice species capable of producing ca. 12 pups per litter at intervals of three weeks), and to a lesser extent their reticent and cryptic nature (scrub hares, genets, yellow and slender mongooses). The two mongoose species and two genet species are very resilient and have a remarkable ability to persist, even close to human settlement. The key to their persistence lie in their reticent nature and in the case of the genets also their nocturnal lifestyles.

The presence of aardvark in the Vlaklaagte Mine area suggests that this unique animal is more resilient than formerly assumed. Pygmy mice and dwarf shrews have a penchant to take refuge in moribund termitaria – hence these structures are taken as indicative of the presence of these diminutive creatures. It is a rare event not to record tunnel systems of rodent moles, but this species is taken to be present.

The listed bats show remarkable adaptivity by expanding their population numbers significantly by capitalizing on the roosting opportunities offered be manmade structures. However, there

are no caves or any other structure, manmade or natural, available for daytime roosts. Hence it is submitted that individuals will commute from daytime roosts elsewhere to hawk for aerial prey in the airspace over the study site.

The species richness is low, which is ascribed to only two habitats being available and an appalling quality of conservation resulting in species displacement. Immigrations are furthermore limited by the extensive tilling on adjacent land.

Table 23: Mammal diversity and species observed or deduced to occupy the site

	SCIENTIFIC NAME	ENGLISH NAME
√	*Orycteropus afer*	Aardvark
√	*Lepus saxatilis*	Scrub hare
√	*Cryptomys hottentotus*	African mole rat
*	*Rhabdomys pumilio*	Four-striped grass mouse
*	*Mus minutoides*	Pygmy mouse
*	*Mastomys natalensis*	Natal multimammate mouse
*	*Aethomys ineptus*	Tete veld rat
*	*Otomys angoniensis*	Angoni vlei rat
*	*Otomys irroratus*	Vlei rat
√	*Gerbilliscus brantsii*	Highveld gerbil
?	*Dendromus melanotis*	Grey pygmy climbing mouse
*	*Dendromus mesomelas*	Brants' climbing mouse
?	*Dendromus mystacalis*	Chestnut climbing mouse
?	*Steatomys pratensis*	Fat mouse
DD*	*Myosorex varius*	Forest shrew
DD*	*Suncus lixus*	Greater dwarf shrew
DD?	*Suncus infinitesimus*	Least dwarf shrew
DD?	*Crocidura cyanea*	Reddish-grey musk shrew
DD*	*Crocidura hirta*	Lesser red musk shrew
*	*Tadarida aegyptiaca*	Egyptian free-tailed bat
*	*Neoromicia capensis*	Cape serotine bat
*	*Scotophilus dinganii*	African yellow house bat
*	*Scotophilus viridis*	Greenish yellow house bat
*	*Felis silvestris*	African wild cat
*	*Genetta genetta*	Small-spotted genet
*	*Genetta tigrina*	SA large-spotted genet
√	*Cynictis penicillata*	Yellow mongoose

	SCIENTIFIC NAME	ENGLISH NAME
√	*Galerella sanguinea*	Slender mongoose
?	*Ichneumia albicauda*	White-tailed mongoose
?	*Atilax paludinosus*	Marsh mongoose
?	*Aonyx capensis*	African clawless otter
NT?	*Lutra maculicollis*	Spotted-necked otter

(Systematics and taxonomy as proposed by Bronner et.al [2003], Skinner & Chimimba [2005], Apps [2012] and Stuart & Stuart [2015]).

√ Definitely there or have a high probability to occur;
* Medium probability to occur based on ecological and distributional parameters;
? Low probability to occur based on ecological and distributional parameters.

Red Data species rankings as defined in Friedmann and Daly's S.A. Red Data Book / IUCN (World Conservation Union) (2004) are indicated in the first column: CR= Critically Endangered, En = Endangered, Vu = Vulnerable, LR/cd = Lower risk conservation dependent, LR/nt = Lower Risk near threatened, DD = Data Deficient. All other species are deemed of Least Concern.

Table 24: Mammal species positively confirmed from the study site, observed indicators and habitat

SCIENTIFIC NAME	ENGLISH NAME	OBSERVATION INDICATOR	HABITAT
O. afer	Aardvark	Damage to termitaria	Grassveld
L. saxatilis	Scrub hare	Faecal pellets	Short grassveld
G. brantsii	Highveld gerbil	Tunnel systems	Sandy grassland

It was somewhat of a surprise to encounter proof of the occurrence of aardvark. Irrespective of the conservation ranking accorded to the Aardvark by Friedmann and Daly (2004), it is herein considered as vulnerable. Scrub hares are outstandingly widespread in the Subcontinent and common within their distribution range. The scrub hare thrive on short grass (which is normally the result of overgrazing or environmental manipulation), and is rarely seen since they are nocturnal and are exceptionally cryptic during day where they lie up in forms constructed at the base of grass clumps or shrubs. Highveld gerbils are fairly common in sandy veld where they can excavate colonial tunnel systems; they are often encountered at the edges of tilled fields.

Treatened and Red Listed Species

By the Scientific Community:

The ecology and population dynamics of "**Data Deficient**" (DD) small mammal species listed in **Table 23** have not been adequately studied to provide quantitative field data to empirically

assign a conservation ranking, and are thus as a precaution considered as 'Data Deficient' Red Data species. Shrews operate at the apex of the food pyramid via an invertebrate trophic sublevel, which means that their population numbers are significantly lower than that of their prey species in order to maintain sustainable prey population levels. Because of their diet, they are furthermore not readily trapped with conventional bait or traps, which may mean that their numbers are under-estimated. Specimen collection of shrews using drift fences and pitfalls invariable yield better acquisition results than live-trapping, which reiterate the sentiment that shrews numbers are more often than not under-estimated and that many species' conservation status are misconstrued.

It is assumed that spotted-necked otters became "**Near Threatened**" as result of a general decline of water quality and availability.

No other Red Data or sensitive species are deemed present on the site, either since the site is too disturbed, falls outside the distributional ranges of some species, or does not offer suitable habitat(s).

By the Biodiversity Act No 10 of 2004
Nil.

By the Regulations of the Mpumalanga Nature Conservation Act No. 10 of 1998: Schedule 5: Wild animals to which the provisions of Section 33 apply: All mongooses, African wild cat.

Formally Prohibited Invasive and Prohibited Species
Nil

As indicated on the mammal sensitivity map (**Figure 24**) sensitive mammal species use the Olifants River, its riparian zones and the buffers zones as feeding and breeding habitat. No highly sensitive area was identified in the Block OC6 area.

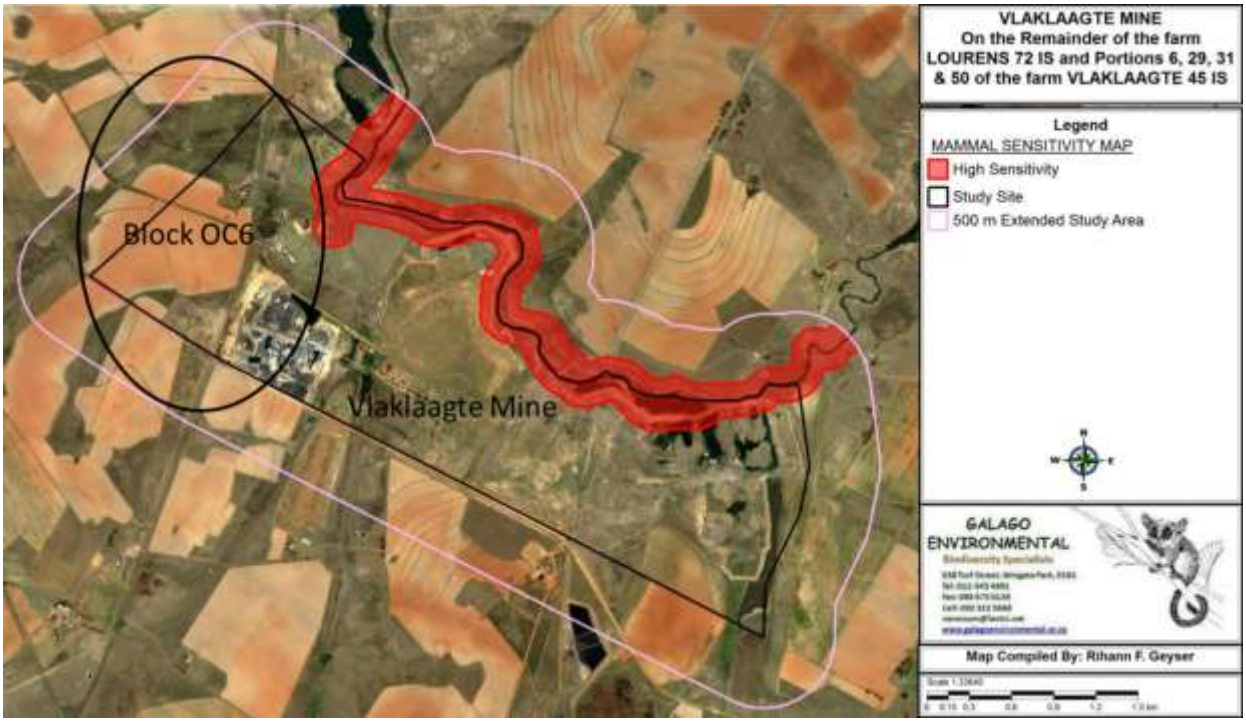


Figure 24: Mammal Sensitivity map

Birds

The study area is situated within the 2629AB quarter degree grid cell. The study site is situated within the Mesic Highveld Grassland Bioregion of the Grassland Biome and more specifically within the Eastern Highveld Grassland (Gm 12) vegetation type according to Mucina and Rutherford (2006).

The landscape consists of slight to moderately undulating plains, including some low hills and pan depressions. The vegetation is short dense grassland dominated by the usual highveld grass composition, for example *Aristida, Digitaria, Eragrostis, Themeda* and *Tristachya*, with small, scattered rocky outcrops of wiry, sour grasses and some woody species, for example *Acacia caffra, Celtis africana, Diospyros lycioides subsp lycioi-des, Parinari capensis, Protea caffra, P. welwitschii* and *Searsia magalismontanum* (Mucina and Rutherford, 2006).

During the site visit, avifaunal species were identified by visual sightings or aural records along random transect walks. No trapping or mist netting was conducted, since the terms of reference did not require such intensive work. In addition, avifaunal species were also identified by means of feathers, nests, signs, droppings, burrows or roosting sites. Locals were interviewed to confirm occurrences or absences of species.

The likely occurrence of key avifaunal species was verified according to distribution records obtained during the Southern African Bird Atlas Project 1 (SABAP1) period from 1981 to 1993

(Harrison et al. 1997). The most recent avifaunal distribution data were obtained from the current SABAP2 project which commenced on 1 July 2007.

The occurrence and historic distribution of likely avifaunal species, especially all Red Data avifaunal species recorded for the q.d.g.c. 2629AB, were verified from SABAP1 (southern Africa Bird Atlas Project 1) data (Harrison et al. 1997) and the current SABAP2 project (SABAP2 data for the 2629 q.d.g.c. and for the 2605_2920 and 2610_2920 pentads).

The following avifaunal habitat systems were identified within the bigger Vlaklaagte Mine study area. These were not necessarily all present at the Block OC6 area. These habitat systems are as follows:

1. River and riparian area
2. Wetlands
3. Drainage lines
4. Artificial impoundments
5. Aquatic and semi-aquatic vegetation (including riparian vegetation)
6. Natural Grassland
7. Disturbed Grassland, Fallow Fields and Pastures
8. Cultivated Fields
9. Mixed alien and indigenous vegetation
10. Alien and Exotic Vegetation
11. Disturbed and Transformed Area

The occurrence of the avifaunal species habitat systems on the Block OC6 area are depicted in **Figure 25**.

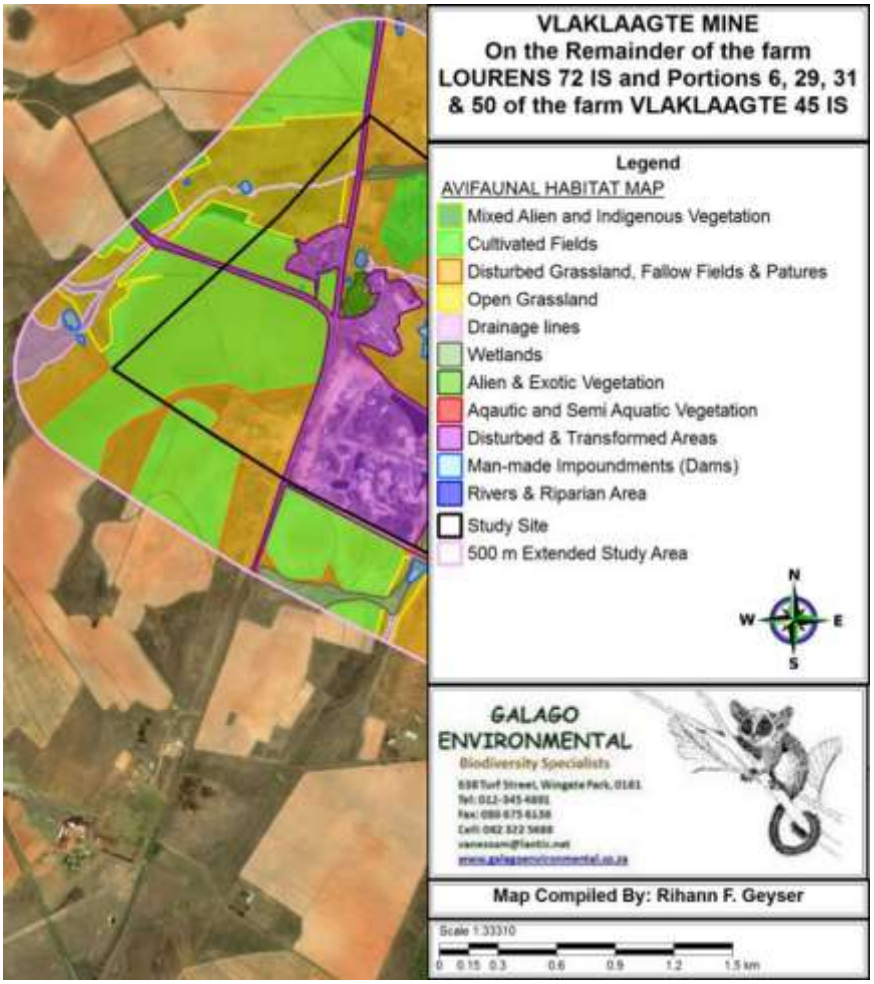


Figure 25: Avifaunal species habitat systems identified on the study site and within the study area

Of the 210 avifaunal species recorded for the 2629AB q.d.g.c. during the SABAP1 period (Harrison et al. 1997) and the current SABAP2 period, 201 (96 %) are likely to occur on the study site and 98 (49 %) of these avifaunal species were actually observed within the study area during the time of the survey. So far, 185 avifaunal species were recorded for the q.d.g.c. during the current SABAP2 project to date compared with 160 species recorded during the SABAP1 period.

The avifaunal biodiversity index (ABI) indicates that the largest avifaunal species diversity is likely to occur within the aquatic habitat vegetation habitat system, with an avifauna biodiversity index (ABI) of 556, followed by the open grassland or open space area (ABI 333) and the disturbed and transformed areas (ABI 314).

A total of 14 Red Data avifaunal species have been recorded within the 2629AB q.d.g.c. during the SABAP1 period and the current SABAP2 period, 7 during the SABAP1 period, 11 during

the current SABAP2 period, one for the 2605_2920 pentad and 2610_2920 pentad in which the study area in situated (sabap2.adu.org.za May 2014).

Most of the Red Data avifaunal species that are likely to occur in the study area are only likely to move through the area on rare occasions due to the fragmented state and surrounding disturbed areas. Some of the habitat systems, however, offer suitable habitat for Red Data avifaunal species during optimal conditions. Most of the aquatic habitat with their buffers, as delineated by an aquatic specialist, should be regarded as highly sensitive and should be kept free from any development or any form of disturbance. Natural grassland along these wetland systems should also be regarded as sensitive to offer suitable foraging habitat for aquatic Red Data avifaunal species (**Figure 26**). Not only are these areas sensitive for Red Data avifaunal species but also for all other avifaunal species that occur or are likely to occur within the area.

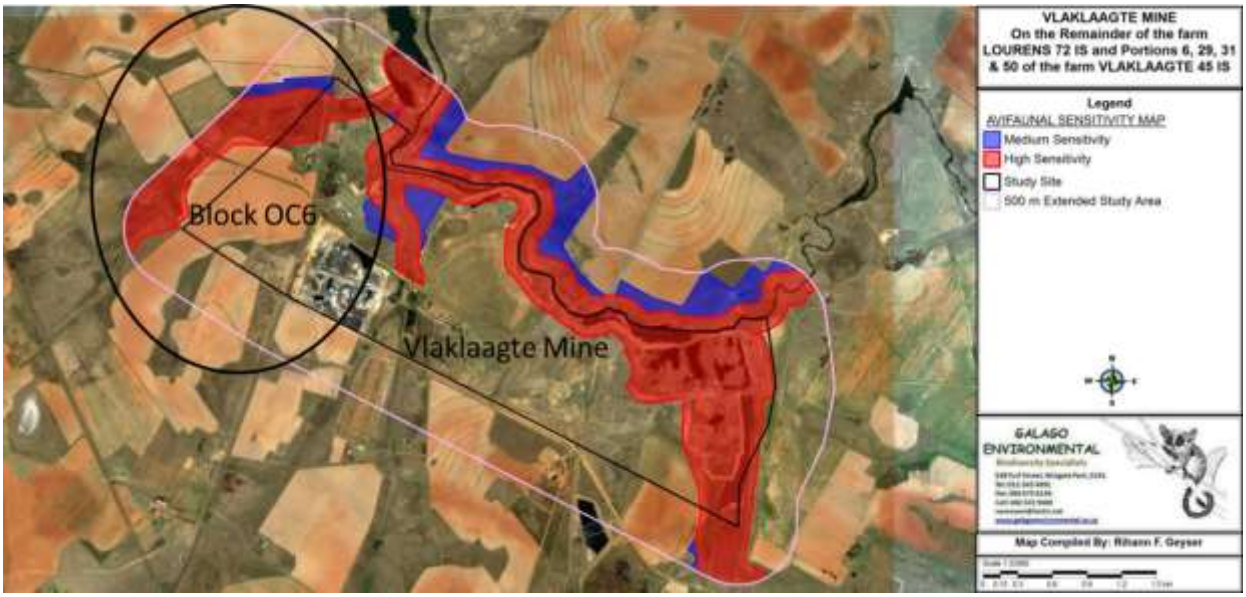


Figure 26: Avifaunal species habitat systems identified on the site and within the wider area

Reptiles and Amphibians

The Vlaklaagte Mine area contains three natural herpetofaunal habitats, namely terrestrial, rupicolous and wetlands. The terrestrial habitat of the area has been ecologically disturbed by mining and agricultural activities. Dumping of building rubble, exotic plants, roads, power lines, old ruins and buildings have also disturbed some parts of the area. Water pollution and invasive plants threaten the aquatic habitat.

Of the 37 reptile species which may occur on the study site one was confirmed during the site visit (**Table 25**) and of the 16 amphibian species which may possibly occur on the study site two were confirmed during the site visit (**Table 25**).

Table 25: Reptile and Amphibian species positively confirmed from the study site, observed indicators and habitat

SCIENTIFIC NAME	ENGLISH NAME	OBSERVATION INDICATOR	HABITAT
Trachylepis punctatissima	Speckled Rock Skink	Sight record of a few adults	Manmade rupicolous habitat in the form of rock piles
Amietaophrynus gutturalis	Guttural Toad	Sight record of tadpoles (Gosner stages 28-34 [Gosner 1960])	Aquatic habitat in dams
Cocosternum boettgeri	Boettger's Caco	Vocalisation	Aquatic habitat in form of rain pools

Due to the presence of three of the four habitat types the study site should have a fair number of species. It must be emphasised that the species richness is for the general area and NOT for the study site itself.

The possibility exists that at least some individuals of coppery grass lizard and giant bullfrog occur on the project site.

The Olifants River tributary and drainage lines are sensitive ecological systems. The study site falls in the Eastern Highveld Grassland (Gm 12) vegetation type, which is considered endangered (Mucina and Rutherford, 2006).

The terrestrial habitat quality has been jeopardised by agricultural activities and later by mining, several buildings, dumping, roads, power lines and exotic plants. Water pollution and invasive plants threaten the integrity of the drainage line.

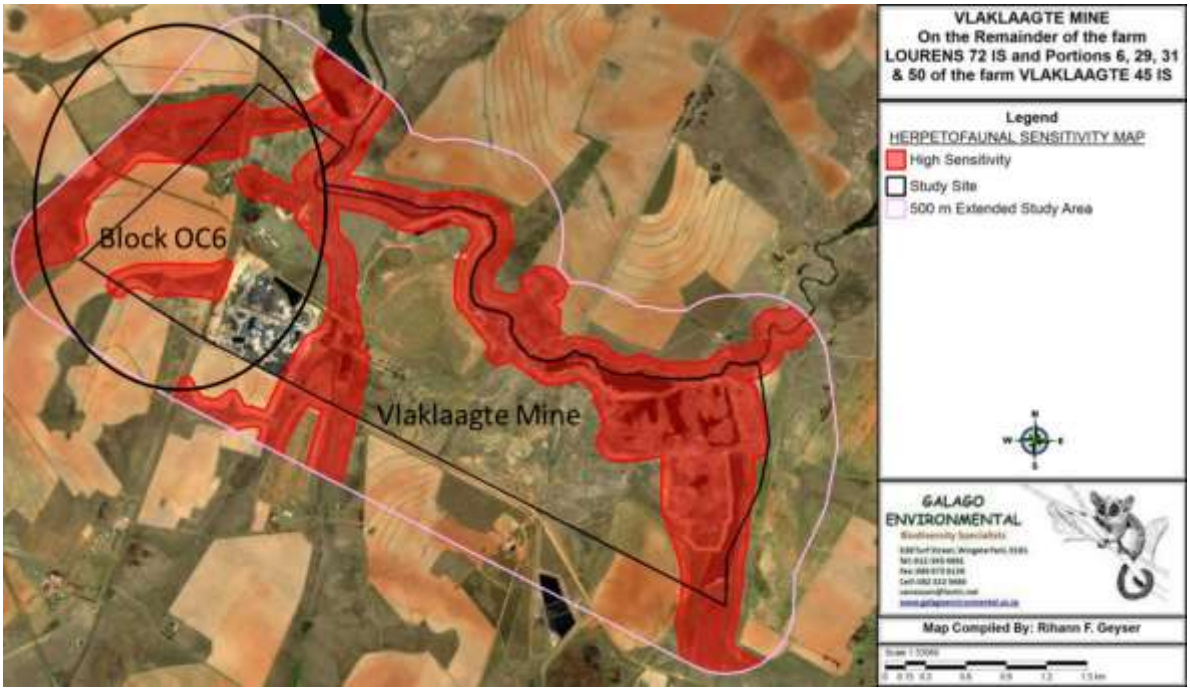


Figure 27: Herpetofaunal Sensitivity Map

Reptiles and Amphibians

Metisella meninx (Marsh Sylph butterfly) is a medium to small sized butterfly with a wing span of maximum 29 mm in the females. Upper side has a strong bronzy brown sheen with only the females having three buff forewing subapical spots close to the tips of the wings.

Their distribution is restricted to wet vleis of Highveld Grassland in KwaZulu Natal (Newcastle area), Mpumalanga, Free State and extreme eastern North West Province. Building developments has driven it out of many Johannesburg localities (Woodhall, 2005).

The site was visited twice for approximately 4 hours each time focusing on the wet vleis and watercourse areas, especially where grasses and various flowers co-existed. Many other butterfly species could be observed to be active and habitat types could be effectively assessed on both days. Due to the difficulty of finding actual specimens of *M. meninx* in the short time frame of the study, special attention was paid to habitat that are most likely to support *M. meninx*.

A sensitivity map is based on the habitat on site that is most probable of supporting *M. meninx* populations, as determined by the site visits.

No siting of *M. meninx* was made, however the wetlands that are assigned a High sensitivity (**Figures 28**) have habitat that is suitable for supporting breeding populations of the Marsh

Sylph. Both sexes of this species of butterfly drink from flowers and the larvae feed on marsh grasses, and the High sensitivity areas comprises of grasses with ample flowering plants. Additionally, the combination of artificial water impounds with natural unchannelled valley bottom wetlands in the High sensitivity areas, can assure the wetland areas to remain moist throughout most of the year and thereby sustaining *M. meninx* habitat.

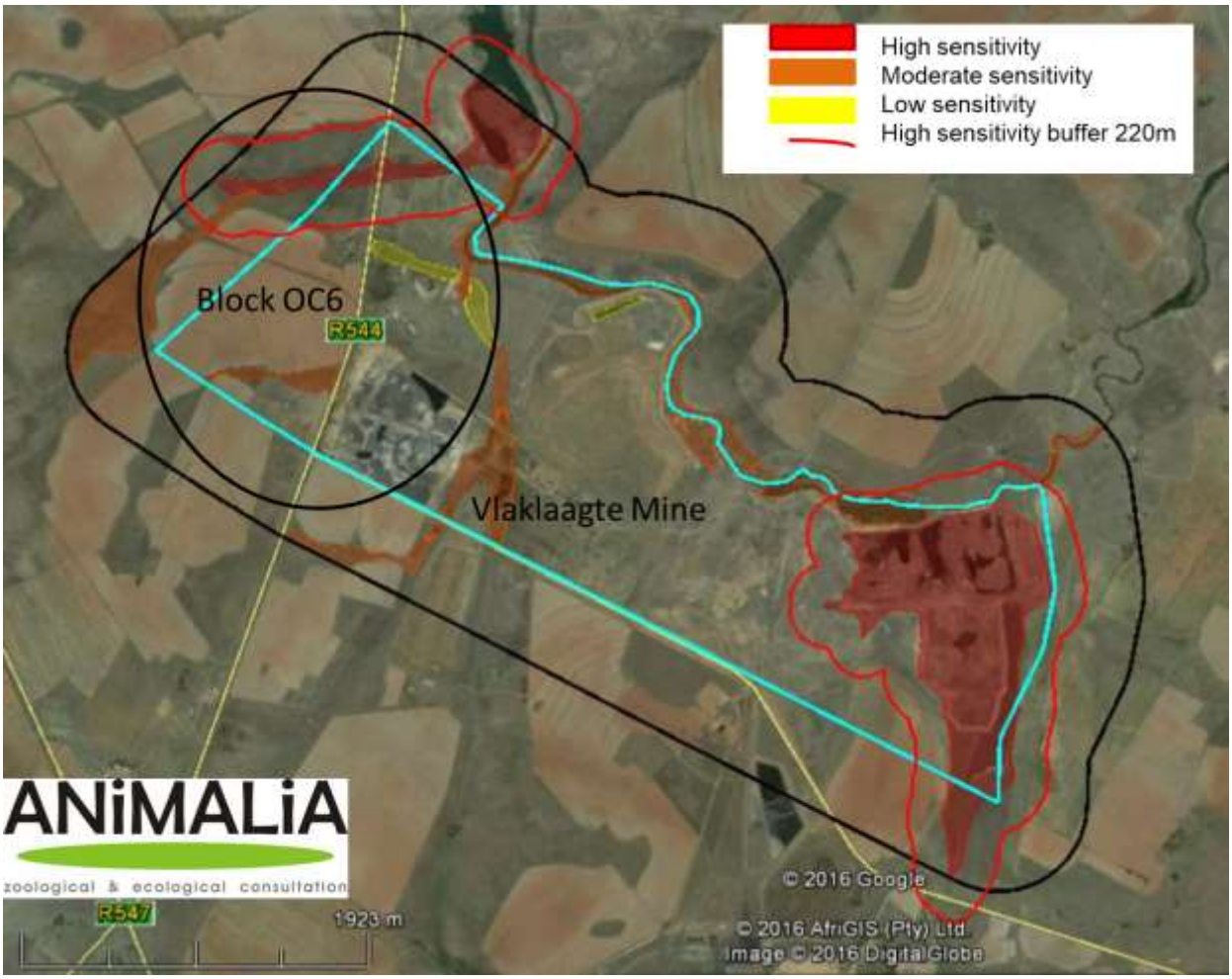


Figure 28: *M. meninx* Sensitivity Map

8.15. Cultural Character - Sites of archaeological and cultural interest

A Phase I Heritage Impact Assessment (HIA) study was done according to Section 38 of the National Heritage Resources Act (No 25 of 1999) for the proposed Vlaklaagte Block OC6 project 12km northe-east of Kriel on the Eastern Highveld in the Mpumalanga Province by A Pelser, an Archaeologist Consultant (APAC), during March 2019.

The Phase I HIA study for the proposed Project revealed the following types and ranges of heritage resources as outlined in Section 3 of the National Heritage Resources Act (No 25 of

1999) in and near the Project Area **(Figure 29)**, namely:

- Site 1 - graveyard

The topography of the area is fairly flat and open, with little or no rocky ridges or outcrops present. Dense grass cover in sections made visibility during the assessment difficult. Most of the study area was utilized in the past (and currently) for agricultural purposes (ploughing/crop growing and cattle grazing). Some old diggings and remnants of an old rail line have also impacted on the area. These activities would have impacted greatly on any cultural heritage (archaeological and/or historical) sites, features or material that might have existed here in the past.

Site 1 contains at least 4 graves with clear headstones and inscriptions while a further 2 graves (in the shape of depressions) could also be present on the site. The vegetation cover was very dense during the assessment, and there might therefore be more graves present.

The 4 graves belong to:

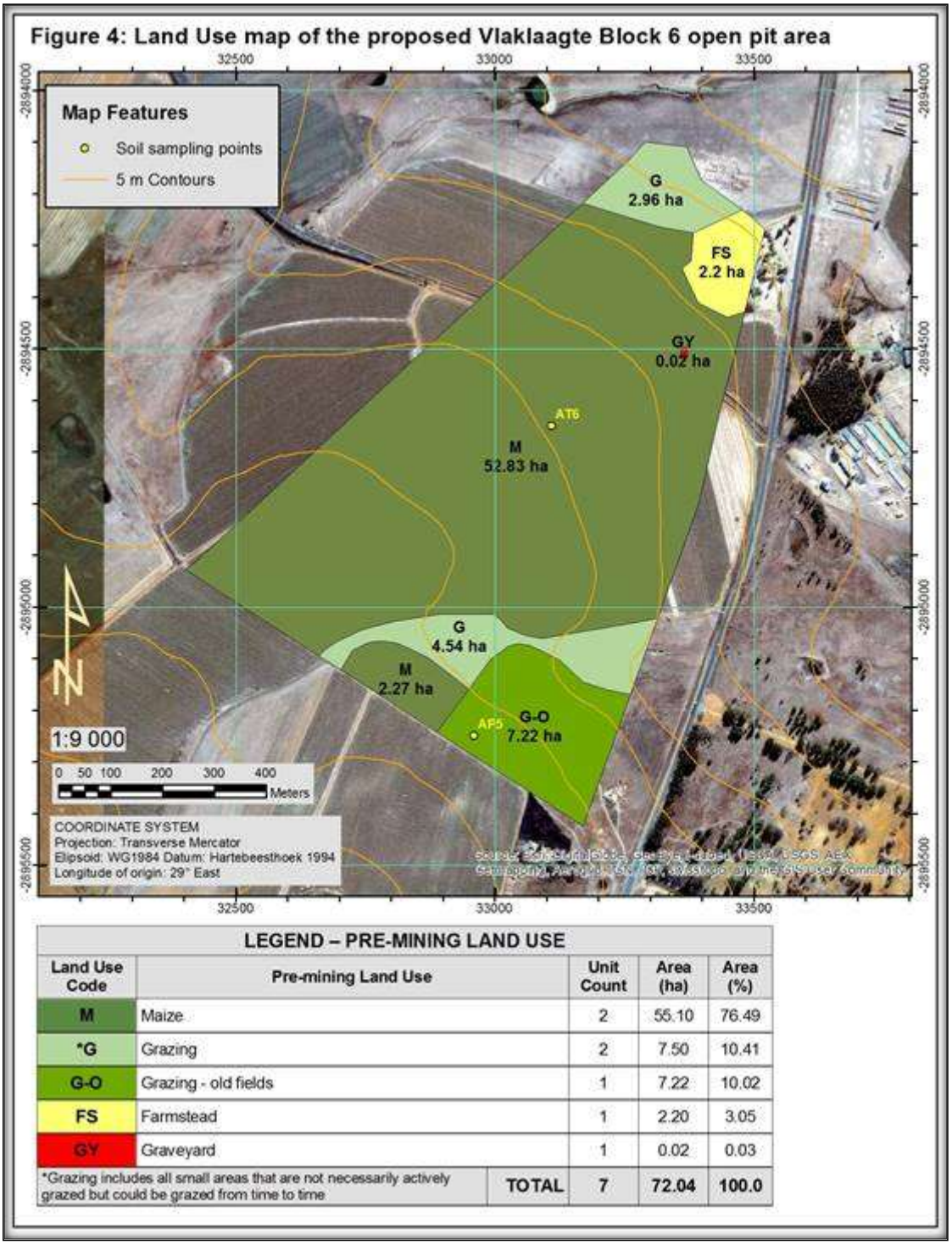
(1) Anna Maria J. Pretorius (born Roos) who was born in 1886 and died in 1944
(2) Matthys Johannes Nicolaas Swart who was born in 1882 and died in 1919
(3) Anna Elizabeth Magrieta Lourens (born De Wet) who was born in 1907. No death date on stone
(4) Matthys Johannes Lourens who was born in 1905 and passed away in 1960.

Graves always carry a High Significance Rating from a Cultural Heritage point of view and should be handled with care. As these graves are older than 60 years of age they are protected by the National Heritage Resources Act as well and should be protected in situ if possible. If the grave site and graves on it cannot be avoided by the proposed mining development then they can be exhumed and relocated after all due processed have been followed. This will include detailed social consultation to try and contact any living descendants of the deceased in order to obtain their consent for the exhumations & relocations and obtaining permits from SAHRA, local, provincial and national authorities before the exhumation and relocation work can be conducted.

GPS Location of Site 1: **S26 09 33.05 E29 20 01.26**
Cultural Significance: High
Heritage Significance: Grade III: Other Heritage resources of Local importance and therefore worthy of conservation.

Field Ratings: Local Grade IIIB: Should be included in the heritage register and may be mitigated (High/Medium significance)

Mitigation: Keep in situ if possible by fencing in and protecting OTHERWISE Exhume and Relocate after permission obtained.



LEGEND – PRE-MINING LAND USE

Land Use Code	Pre-mining Land Use		Unit Count	Area (ha)	Area (%)
M	Maize		2	55.10	76.49
*G	Grazing		2	7.50	10.41
G-O	Grazing - old fields		1	7.22	10.02
FS	Farmstead		1	2.20	3.05
GY	Graveyard		1	0.02	0.03
*Grazing includes all small areas that are not necessarily actively grazed but could be grazed from time to time		TOTAL	7	72.04	100.0

Figure 29: The presence of a graveyard in the Project Area

8.16. Socio-Economic Character - Regional socio-economic structure

Population density, growth and location

2 Seam (which included the Vlaklaagte area) is located 25 km south-east of Emalahleni (formerly Witbank), 10 km northeast of Kriel and 40 km south of Middelburg in the Mpumalanga Province. Emalahleni, Kriel and Middelburg all fall into the Nkangala District Municipality, which is approximately 16 864.63 km^2 in size, and comprises six local municipalities.

According to Nkangala District Municipality (NDM) 2016/17-2020/21 Final Draft Integrated Development Plan, NDM is one of the three (3) District Municipalities in Mpumalanga Province. The headquarters of Nkangala District Municipality are in Middelburg (Steve Tshwete Local Municipality). The District is composed of six (6) Local Municipalities: namely; Victor Khanye Local Municipality, Emalahleni Local Municipality, Steve Tshwete Local Municipality, Emakhazeni Local Municipality, Thembisile Hani Local Municipality and Dr J S Moroka Local Municipality. The area of the District covers a total area of approximately 16,892 square kilometres.

The current Total Population (2014) of NDM is 1 413 021 with an average annual growth rate of 2.3%.

The majority of the population of the District is young people under the age of 35. This accordingly places a demand on the District and its Social Partners to prioritise youth development and empowerment as one of the key drivers towards sustainable development of the District. It can also be deduced that this very component of our population is the most vulnerable to developmental ills confronting the District.

In 2013, the NDM achieved an annual growth rate of 2.83% which has a higher GDP growth than the Mpumalanga Province's 1.25%, and is higher than that of South Africa as a whole, where the 2013 GDP growth rate was 1.89%. The economic growth in Nkangala peaked in 2005 at 5.91%.

Location and setting

The eMalahleni Local Municipality is located at the centre of Mpumalanga, covering 3,976 square kilometres (Census, 2011). Vlaklaagte is situated in an agricultural hub in the Highveld region of Mpumalanga province. It has high-value agricultural land, an above-average rainfall and relatively higher agricultural yields compared to the surrounding areas. Farms are

generally used intensively for dry-crop agricultural and stock farming, producing mostly products such as maize, soya and potatoes.

8.16.1. Major economic activities and sources of employment

According to the NDM (2016/17-2020/21) IDP, the district's economy is made up of various industries is referred to as a resource based economy as the district relies much on the natural resources economy:

- Mining;
- Electricity;
- Construction;
- Agriculture;
- Manufacturing;
- Trade;
- Transport;
- Finance;
- Community services.

In 2014, the mining sector is the largest within Nkangala District Municipality accounting for R 40.9 billion or 41.4% of the total Gross Value Added (GVA) in the district municipality's economy. The sector that contributes the second most to the GVA of the Nkangala District Municipality is the community services sector at 10.6%, followed by the electricity sector with 10.0%. The sector that contributes the least to the economy of Nkangala District Municipality is the agriculture sector with a contribution of R 2.2 billion or 2.2% of the total GVA.

8.16.2. Unemployment estimate for the area

According to Statistics South Africa, Census 2011 the employment rate for Mpumalanga Province and Nkangala District Municipality is 68.4% and 70% respectively, which is an increase of 11.5% and 13.83% between 2001 and 2011 Censuses respectively. It can therefore be deduced that on an annual basis, the employment rate of NDM increased by 1.4%, which is evidently inadequate to half the current unemployment by 2015.

In 2011, the Trade was the biggest employer in Nkangala with a share of 21.0 %. Mining (18.6 %), Community Services (16.1 %) and Manufacturing (12.8 %) contributed significantly to employment in the District. The Trade sector was the leading sector in terms of employment provision in all Municipal areas, with Emalahleni being the highest contributor at 44.3 % followed by Steve Tshwete at 23.7% and Thembisile Hani at 17.5%. In 2014 the leading Industries in terms of employment: Mining 21.2%, Community Services 14.5% and Trade

14.0%. This shows an Increasing role/share of Mining & Community Services and decreasing role/share of Trade and Agriculture as employer.

8.16.3. Housing

No employees will be housed at the mine. The majority of the workers come from the neighbouring towns such as eMalahleni, Kriel and Middelburg.

8.16.4. Social infrastructure

The towns boast a number of schools. Adequate sport and recreational facilities have been established in the town and are enjoyed by the local population. The shopping centres are adequate to supply all requirements. The security forces and civil defence structures (Police and fire departments) are well established within the town.

8.16.5. Water supply

The nearby towns surrounding the project area have adequate access to water which is supplied through the Municipal infrastructure. Potable water is obtained from the Middelburg Dam for Middelburg and the Witbank Dam for the eMalahleni Local Municipality domestic and industrial uses.

8.16.6. Power supply

The power requirements are still to be confirmed, but in all likelihood power will be provided via the current Gloria power infrastructure.

8.17. Description of the current land uses

The pre-mining land use at the Vlaklaagte Block OC6 project area is predominantly agricultural use. Although the 2 seam been mined underground, no industrial surface infrastructure has been constructed to support the mining.

The pre-mining land uses within the proposed mining area are summarized in **Table 26**.

Table 26: Pre-mining land uses

LEGEND – PRE-MINING LAND USE				
Land Use Code	**Pre-mining Land Use**	**Unit Count**	**Area (ha)**	**Area (%)**
M	Maize	2	55.10	76.49
***G**	Grazing	2	7.50	10.41
G-O	Grazing - old fields	1	7.22	10.02

FS	Farmstead	1	2.20	3.05
GY	Graveyard	1	0.02	0.03
*Grazing includes all small areas that are not necessarily actively grazed but could be grazed from time to time	**TOTAL**	**7**	**72.04**	**100.0**

8.18. Description of specific environmental features and infrastructure on the site

The current prevailing environmental conditions within the proposed development area are mostly dominated by existing agricultural activities. Adjacent land uses are also mainly agriculture and mining, provincial and district roads, and infrastructure such as power lines and railway lines. Komati Power Station is within close proximity to the project area (approximately 7 km).

Baseline information for this Draft EIR and EMP was gathered through visual inspections, specialist studies and previous reports compiled as part of 2 Seam EMPR process, desktop studies and review of existing reports of the project area and surroundings.

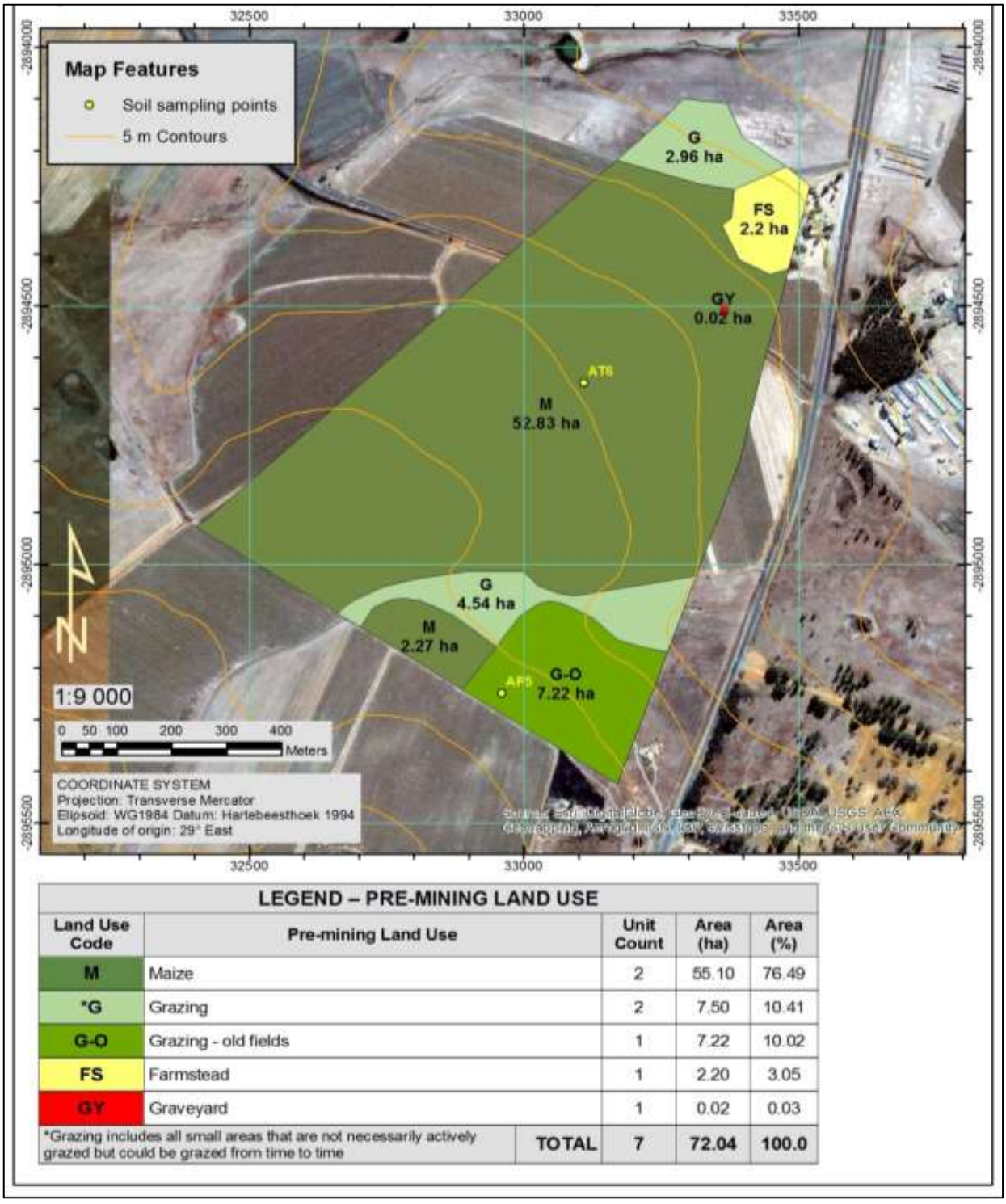
Refer to **Figure 2**, the Locality Map, for an indication of the regional infrastructure significant to the proposed Vlaklaagte Block OC6 Project area. Also see **Figure 4** to view some of the environmental features in relation to the planned mining areas and the proposed project site layout. By viewing these figures, it is clear that there are wetland features that run over and nearby the proposed project site and that some of the proposed infrastructure of the current design will be located close to wetland areas.

8.19. Environmental and current land use map

The total project area is the property of Dorstfontein Mining (Pty) Ltd. Although underground mining on the #2 seam was conducted no mining related infrastructure occurs on the project area. Agricultural activity is the main land use on the area currently as the land is leased to a local farmer.

The main environmental features can be seen on **Figure 4** and the land use on **Figure 30**.

The current land use features as mentioned, are mainly due to agricultural and mining activities, since the project area was an old underground mining area. **Figure 4** indicates the project area the planned open pit mining areas and associated infrastructure, as well as the wetland and river features within the vicinity of the site.



LEGEND – PRE-MINING LAND USE

Land Use Code	Pre-mining Land Use	Unit Count	Area (ha)	Area (%)
M	Maize	2	55.10	76.49
*G	Grazing	2	7.50	10.41
G-O	Grazing - old fields	1	7.22	10.02
FS	Farmstead	1	2.20	3.05
GY	Graveyard	1	0.02	0.03
*Grazing includes all small areas that are not necessarily actively grazed but could be grazed from time to time	TOTAL	7	72.04	100.0

Figure 30: Land use map of the proposed project area

9. Environmental IMPACT ASSESSMENT

9.1. Impact Assessment Method

The potential impacts of the proposed Vlaklaagte OC6 Project on the environment needs to be assessed in terms a formalised method. A typical risk assessment process was undertaken where the significance of the impacts was determined. Once the significance of the impacts was known it was be re-evaluated taking cognisance of the proposed mitigation/management measures. This will enable an understanding of the overall impact after the implementation of mitigation/management measures. The process that will be undertaken is described in the section below.

According to the NEMA Regulations, 'significant impact means an impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment'. In line with the Regulations, and based on the qualitative findings of the activities undertaken, each potentially significant impact has been assessed with regard to:

- the nature and status of the impact;
- the extent and duration of the impact;
- the probability of the impact occurring;
- the effect of significance on decision-makings;
- the magnitude of the impact; and
- the mitigation efficiency.

9.2. Impact significance process

Nature and Status

The 'nature' of the impact describes what is being affected and how. The 'status' is based on whether the impact is positive, negative or neutral.

Spatial Extent

'Spatial Extent' defines the spatial or geographical scale of the impact.

Category	Rate	Descriptor
Site	1	Site of the proposed development
Local	2	Limited to site and/or immediate surrounds (500m zone of influence)
District	3	Local Municipal Areas
Region	4	District Municipal Areas
Provincial	5	Mpumalanga Province
National	6	South Africa
International	7	Beyond South African borders

Duration

'Duration' gives the temporal scale of the impact.

Category	Rate	Descriptor
Temporary	1	Construction phase/0 – 1 years
Short term	2	1 – 5 years
Medium term	3	5 – 15 years
Long term	4	Where the impact will cease after the operational life of the activity either because of natural process or by human intervention
Permanent	5	Where mitigation either by natural processes or by human intervention will not occur in such a way or in such a time span that the impact can be considered as transient

Probability

The 'probability' describes the likelihood of the impact actually occurring.

Category	Rate	Descriptor
Rare	1	Where the impact may occur in exceptional circumstances only
Improbable	2	Where the possibility of the impact materialising is very low either because of design or historic experience
Probable	3	Where there is a distinct possibility that the impact will occur
Highly probable	4	Where it is most likely that the impact will occur
Definite	5	Where the impact will occur regardless of any prevention measures

Magnitude

'Magnitude' defines whether the impact is destructive or benign, in other words the level of impact on the environment.

Category	Rate	Descriptor
Insignificant	1	Where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected. Localised impact and a small percentage of the population is affected
Low	2	Where the impact affects the environment in such a way that natural, cultural and social functions and processes are affected to a limited extent
Moderate	3	Where the affected environment is altered in terms of natural, cultural and social functions and processes continue albeit in a modified way
High	4	Where natural, cultural or social functions or processes are altered to the extent that they will temporarily or permanently cease
Very High	5	Where natural, cultural or social functions or processes are altered to the extent that they will permanently cease and it is not possible to mitigate or remedy the impact

Reversibility

"Reversibility" defines whether the environment/aspect affected can be restored or recovered after activity has resulted in the impact.

Category	Rate	Descriptor
Very High	1	Intensity of the impact is low and the receiving environment has the capacity, resources and mechanisms to mitigate or optimize the impact.
High	2	Intensity of the impact is low to moderate and the receiving environment has the capacity, resources and mechanisms to mitigate or optimize the impact.
Moderate	3	Impact is moderate, and the receiving environment has some mechanisms to mitigate or optimize the impact, as well as resources that can be called upon.
Moderate to Low	4	Potential for mitigation/optimisation is limited because of the severity of the impact and a lack of capacity/resources and coping mechanisms in the receiving environment.
Low	5	Potential for mitigation/optimisation is highly / severely limited because of the severity of the impact and a lack of capacity/resources and coping mechanisms in the receiving environment.

Impact significance without mitigation (WOM)

Following the assignment of the necessary weights to the respective aspects, criteria are summed and multiplied, resulting in a value for each impact (prior to the implementation of mitigation measures).

Equation 1:

Consequence = Extent + Duration + Magnitude + Reversibility

Equation 2:

Impact Significance = Probability x Consequence

Effect of Significance on Decision-makings

Significance is determined through a synthesis of impact characteristics as described in the above paragraphs. It provides an indication of the importance of the impact in terms of both tangible and intangible characteristics. The significance of the impact "without mitigation" is the prime determinant of the nature and degree of mitigation required.

Rating	Rate	Descriptor
Negligible	0	The impact is non-existent or insignificant, is of no or little importance to decision making.
Low	1-19	The impact is limited in extent, even if the intensity is major; the probability of occurrence is low and the impact will not have a significant influence on decision making and is unlikely to require management intervention bearing significant costs.
Low to Medium	20 – 39	The impact is of importance, however, through the implementation of the correct mitigation measures such potential impacts can be reduced to acceptable levels. The impact and proposed mitigation measures can be considered in the decision-making process
Medium	40 – 59	The impact is significant to one or more affected stakeholders, and its intensity will be medium or high; but can be avoided or mitigated and therefore reduced to acceptable levels. The impact and mitigation proposed should have an influence on the decision.
Medium to High	60 -79	The impact is of major importance but through the implementation of the correct mitigation measures, the negative impacts will be reduced to

Rating	Rate	Descriptor
		acceptable levels.
High	80 – 110	The impact could render development options controversial or the entire project unacceptable if it cannot be reduced to acceptable levels; and/or the cost of management intervention will be a significant factor and must influence decision-making.

Mitigation

"Mitigation" is a broad term that covers all components of the 'mitigation hierarchy' defined hereunder. It involves selecting and implementing measures, amongst others, to conserve biodiversity and to protect the users of biodiversity and other affected stakeholders from potentially adverse impacts as a result of mining or any other land use. The aim is to prevent adverse impacts from occurring or, where this is unavoidable, to limit their significance to an acceptable level. Offsetting of impacts is considered to be the last option in the mitigation hierarchy for any project.

The mitigation hierarchy in general consists of the following in order of which impacts should be mitigated: -

- Avoid/prevent impact: can be done through utilising alternative sites, technology and scale of projects to prevent impacts. In some cases, if impacts are expected to be too high the "no project" option should also be considered, especially where it is expected that the lower levels of mitigation will not be adequate to limit environmental damage and eco-service provision to suitable levels;
- Minimise (reduce) impact: can be done through utilisation of alternatives that will ensure that impacts on biodiversity and eco-services provision are reduced. Impact minimisation is considered an essential part of any development project;
- Rehabilitate (restore) impact: is applicable to areas where impact avoidance and minimisation are unavoidable; where an attempt to re-instate impacted areas and return them to conditions which are ecologically similar to the pre-project condition or an agreed post project land use is needed, for example arable land. Rehabilitation can however not be considered as the primary mitigation toll, as even with significant resources and effort rehabilitation usually does not lead to adequate replication of the diversity and complexity of the natural system. Rehabilitation often only restores ecological function to some degree to avoid ongoing negative impacts and to minimise aesthetic damage to the setting of a project. Practical rehabilitation should consist of the following phases in best practice: -
    - Structural rehabilitation, which includes physical rehabilitation of areas by means of earthworks, potential stabilisation of areas as well as any other activities required to develop a long term sustainable ecological structure;

  - Functional rehabilitation, which focuses on ensuring that the ecological functionality of the ecological resources on the subject property supports the intended post closure land use. In this regard special mention is made of the need to ensure the continued functioning and integrity of wetland and riverine areas throughout and after the rehabilitation phase;
  - Biodiversity reinstatement, which focuses on ensuring that a reasonable level of biodiversity is re-instated to a level that supports the local post closure land uses. In this regard special mention is made of re-instating vegetation to levels which will allow the natural climax vegetation community to be suitable for supporting the intended post closure land use; and
  - Species reinstatement which focuses on the re-introduction of any ecologically important species which may be important for socio-cultural reasons, ecosystem functioning reasons and for conservation reasons. Species re-instatement need only occur if deemed necessary.
- Offset impact: refers to compensating for latent or unavoidable negative impacts on biodiversity. Offsetting should take place to address any impacts deemed to be unacceptable which cannot be mitigated through the other mechanisms in the mitigation hierarchy. The objective of biodiversity offsets should be to ensure no net loss of biodiversity. Biodiversity offsets can be considered to be a last resort to compensate for residual negative impacts on biodiversity.

According to the DMR (2013), “Closure” refers to the process for ensuring that mining operations are closed in an environmentally responsible manner, usually with the dual objectives of ensuring sustainable post-mining land uses and remedying negative impacts on biodiversity and ecosystem services.

The significance of residual impacts should be identified on a regional as well as national scale when considering biodiversity conservation initiatives. If the residual impacts lead to irreversible loss or irreplaceable biodiversity, the residual impacts should be considered to be of very high significance and when residual impacts are considered to be of very high significance, offset initiatives are not considered an appropriate way to deal with the magnitude and/or significance of the biodiversity loss. In the case of residual impacts determined to have medium to high significance, an offset initiative may be investigated. If the residual biodiversity impacts are considered of low significance no biodiversity offset is required.

Impact significance with mitigation (WM) measures

In order to gain a comprehensive understanding of the overall significance of the impact after implementation of the mitigation measures, it is necessary to re-evaluate the impact.

Mitigation Efficiency (ME)

The most effective means of deriving a quantitative value of mitigated impacts is to assign each significance rating value without mitigation (WOM) a mitigation effectiveness (ME) rating. The allocation of such a rating is a measure of the efficiency and effectiveness, as identified through professional experience and empirical evidence of how effectively the proposed mitigation measures will manage the impact. Thus, the lower the assigned value the greater the effectiveness of the proposed mitigation measures and subsequently, the lower the impacts with mitigation.

Equation 3:

Significance Rating (WM) = Significance Rating (WOM) x Mitigation Efficiency (ME)

Mitigation Efficiency is rated out of 1 as follows:

Category	Rate	Descriptor
Very Low	1	Mitigation cannot make a difference to the impact
Low	0.8	Mitigation will minimize impact slightly
Moderate	0.6	Mitigation will minimize impact to such an extent that it becomes within acceptable standards
High	0.4	Mitigation will minimize impact to such an extent that it is below acceptable standards
Very High	0.2	Mitigation will minimize impact to such an extent that it becomes insignificant

Significance Following Mitigation (SFM)

The significance of the impact after the mitigation measures are taken into consideration. The efficiency of the mitigation measure determines the significance of the impact. The level of impact is therefore seen in its entirety with all considerations taken into account.

Summary of the significance rating methodology

Extent	Duration	Magnitude	Probability	Reversibility	Significance Rating (SR - WOM) Pre-mitigation	Mitigation Efficiency (ME)	Significance Rating (SR-WM) Post Mitigation
Site (1)	Temporary (1)	Low (1)	Unlikely (1)	Very High (1)	Very Low (0 – 19)	Very High (0.2)	Very Low (0 – 19)
Local (2)	Short Term (2)	Low to Moderate (2)	Low (2)	High (2)	Low (20 – 38)	High (0.4)	Low (20 – 39)

Extent	Duration	Magnitude	Probability	Reversibility	Significance Rating (SR - WOM) Pre-mitigation	Mitigation Efficiency (ME)	Significance Rating (SR-WM) Post Mitigation
Regional (3)	Medium Term (3)	Moderate (3)	Probable (3)	Moderate (3)	Moderate (39 – 59)	Moderate (0.6)	Moderate (40 – 59)
National (4)	Long Term (4)	High (4)	Highly Probable (4)	Moderate to Low (4)	High (60 – 79)	Low (0.8)	High (60 – 79)
International (5)	Permanent (5)	Very High (5)	Definite (5)	Low (5)	Very High (≥ 80)	Very Low (1.0)	Very High (≥ 80)

9.3. Impacts and Risks identified

The detail impact assessments are contained in the specialist reports attached as appendices, and are not repeated here. **Table 28 – Table 35** provides a summary list of the potential risks (and benefits) together with the significance, probability extent, intensity and duration of the impacts.

9.3.1. Activity 1: Opencast Mining

Impacts on Geology

Mining by definition is the extraction of a natural resource and does have a destructive impact on the geology of an area. For the DMR and the owner of a mining right is the maximum exploitation of the natural resource of the utmost importance. Therefor is the loss and sterilisation of the mineral resource through the placement of infrastructure an important impact. The optimised placement and minimisation of mining infrastructure project is the best mitigation to this impact.

The potential impacts on geology are discussed in **Table 28**.

Impacts on Topography

Opencast mining does in its nature have a significant impact on the topography of an area, especially during the operational phase of the project.

Hazardous excavations and infrastructure include all structures into or off which third parties and animals can fall and be harmed. Hazardous excavations and infrastructure occur in all mine phases from construction through operation to decommissioning and closure. In the construction and decommissioning phases these hazardous excavations and infrastructure are temporary in nature, usually existing for a few weeks to a few months. The operational phase will present more long term hazardous excavations and infrastructure and the closure phase

might present final land forms that are considered hazardous. These can include possible surface subsidence due to settling of backfill material.

The potential impacts on topography are discussed in **Table 28**.

Impacts on Soils, Land Use and Land Capability

The specialist soils, land use and land capability report is available as **Appendix 7**.

Soil is a valuable resource that supports a variety of ecological functions. The mine has the potential to damage soil resources through physical disturbance and/or contamination. Contamination of soils also has the potential to impact both surface and groundwater resources.

Soil resources can be damaged and/or lost through:

- Loss of topsoil due to negligent stripping and stockpiling procedures at open pit and due to use of topsoil for construction purposes;
- Deterioration of topsoil quality due to contamination with underlying subsoil layers or rock formations;
- Decline in topsoil fertility due to mixing of soil's A and B horizons (upper and lower horizons) and due to possible mixing of different soil types;
- Compaction and decline in topsoil structure during stockpiling and topsoil re-placing;
- Compaction and sterilisation of undisturbed topsoil underneath stockpiles and dumps;
- Loss of topsoil through erosion at stockpiles, pit edges and rehabilitated areas; and
- Topsoil contamination with hydrocarbons and chemical compounds from mechanical equipment.

Stripping, stockpiling and replacing of topsoil has a very high impact on soil, land capability and land use and the procedures followed during execution of these actions directly influence the post-mining land capability and consequently determine the degree of deterioration from pre-mining to post-mining land capability. They also directly determine the possible post-mining land uses. Direct replacing of topsoil usually cannot take place in the first quarter of the mining process and therefore has to be stockpiled.

Five soil types, Hu1, Hu2, Av1, Av2 and Lo1 occur in the proposed open pit area and should be stripped at different depths and stockpiled as indicated in the specialist report. The soil types occur geographically in non-complex units and separate stockpiling of soil type groups are practical. The specialist report shows the soil types that should be stored on 3 stockpiles

consisting of red well-drained soils, yellow brown moderately well-drained soils and grey poorly drained wetland soils. If required the soils can be stored in 1 continuous stockpile providing that the 3 soil type groups are not mixed.

The backfilled and levelled spoil surface should be covered with the stockpiled topsoil. Care should be taken to tip enough soil per square unit to reinstate the total required post mining soil depth at once. The replaced topsoil thickness (1.3 m) should be progressively monitored during replacement to verify if it is similar to the replacing depth provided in the specialist report and to prevent encountering shortages of topsoil.

The proposed mining footprint could be, and currently is used for crop farming activities. The lost opportunities of alternative land use which the mine will eliminate is however not significant relative to the benefits of the proposed mining activity.

Impacts on Flora

The specialist flora report is available in **Appendix 8**.

Mucina & Rutherford (2006) classified the area as Eastern Highveld Grassland, comprising slightly to moderately undulating plains, including some low hills and pan depressions. The vegetation is short, dense grassland dominated by the usual Highveld grass composition with small scattered rocky outcrops with wiry, sour grasses, and some woody species.

The soils are red to yellow sandy soils found on shales and sandstones of the Madzaringwe Formation. This vegetation unit has a strongly seasonal summer rainfall with very dry winters. Incidence of frost is expected from 13 to 42 days but higher at high elevations.

The Eastern Highveld Grassland vegetation unit is considered a Protected Ecosystem in accordance with the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).

Four vegetation study units were identified on the study site:

- Wetland vegetation;
- Cultivated fields;
- *Eragrostis – Helichrysum* grassland; and
- Mixed vegetation of farming and mining areas.

The flora study found that the part of the Wetland Vegetation unit and the *Eragrostis – Helichrysum* grassland study unit, are deemed sensitive. The rest of the study site comprises secondary grassland and farming areas and is not deemed sensitive.

No Red List, Orange List or protected species were recorded on the study site.

Impacts on Fauna

The specialist fauna reports are available in **Appendix 8**.

The mammal study found that the proposed mining activities will affect the remaining mammals recorded from the site. However, it is argued that this is of little consequence since species richness has been seriously depleted and the *Crocidura* species are not endangered. The proposed mining on the terrestrial portion of the site will not impact much more on species richness or the depleted ecological functionality. The wetland system is the main corridor for immigration of species and the integrity of the wetland system is critical.

Connectivity is near unhindered, but in the terrestrial habitat from the region the environment has been cleared by agriculture and mining. From a mammal perspective no areas were identified as a high sensitivity.

The avifaunal study found that most of the Red Data avifaunal species that are likely to occur in the study area are only likely to move through the area on rare occasions due to the fragmented state and surrounding disturbed areas. Some of the habitat systems, however, offer suitable habitat for Red Data avifaunal species during optimal conditions. Most of the aquatic habitat with their buffers, as delineated by an aquatic specialist, should be regarded as highly sensitive and should be kept free from any development or any form of disturbance. Natural grassland along these wetland systems should also be regarded as sensitive to offer suitable foraging habitat for aquatic Red Data avifaunal species. Not only are these areas sensitive for Red Data avifaunal species but also for all other avifaunal species that occur or are likely to occur within the study area.

The herpetological study found that the Olifants River drainage lines are sensitive ecological systems. A 100 meter buffer must be conserved next to the water courses. Measures will have to be taken to stop water pollution of the Olifants River drainage lines. The removal of exotic trees along the drainage lines will increase the water quality and the habitat of water-dependent herpetofauna.

The possibility exists that individuals of the giant bullfrog and coppery grass lizard occur on the study site.

The terrestrial habitat quality has been jeopardised by former agricultural activities and exotic plants. Water pollution and invasive plants threaten the integrity of the drainage line.

If the mining should go ahead, a very important indirect effect would be the likely impact that the proposed mining activities might have on the water quality of the Olifants River and wetlands due to the waste water and surface water runoff. However no real objection can be raised against the mining if the integrity of the Olifants River and wetlands are not jeopardised in any way by the mining activities.

The Invertebrate study found that wetlands on site have habitat that is suitable for supporting breeding populations of the Marsh Sylph. Both sexes of this species of butterfly drink from flowers and the larvae feed on marsh grasses, and the High sensitivity areas comprises of grasses with ample flowering plants. A 50-200m buffer has been allocated to the sensitive areas in the north of the study site. It is essential that the wetland areas and at least a 50m buffer be preserved to conserve the habitat of the *M. meninx*.

Impacts on Groundwater

Operational Phase

Groundwater Quantity (groundwater level drawdown)

The mine floor elevation is below the general groundwater level thus causing groundwater inflows into the opencast mining areas from the surrounding aquifers during operations. The mining areas will have to be actively dewatered to ensure a safe working environment. Abstraction of groundwater that seeps into the mine areas will cause dewatering of the surrounding aquifers and an associated decrease in 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, vertical infiltration of the recharging water, the size of the mining area, and the aquifer transmissivity amongst others. The 3-D numerical groundwater flow model was used to simulate the development of the drawdown cone over time in the study area. The latest mining schedules (at the time of investigation) also taken in consideration when calculating the drawdown.

During the operational phase, it is expected that the main impact on the groundwater environment will be de-watering of the surrounding aquifer. The OC1, OC2, OC3, OC3A, OC4 and OC6 opencasts will be mined at various stages. For this investigation it has been assumed mining will take place between 2017 and 2027. The smaller opencasts on the eastern part of the site, targeting the No. 1, 2 and 4 seams, will be mined from 2019. The larger opencasts on the western part of the site targeting the No. 4 seam will be mined in 2019 - 2037 (OC4 & OC6).

However, the model results indicate groundwater drawdown will be limited to small areas surrounding the opencasts due to the water collected in the underground voids of the old TNC colliery. This limits the drawdown effects of the proposed opencasts. As the operational phase is limited to maximum 10 years, the limited drawdown effects will be short term. The following deductions can be made:

- Groundwater levels will likely only be lowered in relatively small areas surrounding the proposed opencasts due to the influence of the existing underground voids;
- However, the underground voids are numerically modelled as river-cells which feed groundwater into the opencasts while mining continues. The modelling calculations did not incorporate potential lowering of water levels in the underground voids due to the mining activities, nor did it include potential preferential pathways between existing underground voids and proposed opencasts;
- Base flow to some of the tributaries of the Olifants River crossing the site could be affected and reduced due to the dewatering of the opencasts; and
- No privately owned boreholes are likely to be impact by lowering of groundwater levels.

Groundwater Quantity (Mine Inflow volumes)

The mine inflows were calculated using the model as described in the report. These volumes do not take into account potential inflows from the existing underground voids of the TNC Colliery, which will be discussed in the next section. Initial peaks in groundwater inflows at the start of mining of each opencast due to storage depletion in the surrounding aquifer.

Total groundwater inflow for the 2 Seam mine without additional groundwater inflow through pillars will be between ~ 150 m3/d and ~1 500 m3/d with inflows increasing as the year progresses due to the mining of several opencasts at different times. The mining activities cease towards the latter half of 2027.

Inflows into the opencast mining operations will likely be higher than calculated with the numerical model due to the presence of underground voids in areas adjacent to some of the

opencasts. Block 1, Block 2, and Block 6 are likely to receive additional inflows from adjacent underground voids though barrier pillars.

Spreadsheet calculations were used to estimate additional inflows to opencasts from underground voids. Based on information received from the client an 18 m barrier pillar will be left between the existing underground voids and flooded opencasts and the proposed opencasts, and this was used as input into the calculations. Groundwater inflow calculations were based on this width to determine the sensitivity of the inflows based on the pillar width.

Based on Packer test results of the No. 2 Seam (Hodgson & Krantz, 1998) and aquifer test results as part of this study 0.1 m/day was considered a good estimate for the hydraulic conductivity of the No. 2 seam. However impacts of the historic and proposed mining activities could be significantly increase the hydraulic conductivity of the barrier pillars. Therefore conductivities for the pillars of 0.1, 0.5 and 1 m/day were used as input into the calculations.

It was found in the GCS 2016 study that the pillar width has a minimal effect when compared to hydraulic conductivity.

Inflows including the potential inflows from adjacent mining areas were estimated for Block 1, Block 2, Block 2A and Block 6. A pillar width of 18 m and a hydraulic conductivity of 0.1 m/day was assumed.

With the inclusion of pillar inflows the total inflows are higher for the whole 11 years of mining. Inflows vary between ~370 and ~1 900 m3/d.
Inflows from adjacent mining areas could increase if the hydraulic conductivity of the coal seam is higher than 0.1 m/d. This can be the case as hydraulic conductivities as high as 0.5 m/day for the No. 2 coal seam have been reported (Hodgson & Krantz, 1998). In addition, mining activities such as blasting could impact on pillar hydraulic conductivities.

Therefore hydraulic conductivities of 0.5 and 1 m/d were used for an estimated range of inflows through the pillars. The inflows with a k of 1 m/d should be considered as a worst case scenario and measures should be taken to deal with inflows of this order.

Mining of the opencasts should be done with caution given the close proximity of the proposed workings to TNC underground, flooded opencasts and potential inaccuracies in the extents of the underground voids. There is a high risk of increased groundwater inflows due to barrier pillar failure or (partly) mining of these pillars and mitigation measures should be implemented

to address this risk. The mine should also ensure that sufficient pumping capacity is available to manage any sudden inrushes to prevent loss of life and equipment damage.

Groundwater Quality (Contamination of the surrounding aquifers)

The life of mine for the proposed mining at the 2 Seam Pty Ltd Mine is planned until 2027. This allows time for chemical reactions to take place in the mined out areas, overburden dumps and other potential pollution sources to produce ARD conditions. Groundwater flow directions will be directed towards the mining areas due to the mine dewatering. Therefore, contamination will be contained within the mining areas, and little contamination will be able to migrate away from the mining area. Any water balancing dams and/or pollution control dams should be lined, thereby preventing contamination of the underlying aquifers.

Due to the possibility of high inflows from underground voids and pillar barriers it is likely the water balance for the site will show large volumes of excess water on-site abstracted from the opencasts.

Post Closure Phase

Groundwater Quality

Once the mining has ceased, ARD is likely to form given the unsaturated conditions in the opencasts 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.

The contaminant plumes emanating from the rehabilitated opencasts will have a cumulative impact on the groundwater quality as seen in the post mining simulations (**Figure 31 and Figure 32**). The migration of contaminated water from the opencasts has been simulated for 50 and 100 years after mine closure (i.e. it is assumed that all opencast have been rehabilitated and backfilled).

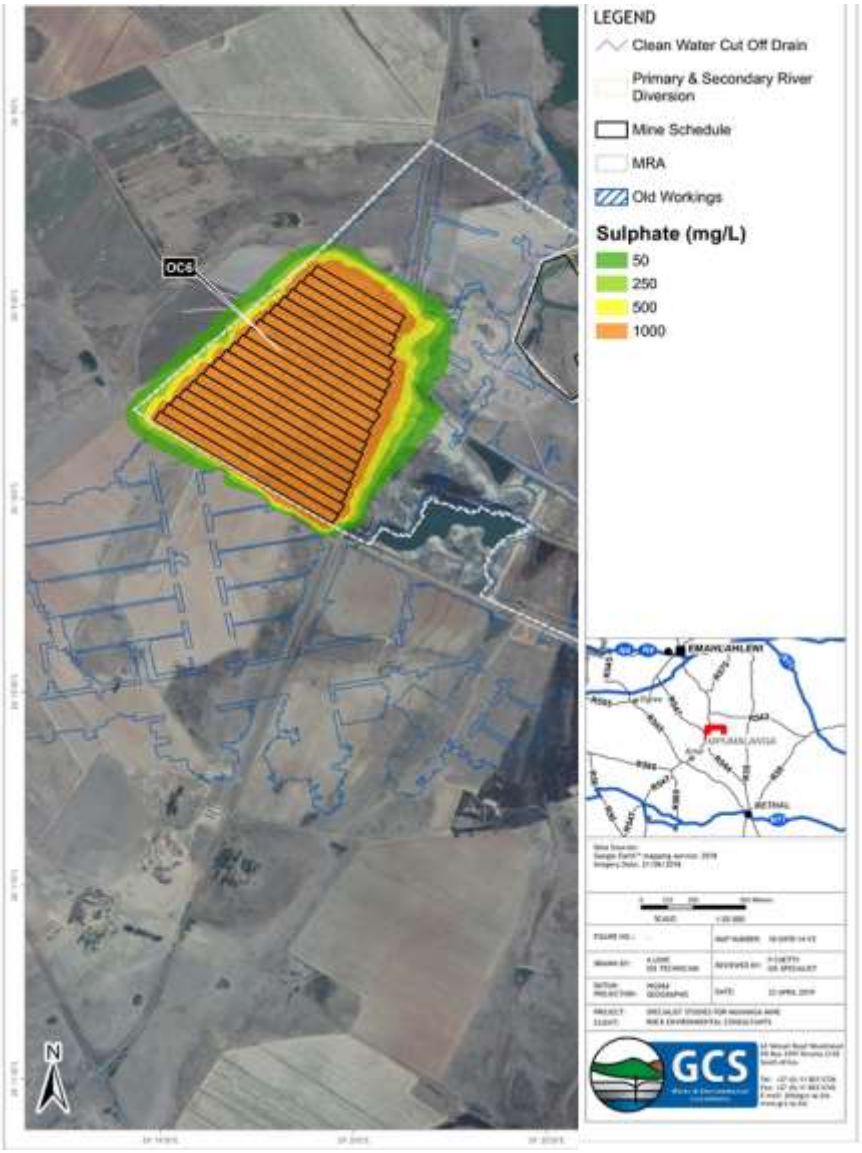


Figure 31: Simulated Sulphate contaminant plume – 50 years post closure

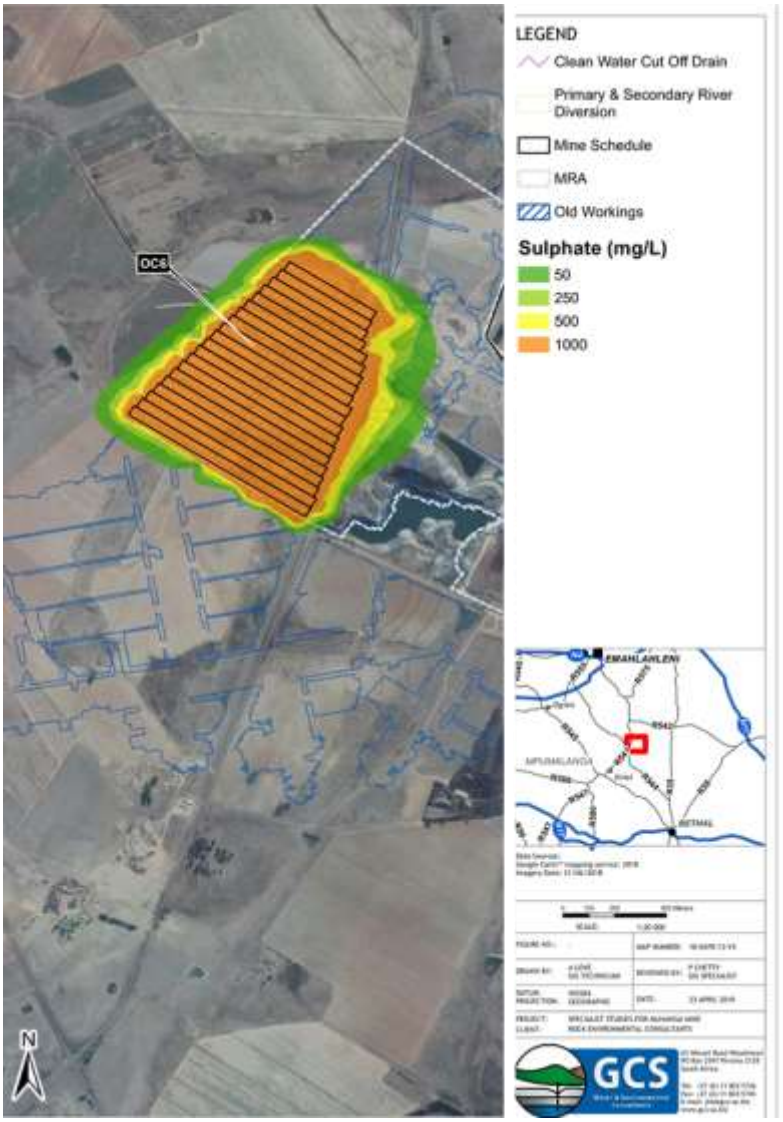


Figure 32: Simulated Sulphate contaminant plume – 100 years post closure

The contaminant plume emanating from Block OC6 will move in a north-north-westerly direction towards the Olifants River. The contaminant concentration is likely to increase over time as the plume develops. Based on the geochemical assessment the sulphate concentration is expected to increase from 500 to 3000 mg/l during the first 20 years post-closure and stabilise at 3000 mg/l for the period 20 – 100 years post-closure at the mining block.

No privately owned boreholes located in the Karoo lithologies are likely to be impacted based on the impact simulations. However shallow contaminated seepage may impact on the tributaries of the Olifants River, and water quality monitoring in the tributaries is proposed.

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.

Mine Water Decant

For opencast mining the decant point can be established as the lowest topographical point of the pit outline at the end of life of mine. When the active dewatering of the blocks has ceased, groundwater levels will rebound. As the backfilled opencasts flood, decant will occur when the groundwater level recovers to above the lowest surface elevation of the pit. This can occur long after the end of life of mine and is referred to as the time-to-decant.

Based on the current groundwater levels at the site, decant is only likely to occur in Block 1. This is because this opencast is found within a low lying area of the site which is in close proximity to a tributary of the Olifants River. For all other opencasts it is unlikely that decant will occur as groundwater levels in the area are significantly influenced by the historic mining activities at the site, and overall groundwater levels are subdued. Therefore, the probability of decant from the backfilled opencast Block OC6 is low, and moderate for Block 1.

Impacts of Freshwater resources

The specialist surface water report is available as **Appendix 9**. The specialist report included an assessment of existing clean and dirty water management infrastructure.

According to the Water Research Commission (WRC) study of the Water Resources of South Africa (WR 2012), the Vlaklaagte OC6 Project falls within the Olifants River Water Management Area (WMA 4) and more specifically within Quaternary Catchment B11B, with the following catchment characteristics:

- Mean Annual Precipitation (MAP) : 688mm
- Mean Annual Evaporation (MAE) : 1 550mm
- Mean Annual Runoff (MAR) : 23.65 mil m3
- Rain Zone : B1A
- Evaporation Zone : 4A

The confluence of the tributary and the Olifants River is on RE of the farm Clydesdale 483 IS.

The Vlaklaagte OC6 Project is in close proximity to the Olifants River and the western wetland system is a small tributary of the Olifants River and flows from south-west to north-east. The Western stream of the Vlaklaagte OC6 Project has a catchment area of ±6.69 km².

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The quantified impact that the Vlaklaagte Block OC6 Opencast will have on the Quaternary Catchment Yield is minimal during the operational phase. The opencast area will be rehabilitated to ensure a free draining profile as close as possible to pre-mining topography. This will result in no loss of surface run-off post-closure.

The major impacts associated with the whole project are as follows:

- Water quality

Water quality impacts are due to a change in natural conditions and enhancement of pollution from sources. On a regional scale, due to a decrease in runoff, the dilution of other pollution sources is affected. Therefore, a reduction in runoff could result in a more pronounced pollution effect.

- Catchment yield and hydrology

The affected stream will be affected due to a reduction in runoff. Polluted water that would naturally flow to the stream is contained on site.

The potential impacts could be grouped in the following:

- Stream Flow Reduction
- Sediment Transport/ erosion
- Unstable River Banks
- Removal of Vegetation
- Deterioration of Water Quality

Stream Flow Reduction

The collection, storage and re-use of affected water from activities like the access roads, haul roads and opencast mining will decrease the run-off towards the tributary of the Olifants River. This will result in the reduction of stream flow in these streams/rivers and the total catchment yield.

Sediment Transport/ erosion

Paved and roof areas result in an increase in the volume and the speed of surface runoff. This results in a higher potential of soil erosion which will lead to increase in the sedimentation of local streams and the resultant deterioration in the water quality.

Unstable River Banks
Clean water will be diverted around dirty areas and the opencast operation. Drains and channels will be constructed to handle the clean water run-off. If these water management structures are not designed and constructed correctly, it can cause damage to stream/river banks where high volumes of water enter streams/river.

Removal of Vegetation
Due to the clearing of land of vegetation and topsoil for opencast mining, construction purposes, construction of access roads and construction camps, contaminated runoff from these areas may increase resulting in an increase of the volume of contaminated water that needs to be handled on the Vlaklaagte OC6 project footprint.

Deterioration of Water Quality
The opencast area must be considered as a dirty catchment area and all surface runoff from this area will be contaminated. There is a high potential of water quality impact from this activity if water is not contained.

The mining and hauling of coal, increases the probability of localised accidental spillages of hydrocarbons (diesel, oils etc.) from earthmoving and construction equipment and transport of equipment and personnel to and from the site. The impact will be contained to the site only and will be of a short duration as spillages can usually be remediated immediately. Accidental spillage from areas seen as dirty area will have a negative impact on the water quality of the natural surface water and will be collected and pumped to the PCD at Vlaklaagte Mine.

Run-off water from haul roads and spoil stockpiles can increase the salinity levels of the stream/river and should be minimized, contained and re-use as far as possible.

Impact on Wetlands and Aquatic Ecology

The specialist reports on wetlands and aquatic ecology are available in **Appendix 11**.

According to the **Wetland Ecological Assessment**, there are four key ecological impacts on the wetlands that are anticipated to occur namely,

- Loss of wetland habitat and ecological structure;
- Changes to the sociocultural and service provision;
- Impacts on the hydrology and sediment balance of the wetlands; and
- Impacts on water quality.

Various activities and development aspects may lead to these impacts, however, provided that the mitigation hierarchy is followed, some impacts can be avoided or adequately minimised where avoidance is not feasible. The mitigation measures provided in the report have been developed with the mitigation hierarchy in mind, and the implementation and strict adherence to these measures will assist in minimising the significance of impacts on the receiving environment.

As some of the site clearing and preparation activities will occur within the wetlands, these activities are considered to be of '**Medium**' risk significance to these wetlands. However, construction of the surface infrastructure is considered to be of a relatively short duration which will take place at selected localities within the southern portion of the UCVB wetland (complete removal of vegetation and ripping of top soil) and within the 32m NEMA Zone of Regulation of the CVB wetland.

The clean water trench proposed to divert clean water into the CVB wetland was determined to also pose a '**Medium**' risk significance to the wetland, during the construction and operation thereof. This trench will affect the surface and subsurface recharge of the CVB wetland. It is recommended that the trench outlet be constructed with energy dissipating structures to slow down the velocity of water entering the wetland. The area surrounding the outlet should also be re-seeded with indigenous wetland vegetation in order to limit erosion within the wetland.

In applying the risk assessment, it was assumed that the mitigation hierarchy as advocated by the DEA et al. would be followed, i.e. the impacts would first be avoided. As the proposed open cast pit is located within the UCVB wetland, which will be lost, this is not feasible. Unless its practical and feasible to reinstate this wetland post-closure (to at least a PES Category D condition), rehabilitation (post-closure) or offsetting thereof is recommended. As only a small portion of the UCVB wetland would be lost, the residual impact is considered relatively small, however, a net loss of wetland resources is not avoidable (thus a '**High**' risk significance). If offsetting is considered, it is expected that the quantum of offsetting would be limited.

The open cast pit is also considered to cause alteration to the hydropedological flow drivers of the CVB wetland. Impacts to the subsurface flow (considered to be the main hydrological driver of this wetland), does pose a risk to the hydrological functioning to the CVB wetland. Mining within the wetland recharge soils should be reconsidered, as the CVB wetland is largely driven by subsurface flow, of which a portion thereof would be mined out as part of the open cast pit area. The overburden stockpile areas are also anticipated to hinder water infiltration or distribution across this wetland system (during all phases) due to the proposed overburden

stockpile being located on soil resources defined as wetland recharge soils. If possible, the location of these stockpiles should be reconsidered. The overburden stockpiles should not be located on any soil considered to be of hydropedological importance to the wetlands, nor within the 100m GN704 Zone of Regulation of the wetlands.

Dewatering of the open cast pit is expected to occur. This poses a '**Medium**' risk significance on the hydrological regime of the remaining upstream portion of the UCVB wetland, by decreasing the level of the subsurface flow (draw down due to a cone of depression forming, and thus reduce the rate of recharge. Dewatering is, however, expected to occur at a very low rate, and thus, the likelihood of the impact of dewatering is expected to be of **Medium** risk significance.

It is the opinion of the freshwater ecologist that the proposed activities is not fatally flawed, since the loss of a portion of the UCVB wetland could be considered a low quantum of loss, in relation to the surrounding freshwater environment and considering its current ecological condition. Nevertheless, strict adherence to mitigation measures should be enforced, in order to ensure that the ecological integrity of the remaining freshwater environment is not further compromised.

Impacts on Air Quality

There is a number of activities/infrastructure associated with mining operations that have the potential to pollute the air. In the construction and decommissioning phases these activities are temporary in nature. The operational phase will present more long term activities and the closure phase will present final land forms that may have the potential to pollute the air through long term wind erosion.

The Vlaklaagte OC6 project is located in a region which is already exposed to a wide range of air pollution sources.

Dust is generated as a result of opencast mining operation, blasting and wind erosion from stockpiles and unpaved areas.

The potential impacts on air quality are discussed in **Table 28.**

Impacts on Heritage

The Phase I HIA study for the proposed Vlaklaagte Block OC6 Project revealed the following types and ranges of heritage resources as outlined in Section 3 of the National Heritage

Resources Act (No 25 of 1999) in and near the Project Area, namely:

- A graveyard.

The 4 graves belong to:

(1) Anna Maria J. Pretorius (born Roos) who was born in 1886 and died in 1944

(2) Matthys Johannes Nicolaas Swart who was born in 1882 and died in 1919

(3) Anna Elizabeth Magrieta Lourens (born De Wet) who was born in 1907. No death date on stone

(4) Matthys Johannes Lourens who was born in 1905 and passed away in 1960.

Graves always carry a High Significance Rating from a Cultural Heritage point of view and should be handled with care. As these graves are older than 60 years of age they are protected by the National Heritage Resources Act as well and should be protected in situ if possible. If the grave site and graves on it cannot be avoided by the proposed mining development then they can be exhumed and relocated after all due processed have been followed. This will include detailed social consultation to try and contact any living descendants of the deceased in order to obtain their consent for the exhumations & relocations and obtaining permits from SAHRA, local, provincial and national authorities before the exhumation and relocation work can be conducted.

The graveyard was geo-referenced and mapped.

Visual Impacts

The assessment of visual impacts takes the following issues into account: the pre-mining visual resource and the visibility, visual intrusion, sensitivity of viewing receptors, and visual exposure, associated with the mine.

The visual resource of the mine area is determined by considering landscape character, sense of place, and landscape quality. The pre-mining visual resource was considered to be of moderate to low value because the predominantly rural agricultural setting of the broader area is compromised by power lines, roads, telephone lines and mining activities neighboring the project area.

Visibility refers to the extent to which people in the surrounding areas will see the project. The mine can be seen from all directions.

Visual intrusion refers to the magnitude of the intrusion that the mine has on existing views. The visual intrusion of the mine is high during the operational phase, which can be reduced to a low intrusion with successful implementation of the requirements for rehabilitation and closure.

Sensitivity of visual receptors refers to the fact that the visual impact varies according to the sensitivity of the receptors in the project area. Although various third parties currently remain within a relatively close proximity of the area no issues regarding visual impacts have been raised. It must therefore be concluded that the visual impact is not a sensitive issue.

Visual exposure is the extent to which infrastructure and activities will appear in various views. It follows that the closer the infrastructure and activities, the greater the visual exposure.

Table 27: Impact Assessment – Opencast Mining

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Geology										
Disturbance of natural geology (C, O, D, Clo).	N	Permanent	Site	Very High	Low	Definite	Very High	Low	Very High	No mitigation possible.
Use and loss of non-renewable coal resource (C, O, D, Clo).	N	Permanent	Site	High	Moderate	Definite	Moderate	Very Low	Moderate	No mitigation possible.
Increased porosity and hydraulic conductivity (O, D, Clo).	N	Permanent	Site	High	Low	Definite	High	Very Low	High	Ensure rehabilitation is conducted as per approved plan.
Subsidence and development of surface cracks (O, D, Clo).	N	Long Term	Site	Moderate	Moderate	Improbable	Low	Moderate	Very Low	Control collapsing of areas, development of surface cracks of rehabilitated areas by means of regular monitoring of the areas and suitable remediation methods.
Topography										
Alteration of the topography due to mining and the proposed infrastructure (C, O, D, Cl).	N	Long Term	Site	High	Moderate	Definite	High	Moderate	Low	Disturbances to natural areas must be minimised.
Soil, Land Use and Land Capability										
Loss of natural soil horizons, soil as growth medium and soil productivity due to the open pit mining and construction of associated infrastructure. (C, O, D, Cl).	N	Long Term	Site	High	Moderate	Definite	Moderate	High	Very Low	Soil types should be stripped at depth and stockpiled as indicated on the soil stripping plan.
Loss of topsoil due to negligent stripping and stockpiling procedures at open pit and due to use of topsoil for construction purposes.	N	Permanent	Site	Moderate	Moderate	Definite	Moderate	High	Very Low	Soil types should be stripped at depth and stockpiled as indicated on the soil stripping plan.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Deterioration of topsoil quality due to contamination with underlying subsoil layers or rock formations	N	Long Term	Site	High	High	Definite	Low	High	Very Low	Soil types should be stripped at depth and stockpiled as indicated on the soil stripping plan.
Compaction and decline in topsoil structure during stockpiling and topsoil re-placing	N	Medium Term	Site	High	High	Definite	Low	High	Very Low	Handling of stripped topsoil should be minimized to ensure soil's structure does not deteriorate and traffic on stockpile should be avoided to prevent compaction.
Compaction and sterilisation of undisturbed topsoil underneath stockpiles and dumps.	N	Medium Term	Site	High	Moderate	Definite	Moderate	Moderate	Low	The cleaned footprint should be deep cross-ripped to alleviate compaction caused by the stockpiles or dumps and related activities
Loss of topsoil through erosion at stockpiles, pit edges and rehabilitated areas	N	Medium Term	Site	High	Moderate	Highly Probable	Low	High	Very Low	Ensure proper storm water management designs and systems are in place
Topsoil contamination with hydrocarbons and chemical compounds from mechanical equipment (C, O, D).	N	Medium Term	Site	Moderate	Moderate	Probable	Low	Moderate	Very Low	Diesel storage tanks should be bunded. Prevent any spills from occurring as far as possible.
Cease in land capability at pit, dumps, stockpiles and infrastructure footprints during mine construction and operation (C, O).	N	Long Term	Site	Very High	Moderate	Definite	High	Moderate	Low	No mitigation is possible during the construction and operational phase.
Cease in current land use at pit, dumps, stockpiles and infrastructure footprints during mine construction and operation (C, O).	N	Long Term	Site	Very High	Moderate	Definite	High	Moderate	Low	Rehabilitation during decommissioning must be conducted as per approved closure and rehabilitation plan.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Cease in agricultural production at pit, dumps, stockpiles and infrastructure footprints during mine construction and operation (C, O).	N	Long Term	Site	Very High	Moderate	Definite	High	Moderate	Low	
Flora										
Impact on the floral habitat integrity of the Low sensitivity area (C, O, D, Cl).	N	Medium Term	Local	Moderate	Moderate	Definite	Moderate	Moderate	Low	Any proposed mining surface infrastructure must be placed within low sensitivity areas as far as possible, as these areas are of low ecological importance.
Impact on the floral habitat integrity of the Wetland habitat (C, O, D, Cl).	N	Medium Term	Local	High	Moderate	Definite	High	Moderate	Low	Site offices, parking areas for mine vehicles, etc. should be confined to non-sensitive areas. Sensitive areas must be demarcated off and vehicles and personnel are not allowed to enter demarcated areas. No collection of floral SCC or medicinal floral species must be allowed by mining personnel. All Declared invasive species must be removed from the site.
Floral Species of Conservation Concern within the Transformed Habitat unit (C, O, D, Cl.).	N	Medium Term	Local	Low to Moderate	High	Probable	Low	High	Very Low	No collection of floral SCC or medicinal floral species must be allowed by construction personnel.
Floral Species of Conservation Concern within the Wetland habitat (C, O, D, Cl).	N	Medium Term	Regional	High	Moderate	Probable	Moderate	Moderate	Low	Dumping of rubble and other waste in the sensitive areas should be prevented through fencing or other management measures. These areas must be properly managed throughout the lifespan of the project in terms of fire, eradication of exotics and monitoring for Red List species to ensure continuous biodiversity.
Fauna										

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Impact on faunal habitat integrity within low sensitivity area (C, O, D, Cl).	N	Medium Term	Local	Moderate	Moderate	Definite	Moderate	Moderate	Low	Fires are strictly prohibited on site. Trapping, hunting or handling of fauna is strictly prohibited. Monitoring of rehabilitation should be conducted by a suitably qualified specialist.
Loss of wetland and riparian habitat and impact on ecological sensitive areas (C, O, D, Cl)	N	Medium Term	Local	High	Moderate to Low	Definite	High	Low	Moderate	Unless it's practical and feasible to reinstate the UCVB wetland post-closure (to at least a PES Category D), rehabilitation (post-closure) or offsetting thereof is recommended. If offsetting is considered, it is expected that the quantum of offsetting would be limited. Implement a monitoring programme to detect and prevent the pollution of soils, surface water and groundwater; Mining within the wetland recharge soils should be strongly reconsidered
Faunal Species of Conservation Concern within the Wetland habitat (C, O).	N	Long Term	National	Very High	Moderate	Probable	High	Moderate	Moderate	If the giant bullfrog, coppery grass lizard or any herpetological species are encountered or exposed during the mining activities, they should be removed and relocated to natural areas in the vicinity. The wetlands, sensitive areas and buffers must be excluded from mining activities as far as possible.
Faunal Species of Conservation Concern within the Wetland habitat (D, Clo).	N	Short Term	National	Very High	Moderate	Probable	High	Moderate	Moderate	Unless it's practical and feasible to reinstate the UCVB wetland post-closure (to at least a PES Category D), rehabilitation (post-closure) or offsetting thereof is recommended. If offsetting is considered, it is expected that the quantum of offsetting would be limited.
Groundwater										

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Impacts on groundwater volumes due to active dewatering of the mining area (O).	N	Medium Term	Local	Low to Moderate	Moderate	Definite	Moderate	Low	Moderate	Keeping the workings dry is necessary for mining and mitigation is not possible. No users are currently likely to be affected. Long term groundwater level monitoring is proposed to compare measured groundwater levels to modelling results.
High water inrushes proceeding from the barrier pillar inflows are a possibility through the life of the mine, and excess water must be pumped for mine safety. (O)	N	Medium Term	Local	Low to Moderate	Moderate	Probable	Low	Low	Low	Sufficient pumping capacity must be in place to deal with the high water inflows to keep workings dry. There must be a necessary plan to handle the excess water and divert it away from the workings.
Impacts on groundwater quality due to poor quality seepage from the mining area (O).	N	Permanent	Site	Low	Low	Unlikely	Very Low	Low	Very Low	There is nothing that can be done to mitigate contamination from the opencasts. However, the area surrounding the mine will not be affected during the operational stage. Long-term groundwater quality monitoring is proposed.
Recovery of groundwater level after dewatering stopped (D, Cl).	P	Permanent	Regional	High	Low	Definite	Very High	-	-	
Impacts on groundwater quality due to contaminant plume from the mining area (D, Cl).	N	Permanent	Local	Moderate	Low	Definite	High	Low	High	All mined areas should be flooded as soon as possible to bar oxygen from reacting with remaining pyrite. The final backfilled opencast topography should be engineered such that runoff is directed away from the opencast areas. 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.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Deterioration of groundwater quality within the backfilled open pits due to AMD reactions and subsequent decant into the shallow aquifer or on surface at the lowest surface elevations intersected by the pit (Clo)	N	Permanent	Local	High	Low	Probable	High	Moderate	Moderate	According to specialist chances of decant at OC6 is very low. It is very difficult to mitigate against AMD. Typically mitigation measures follow one of two routes (or a combination of both): 1) Limiting the amount of water entering the voids left by the mined out areas can be achieved by replacing spoils in such a manner as to be free-draining and preventing the collection and pooling of water on rehabilitated mined land. 2) Treating of decanting mine water to acceptable water quality levels can be achieved by the installation of a treatment plant. The necessity and feasibility of treating the decanting water should be investigated and treatment implemented if necessary.
Freshwater Resources										
Site clearing (C).	N	Short Term	Site	Very High	Moderate	Definite	Moderate	Moderate	Low	The project footprint must be limited as much as possible (this includes clearing of vegetation, which must be restricted to what is essential).
Changes in natural surface water flow parameters.	N	Medium Term	Site	Moderate	Moderate	Definite	Moderate	Moderate	Low	Disturbances to natural areas must be minimized. Rehabilitation must be free draining.
Ancillary activities by construction personnel and employees during other phases (C, O, D).	N	Medium Term	Site	Moderate	High	Probable	Moderate	High	Very Low	Site offices, parking areas for mine vehicles, etc. should be confined to non-sensitive areas. Sensitive areas must be demarcated off and vehicles and personnel are not allowed to enter demarcated areas. Disturbances to natural areas must be minimized. Awareness training must be done with all employees and contractors.
Reduction in clean water runoff to the tributary of the Olifants river. (C, O).	N	Medium Term	Regional	Moderate	Moderate	Definite	High	Moderate	Low	Surface water management plan must be implemented and maintained as designed. Rehabilitation must be free draining.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Reduction in water quality due to the release of suspended solids	N	Medium Term	Local	Moderate	High	Probable	Low	High	Very Low	Ensure proper storm water management designs and systems are in place.
Pollution due to uncontrolled releases from the mining footprint and infrastructure areas	N	Medium Term	Local	High	Low to Moderate	Probable	Moderate	High	Low	Ensure proper storm water management designs and systems are in place.
Impacts on surface water and wetland volumes due to active dewatering of the mining area (C).	N	Medium Term	Local	Low to Moderate	Moderate	Definite	Moderate	Low	Moderate	Mining within the wetland recharge soils should be strongly reconsidered, as the wetland is largely driven by surface runoff and subsurface (interflow) flow.
Potential invasion of alien/invasive species (C, O, D, Cl).	N	Permanent	Local	Moderate	High	Highly Probable	Moderate	High	Low	All disturbances caused by the construction activities must ensure that all recruited alien vegetation is eradicated, and that ongoing alien vegetation control is implemented.
Decant of contaminated water from the mine into the receiving environment (D, Cl).	N	Permanent	Local	High	Low	Probable	Very High	Moderate	Moderate	According to specialist chances of decant at OC6 is very low. It is very difficult to mitigate against AMD. Typically mitigation measures follow one of two routes (or a combination of both): 1) Limiting the amount of water entering the voids left by the mined out areas can be achieved by replacing spoils in such a manner as to be free-draining and preventing the collection and pooling of water on rehabilitated mined land. 2) Treating of decanting mine water to acceptable water quality levels can be achieved by the installation of a treatment plant. The necessity and feasibility of treating the decanting water should be investigated and treatment implemented if necessary.
Potential further habitat degradation (D, Cl).	N	Short Term	Site	Moderate	High	Probable	Low	High	Very Low	Rehabilitation must be conducted as stipulated in the closure and rehabilitation plan.
Air Quality										

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Dust will be generated by construction activities. Exposed surfaces from the removal of vegetation are susceptible to erosional forces including wind. Construction vehicles and machinery moving along roads will generate dust (C).	N	Temporary	Local	Moderate	High	Probable	Low	High	Very Low	Minimise extent of disturbed areas.
Dust will be generated by materials handling activities, blasting and drilling, vehicle entrainment and wind erosion due to ROM stockpile (O).	N	Long Term	Regional	Moderate	Moderate	Probable	Moderate	Moderate	Low	Water sprayers at materials handling points.
Dust will be generated by rehabilitation activities. Exposed surfaces are susceptible to erosional forces including wind. Vehicles and machinery moving along roads will generate dust (D, Cl).	N	Temporary	Local	Moderate	High	Probable	Low	High	Very Low	Ensure site is restored to pre-mining conditions.
Coal bed methane released from the coal bed	N	Medium Term	Local	Low	Moderate	Probable	Low	Very Low	Low	Do roll-over rehabilitation and close pits as soon as possible.
Noise and Blasting										
Blasting Noise (C, O).	N	Temporary	Local	High	Moderate	Definite	Moderate	Moderate	Low	Calculating the charge size to keep air blast and ground vibration levels below pre-determined acceptable values.
Ground vibrations due to blasting potentially affecting surrounding structures (C, O).	N	Temporary	Local	Low	Moderate	Probable	Low	Moderate	Very Low	No structure within 1000 m radius. Investigate complaints from possible damage to structures.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Noise generated by opencast mining activities, transport of materials and rehabilitation post-mining (C, O, D).	N	Long Term	Local	Low	Moderate	Probable	Low	Moderate	Very Low	Fit efficient silencers and enclose engine compartments.
Visual										
Visual intrusion of mining activities, impacting on the sense of place (C, O).	N	Long Term	Site	Moderate	Moderate	Definite	Moderate	Moderate	Low	Mitigation is not possible during operations. Rehabilitate to resemble pre-mining conditions as close as possible.
Impacts on Heritage										
Impact on graveyard as a result of opencast mining	N	Permanent	Site	High	Low	Definite	High	Moderate	Moderate	If the grave site and graves on it cannot be avoided by the proposed mining development then they can be exhumed and relocated after all due processed have been followed. This will include detailed social consultation to try and contact any living descendants of the deceased in order to obtain their consent for the exhumations & relocations and obtaining permits from SAHRA, local, provincial and national authorities before the exhumation and relocation work can be conducted.

9.3.2. Activity 2: Storage and/or Handling of Dangerous Goods

9.3.2.1. Impacts on Soils, Land Use and Land Capability

The specialist soils, land use and land capability report is available as **Appendix 7**.

Soil is a valuable resource that supports a variety of ecological functions. The mine has the potential to damage soil resources through physical disturbance and/or contamination. Contamination of soils also has the potential to impact both surface and groundwater resources.

Soil resources can be damaged and/or lost through:

- Loss of topsoil due to negligent stripping and stockpiling procedures at open pit and due to use of topsoil for construction purposes;
- Deterioration of topsoil quality due to contamination with underlying subsoil layers or rock formations;
- Decline in topsoil fertility due to mixing of soil's A and B horizons (upper and lower horizons) and due to possible mixing of different soil types;
- Compaction and decline in topsoil structure during stockpiling and topsoil re-placing;
- Compaction and sterilisation of undisturbed topsoil underneath stockpiles and dumps;
- Loss of topsoil through erosion at stockpiles, pit edges and rehabilitated areas; and
- Topsoil contamination with hydrocarbons and chemical compounds from mechanical equipment.

Stripping, stockpiling and replacing of topsoil has a very high impact on soil, land capability and land use and the procedures followed during execution of these actions directly influence the post-mining land capability and consequently determine the degree of deterioration from pre-mining to post-mining land capability. They also directly determine the possible post-mining land uses. Direct replacing of topsoil usually cannot take place in the first quarter of the mining process and therefore has to be stockpiled.

Five soil types, Hu1, Hu2, Av1, Av2 and Lo1 occur in the proposed open pit area and should be stripped at different depths and stockpiled as indicated in the specialist report. The soil types occur geographically in non-complex units and separate stockpiling of soil type groups are practical. The specialist report shows the soil types that should be stored on 3 stockpiles consisting of red well-drained soils, yellow brown moderately well-drained soils and grey poorly drained wetland soils. If required the soils can be stored in 1 continuous stockpile providing that the 3 soil type groups are not mixed.

The backfilled and levelled spoil surface should be covered with the stockpiled topsoil. Care should be taken to tip enough soil per square unit to reinstate the total required post mining soil depth at once. The replaced topsoil thickness (1.3 m) should be progressively monitored during replacement to verify if it is similar to the replacing depth provided in the specialist report and to prevent encountering shortages of topsoil.

9.3.2.2. Impacts on Flora

The specialist flora report is available in **Appendix 8**.

Mucina & Rutherford (2006) classified the area as Eastern Highveld Grassland, comprising slightly to moderately undulating plains, including some low hills and pan depressions. The vegetation is short, dense grassland dominated by the usual Highveld grass composition with small scattered rocky outcrops with wiry, sour grasses, and some woody species.

The soils are red to yellow sandy soils found on shales and sandstones of the Madzaringwe Formation. This vegetation unit has a strongly seasonal summer rainfall with very dry winters. Incidence of frost is expected from 13 to 42 days but higher at high elevations.

The Eastern Highveld Grassland vegetation unit is considered a Protected Ecosystem in accordance with the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).

Four vegetation study units were identified on the study site:

- Wetland vegetation;
- Cultivated fields;
- *Eragrostis – Helichrysum* grassland; and
- Mixed vegetation of farming and mining areas.

The flora study found that the part of the Wetland Vegetation unit and the *Eragrostis – Helichrysum* grassland study unit, are deemed sensitive. The rest of the study site comprises secondary grassland and farming areas and is not deemed sensitive.

No Red List, Orange List or protected species were recorded on the study site.

9.3.2.3. Impacts on Fauna

The specialist fauna reports are available in **Appendix 8**.

The mammal study found that the proposed mining activities will affect the remaining mammals recorded from the site. However, it is argued that this is of little consequence since species richness has been seriously depleted and the *Crocidura* species are not endangered. The proposed mining on the terrestrial portion of the site will not impact much more on species richness or the depleted ecological functionality. The wetland system is the main corridor for immigration of species and the integrity of the wetland system is critical.

Connectivity is near unhindered, but in the terrestrial habitat from the region the environment has been cleared by agriculture and mining. From a mammal perspective no areas were identified as a high sensitivity.

The avifaunal study found that most of the Red Data avifaunal species that are likely to occur in the study area are only likely to move through the area on rare occasions due to the fragmented state and surrounding disturbed areas. Some of the habitat systems, however, offer suitable habitat for Red Data avifaunal species during optimal conditions. Most of the aquatic habitat with their buffers, as delineated by an aquatic specialist, should be regarded as highly sensitive and should be kept free from any development or any form of disturbance. Natural grassland along these wetland systems should also be regarded as sensitive to offer suitable foraging habitat for aquatic Red Data avifaunal species. Not only are these areas sensitive for Red Data avifaunal species but also for all other avifaunal species that occur or are likely to occur within the study area.

The herpetological study found that the Olifants River drainage lines are sensitive ecological systems. A 100 meter buffer must be conserved next to the water courses. Measures will have to be taken to stop water pollution of the Olifants River drainage lines. The removal of exotic trees along the drainage lines will increase the water quality and the habitat of water-dependent herpetofauna.

The possibility exists that individuals of the giant bullfrog and coppery grass lizard occur on the study site.

The terrestrial habitat quality has been jeopardised by former agricultural activities and exotic plants. Water pollution and invasive plants threaten the integrity of the drainage line.

If the mining should go ahead, a very important indirect effect would be the likely impact that the proposed mining activities might have on the water quality of the Olifants River and wetlands due to the waste water and surface water runoff. However no real objection can be

raised against the mining if the integrity of the Olifants River and wetlands are not jeopardised in any way by the mining activities.

The Invertebrate study found that wetlands on site have habitat that is suitable for supporting breeding populations of the Marsh Sylph. Both sexes of this species of butterfly drink from flowers and the larvae feed on marsh grasses, and the High sensitivity areas comprises of grasses with ample flowering plants. A 50-200m buffer has been allocated to the sensitive areas in the north of the study site. It is essential that the wetland areas and at least a 50m buffer be preserved to conserve the habitat of the *M. meninx*.

9.3.2.4. Impacts on Groundwater

Operational Phase

Groundwater Quantity (groundwater level drawdown)

The mine floor elevation is below the general groundwater level thus causing groundwater inflows into the opencast mining areas from the surrounding aquifers during operations. The mining areas will have to be actively dewatered to ensure a safe working environment. Abstraction of groundwater that seeps into the mine areas will cause dewatering of the surrounding aquifers and an associated decrease in 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, vertical infiltration of the recharging water, the size of the mining area, and the aquifer transmissivity amongst others. The 3-D numerical groundwater flow model was used to simulate the development of the drawdown cone over time in the study area. The latest mining schedules (at the time of investigation) also taken in consideration when calculating the drawdown.

During the operational phase, it is expected that the main impact on the groundwater environment will be de-watering of the surrounding aquifer. The OC1, OC2, OC3, OC3A, OC4 and OC6 opencasts will be mined at various stages. For this investigation it has been assumed mining will take place between 2017 and 2027. The smaller opencasts on the eastern part of the site, targeting the No. 1, 2 and 4 seams, will be mined from 2019. The larger opencasts on the western part of the site targeting the No. 4 seam will be mined in 2019 - 2037 (OC4 & OC6).

However, the model results indicate groundwater drawdown will be limited to small areas surrounding the opencasts due to the water collected in the underground voids of the old TNC

colliery. This limits the drawdown effects of the proposed opencasts. As the operational phase is limited to maximum 10 years, the limited drawdown effects will be short term. The following deductions can be made:

- Groundwater levels will likely only be lowered in relatively small areas surrounding the proposed opencasts due to the influence of the existing underground voids;
- However, the underground voids are numerically modelled as river-cells which feed groundwater into the opencasts while mining continues. The modelling calculations did not incorporate potential lowering of water levels in the underground voids due to the mining activities, nor did it include potential preferential pathways between existing underground voids and proposed opencasts;
- Base flow to some of the tributaries of the Olifants River crossing the site could be affected and reduced due to the dewatering of the opencasts; and
- No privately owned boreholes are likely to be impact by lowering of groundwater levels.

Groundwater Quantity (Mine Inflow volumes)

The mine inflows were calculated using the model as described in the report. These volumes do not take into account potential inflows from the existing underground voids of the TNC Colliery, which will be discussed in the next section. Initial peaks in groundwater inflows at the start of mining of each opencast due to storage depletion in the surrounding aquifer.

Total groundwater inflow for the 2 Seam mine without additional groundwater inflow through pillars will be between ~ 150 m3/d and ~1 500 m3/d with inflows increasing as the year progresses due to the mining of several opencasts at different times. The mining activities cease towards the latter half of 2027.

Inflows into the opencast mining operations will likely be higher than calculated with the numerical model due to the presence of underground voids in areas adjacent to some of the opencasts. Block 1, Block 2, and Block 6 are likely to receive additional inflows from adjacent underground voids though barrier pillars.

Spreadsheet calculations were used to estimate additional inflows to opencasts from underground voids. Based on information received from the client an 18 m barrier pillar will be left between the existing underground voids and flooded opencasts and the proposed opencasts, and this was used as input into the calculations. Groundwater inflow calculations were based on this width to determine the sensitivity of the inflows based on the pillar width.

Based on Packer test results of the No. 2 Seam (Hodgson & Krantz, 1998) and aquifer test results as part of this study 0.1 m/day was considered a good estimate for the hydraulic conductivity of the No. 2 seam. However impacts of the historic and proposed mining activities could be significantly increase the hydraulic conductivity of the barrier pillars. Therefore conductivities for the pillars of 0.1, 0.5 and 1 m/day were used as input into the calculations.

It was found in the GCS 2016 study that the pillar width has a minimal effect when compared to hydraulic conductivity.

Inflows including the potential inflows from adjacent mining areas were estimated for Block 1, Block 2, Block 2A and Block 6. A pillar width of 18 m and a hydraulic conductivity of 0.1 m/day were assumed.

With the inclusion of pillar inflows the total inflows are higher for the whole 11 years of mining. Inflows vary between ~370 and ~1 900 m3/d.
Inflows from adjacent mining areas could increase if the hydraulic conductivity of the coal seam is higher than 0.1 m/d. This can be the case as hydraulic conductivities as high as 0.5 m/day for the No. 2 coal seam have been reported (Hodgson & Krantz, 1998). In addition, mining activities such as blasting could impact on pillar hydraulic conductivities.

Therefore hydraulic conductivities of 0.5 and 1 m/d were used for an estimated range of inflows through the pillars. The inflows with a k of 1 m/d should be considered as a worst case scenario and measures should be taken to deal with inflows of this order.

Mining of the opencasts should be done with caution given the close proximity of the proposed workings to TNC underground, flooded opencasts and potential inaccuracies in the extents of the underground voids. There is a high risk of increased groundwater inflows due to barrier pillar failure or (partly) mining of these pillars and mitigation measures should be implemented to address this risk. The mine should also ensure that sufficient pumping capacity is available to manage any sudden inrushes to prevent loss of life and equipment damage.

Groundwater Quality (Contamination of the surrounding aquifers)

The life of mine for the proposed mining at the 2 Seam Pty Ltd Mine is planned until 2027. This allows time for chemical reactions to take place in the mined out areas, overburden dumps and other potential pollution sources to produce ARD conditions. Groundwater flow directions will be directed towards the mining areas due to the mine dewatering. Therefore, contamination will be contained within the mining areas, and little contamination will be able to migrate away from

the mining area. Any fuel storage areas should be bunded, thereby preventing contamination of the underlying aquifers during spills.

9.3.2.5. Impacts of Freshwater resources

The specialist surface water report is available as **Appendix 9**. The specialist report included an assessment of existing clean and dirty water management infrastructure.

According to the Water Research Commission (WRC) study of the Water Resources of South Africa (WR 2012), the Vlaklaagte OC6 Project falls within the Olifants River Water Management Area (WMA 4) and more specifically within Quaternary Catchment B11B, with the following catchment characteristics:

- Mean Annual Precipitation (MAP) : 688mm
- Mean Annual Evaporation (MAE) : 1 550mm
- Mean Annual Runoff (MAR) : 23.65 mil m3
- Rain Zone : B1A
- Evaporation Zone : 4A

The confluence of the tributary and the Olifants River is on RE of the farm Clydesdale 483 IS.

The Vlaklaagte OC6 Project is in close proximity to the Olifants River and the western wetland system is a small tributary of the Olifants River and flows from south-west to north-east. The Western stream of the Vlaklaagte OC6 Project has a catchment area of ±6.69 km².

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The quantified impact that the Vlaklaagte Block OC6 Opencast will have on the Quaternary Catchment Yield is minimal during the operational phase. The opencast area will be rehabilitated to ensure a free draining profile as close as possible to pre-mining topography. This will result in no loss of surface run-off post-closure.

The major impacts associated with the whole project are as follows:

- Water quality

Water quality impacts are due to a change in natural conditions and enhancement of pollution from sources. On a regional scale, due to a decrease in runoff, the dilution of other pollution sources is affected. Therefore, a reduction in runoff could result in a more pronounced pollution effect.

- Catchment yield and hydrology

The affected stream will be affected due to a reduction in runoff. Polluted water that would naturally flow to the stream is contained on site.

The potential impacts could be grouped in the following:

- Stream Flow Reduction
- Sediment Transport/ erosion
- Unstable River Banks
- Removal of Vegetation
- Deterioration of Water Quality

Stream Flow Reduction
The collection, storage and re-use of affected water from activities like the access roads, haul roads and opencast mining will decrease the run-off towards the tributary of the Olifants River. This will result in the reduction of stream flow in these streams/rivers and the total catchment yield.

Sediment Transport/ erosion
Paved and roof areas result in an increase in the volume and the speed of surface runoff. This results in a higher potential of soil erosion which will lead to increase in the sedimentation of local streams and the resultant deterioration in the water quality.

Unstable River Banks
Clean water will be diverted around dirty areas and the opencast operation. Drains and channels will be constructed to handle the clean water run-off. If these water management structures are not designed and constructed correctly, it can cause damage to stream/river banks where high volumes of water enter streams/river.

Removal of Vegetation
Due to the clearing of land of vegetation and topsoil for opencast mining, construction purposes, construction of access roads and construction camps, contaminated runoff from these areas may increase resulting in an increase of the volume of contaminated water that needs to be handled on the Vlaklaagte OC6 project footprint.

Deterioration of Water Quality
The opencast area must be considered as a dirty catchment area and all surface runoff from this area will be contaminated. There is a high potential of water quality impact from this activity if water is not contained.

The mining and hauling of coal, increases the probability of localised accidental spillages of hydrocarbons (diesel, oils etc.) from earthmoving and construction equipment and transport of equipment and personnel to and from the site. The impact will be contained to the site only and

will be of a short duration as spillages can usually be remediated immediately. Accidental spillage from areas seen as dirty area will have a negative impact on the water quality of the natural surface water and will be collected and pumped to the PCD at Vlaklaagte Mine.

Run-off water from haul roads and spoil stockpiles can increase the salinity levels of the stream/river and should be minimized, contained and re-use as far as possible.

9.3.2.6. Impact on Wetlands and Aquatic Ecology

The specialist reports on wetlands and aquatic ecology are available in **Appendix 11**.

According to the **Wetland Ecological Assessment**, there are four key ecological impacts on the wetlands that are anticipated to occur namely,

- Loss of wetland habitat and ecological structure;
- Changes to the sociocultural and service provision;
- Impacts on the hydrology and sediment balance of the wetlands; and
- Impacts on water quality.

Various activities and development aspects may lead to these impacts, however, provided that the mitigation hierarchy is followed, some impacts can be avoided or adequately minimised where avoidance is not feasible. The mitigation measures provided in the report have been developed with the mitigation hierarchy in mind, and the implementation and strict adherence to these measures will assist in minimising the significance of impacts on the receiving environment.

As some of the site clearing and preparation activities will occur within the wetlands, these activities are considered to be of '**Medium**' risk significance to these wetlands. However, construction of the surface infrastructure is considered to be of a relatively short duration which will take place at selected localities within the southern portion of the UCVB wetland (complete removal of vegetation and ripping of top soil) and within the 32m NEMA Zone of Regulation of the CVB wetland.

The clean water trench proposed to divert clean water into the CVB wetland was determined to also pose a '**Medium**' risk significance to the wetland, during the construction and operation thereof. This trench will affect the surface and subsurface recharge of the CVB wetland. It is recommended that the trench outlet be constructed with energy dissipating structures to slow

down the velocity of water entering the wetland. The area surrounding the outlet should also be re-seeded with indigenous wetland vegetation in order to limit erosion within the wetland.

In applying the risk assessment, it was assumed that the mitigation hierarchy as advocated by the DEA et al. would be followed, i.e. the impacts would first be avoided. As the proposed open cast pit is located within the UCVB wetland, which will be lost, this is not feasible. Unless its practical and feasible to reinstate this wetland post-closure (to at least a PES Category D condition), rehabilitation (post-closure) or offsetting thereof is recommended. As only a small portion of the UCVB wetland would be lost, the residual impact is considered relatively small, however, a net loss of wetland resources is not avoidable (thus a '**High**' risk significance). If offsetting is considered, it is expected that the quantum of offsetting would be limited.

The open cast pit is also considered to cause alteration to the hydropedological flow drivers of the CVB wetland. Impacts to the subsurface flow (considered to be the main hydrological driver of this wetland), does pose a risk to the hydrological functioning to the CVB wetland. Mining within the wetland recharge soils should be reconsidered, as the CVB wetland is largely driven by subsurface flow, of which a portion thereof would be mined out as part of the open cast pit area. The overburden stockpile areas are also anticipated to hinder water infiltration or distribution across this wetland system (during all phases) due to the proposed overburden stockpile being located on soil resources defined as wetland recharge soils. If possible, the location of these stockpiles should be reconsidered. The overburden stockpiles should not be located on any soil considered to be of hydropedological importance to the wetlands, nor within the 100m GN704 Zone of Regulation of the wetlands.

Dewatering of the open cast pit is expected to occur. This poses a '**Medium**' risk significance on the hydrological regime of the remaining upstream portion of the UCVB wetland, by decreasing the level of the subsurface flow (draw down due to a cone of depression forming, and thus reduce the rate of recharge. Dewatering is, however, expected to occur at a very low rate, and thus, the likelihood of the impact of dewatering is expected to be of **Medium** risk significance.

It is the opinion of the freshwater ecologist that the proposed activities is not fatally flawed, since the loss of a portion of the UCVB wetland could be considered a low quantum of loss, in relation to the surrounding freshwater environment and considering its current ecological condition. Nevertheless, strict adherence to mitigation measures should be enforced, in order to ensure that the ecological integrity of the remaining freshwater environment is not further compromised.

9.3.2.7. Impacts on Air Quality

There is a number of activities/infrastructure associated with mining operations that have the potential to pollute the air. In the construction and decommissioning phases these activities are temporary in nature. The operational phase will present more long term activities and the closure phase will present final land forms that may have the potential to pollute the air through long term wind erosion.

The Vlaklaagte OC6 project is located in a region which is already exposed to a wide range of air pollution sources.

Dust is generated as a result of opencast mining operation, blasting and wind erosion from stockpiles and unpaved areas.

The potential impacts on air quality are discussed in **Table 28.**

Table 28: Impact Assessment – Storage and/or handling of dangerous goods

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Soil, Land Use and Land Capability										
Topsoil contamination with hydrocarbons and chemical compounds from mechanical equipment (C, O, D).	N	Medium Term	Site	Moderate	Moderate	Probable	Low	Moderate	Very Low	Diesel storage tanks should be bunded. Prevent any spills from occurring as far as possible.
Cease in land capability at pit, dumps, stockpiles and infrastructure footprints during mine construction and operation (C, O).	N	Long Term	Site	Very High	Moderate	Definite	High	Moderate	Low	No mitigation is possible during the construction and operational phase. Rehabilitation during decommissioning must be conducted as per approved closure and rehabilitation plan.
Cease in current land use at pit, dumps, stockpiles and infrastructure footprints during mine construction and operation (C, O).	N	Long Term	Site	Very High	Moderate	Definite	High	Moderate	Low	
Cease in agricultural production at pit, dumps, stockpiles and infrastructure footprints during mine construction and operation (C, O).	N	Long Term	Site	Very High	Moderate	Definite	High	Moderate	Low	
Flora										
Impact on the floral habitat integrity of the Low sensitivity area (C, O, D, Cl).	N	Medium Term	Local	Moderate	Moderate	Definite	Moderate	Moderate	Low	Any proposed mining surface infrastructure must be placed within low sensitivity areas as far as possible, as these areas are of low ecological importance.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Impact on the floral habitat integrity of the Wetland habitat (C, O, D, Cl).	N	Medium Term	Local	High	Moderate	Definite	High	Moderate	Low	Site offices, parking areas for mine vehicles, etc. should be confined to non-sensitive areas. Sensitive areas must be demarcated off and vehicles and personnel are not allowed to enter demarcated areas. No collection of floral SCC or medicinal floral species must be allowed by mining personnel. All Declared invasive species must be removed from the site. .
Floral Species of Conservation Concern within the Transformed Habitat unit (C, O, D, Cl.).	N	Medium Term	Local	Low to Moderate	High	Probable	Low	High	Very Low	No collection of floral SCC or medicinal floral species must be allowed by construction personnel.
Floral Species of Conservation Concern within the Wetland habitat (C, O, D, Cl).	N	Medium Term	Regional	High	Moderate	Highly Probable	Moderate	Moderate	Low	Dumping of rubble and other waste in the sensitive areas should be prevented through fencing or other management measures. These areas must be properly managed throughout the lifespan of the project in terms of fire, eradication of exotics and monitoring for Red List species to ensure continuous biodiversity.
Fauna										
Impact on faunal habitat integrity within low sensitivity area (C, O, D, Cl).	N	Medium Term	Local	Moderate	Moderate	Definite	Moderate	Moderate	Low	Fires are strictly prohibited on site. Trapping, hunting or handling of fauna is strictly prohibited. Monitoring of rehabilitation should be conducted by a suitably qualified specialist.
Loss of wetland and riparian habitat and impact on ecological sensitive areas (C, O, D, Cl)	N	Medium Term	Local	High	Moderate to Low	Definite	High	Low	Moderate	Unless it's practical and feasible to reinstate the UCVB wetland post-closure (to at least a PES Category D), rehabilitation (post-closure) or offsetting thereof is recommended. If offsetting is considered, it is expected that the quantum of offsetting would be limited. Implement a monitoring programme to detect and prevent the pollution of soils, surface water and groundwater; Mining within the wetland recharge soils should be strongly reconsidered

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Groundwater										
Pollution with hydrocarbons and chemical compounds from mechanical equipment and storage area. (C, O, D).	N	Permanent	Site	Low	Low	Unlikely	Very Low	Low	Very Low	Prevent spillage as far as possible and store fuel in bunded areas.
Freshwater Resources										
Site clearing (C).	N	Short Term	Site	Very High	Moderate	Definite	Moderate	Moderate	Low	The project footprint must be limited as much as possible (this includes clearing of vegetation, which must be restricted to what is essential).
Ancillary activities by construction personnel and employees during other phases (C, O, D).	N	Short Term	Site	Low	High	Probable	Moderate	High	Very Low	Site offices, parking areas for mine vehicles, etc. should be confined to non-sensitive areas. Sensitive areas must be demarcated off and vehicles and personnel are not allowed to enter demarcated areas. Disturbances to natural areas must be minimized. Awareness training must be done with all employees and contractors.
Reduction in clean water runoff to the tributary of the Olifants river. (C, O).	N	Medium Term	Regional	Low	Moderate	Definite	Moderate	Moderate	Very Low	Surface water management plan must be implemented and maintained as designed.
Pollution with hydrocarbons and chemical compounds from mechanical equipment (C, O, D).	N	Medium Term	Site	High	Low	Probable	High	Very High	Very Low	Prevent spillage as far as possible and store fuel in bunded areas.
Pollution due to uncontrolled releases from the mining footprint and infrastructure areas	N	Medium Term	Local	High	Low to Moderate	Probable	Moderate	High	Low	Ensure proper storm water management designs and systems are in place.
Potential invasion of alien/invasive species (C, O, D, Cl).	N	Permanent	Local	Moderate	High	Highly Probable	Moderate	High	Low	All disturbances caused by the construction activities must ensure that all recruited alien vegetation is eradicated, and that ongoing alien vegetation control is implemented.
Potential further habitat degradation (D, Cl).	N	Medium Term	Site	Moderate	High	Probable	Low	High	Very Low	Rehabilitation must be conducted as stipulated in the closure and rehabilitation plan.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Noise and Blasting										
Noise generated by opencast mining activities, transport of materials and rehabilitation post-mining (C, O, D).	N	Long Term	Local	Low	Moderate	Probable	Low	Moderate	Very Low	Fit efficient silencers and enclose engine compartments.

9.3.3. Activity 3: Office, Change House and Workshop

9.3.3.1. Impacts on Geology

Mining by definition is the extraction of a natural resource and does have a destructive impact on the geology of an area. For the DMR and the owner of a mining right is the maximum exploitation of the natural resource of the utmost importance. Therefor is the loss and sterilisation of the mineral resource through the placement of infrastructure an important impact. The optimised placement and minimisation of mining infrastructure project is the best mitigation to this impact.

The potential impacts on geology are discussed in **Table 29**.

9.3.3.2. Impacts on Topography

Opencast mining does in its nature have a significant impact on the topography of an area, especially during the operational phase of the project.

Hazardous excavations and infrastructure include all structures into or off which third parties and animals can fall and be harmed. Hazardous excavations and infrastructure occur in all mine phases from construction through operation to decommissioning and closure. In the construction and decommissioning phases these hazardous excavations and infrastructure are temporary in nature, usually existing for a few weeks to a few months. The operational phase will present more long term hazardous excavations and infrastructure and the closure phase might present final land forms that are considered hazardous. These can include possible surface subsidence due to settling of backfill material.

The potential impacts on topography are discussed in **Table 29**.

9.3.3.3. Impacts on Soils, Land Use and Land Capability

The specialist soils, land use and land capability report is available as **Appendix 7**.

Soil is a valuable resource that supports a variety of ecological functions. The mine has the potential to damage soil resources through physical disturbance and/or contamination. Contamination of soils also has the potential to impact both surface and groundwater resources.

Soil resources can be damaged and/or lost through:

- Loss of topsoil due to negligent stripping and stockpiling procedures at open pit and due to use of topsoil for construction purposes;

- Deterioration of topsoil quality due to contamination with underlying subsoil layers or rock formations;
- Decline in topsoil fertility due to mixing of soil's A and B horizons (upper and lower horizons) and due to possible mixing of different soil types;
- Compaction and decline in topsoil structure during stockpiling and topsoil re-placing;
- Compaction and sterilisation of undisturbed topsoil underneath stockpiles and dumps;
- Loss of topsoil through erosion at stockpiles, pit edges and rehabilitated areas; and
- Topsoil contamination with hydrocarbons and chemical compounds from mechanical equipment.

Stripping, stockpiling and replacing of topsoil has a very high impact on soil, land capability and land use and the procedures followed during execution of these actions directly influence the post-mining land capability and consequently determine the degree of deterioration from pre-mining to post-mining land capability. They also directly determine the possible post-mining land uses. Direct replacing of topsoil usually cannot take place in the first quarter of the mining process and therefore has to be stockpiled.

Five soil types, Hu1, Hu2, Av1, Av2 and Lo1 occur in the proposed open pit area and should be stripped at different depths and stockpiled as indicated in the specialist report. The soil types occur geographically in non-complex units and separate stockpiling of soil type groups are practical. The specialist report shows the soil types that should be stored on 3 stockpiles consisting of red well-drained soils, yellow brown moderately well-drained soils and grey poorly drained wetland soils. If required the soils can be stored in 1 continuous stockpile providing that the 3 soil type groups are not mixed.

The backfilled and levelled spoil surface should be covered with the stockpiled topsoil. Care should be taken to tip enough soil per square unit to reinstate the total required post mining soil depth at once. The replaced topsoil thickness (1.3 m) should be progressively monitored during replacement to verify if it is similar to the replacing depth provided in the specialist report and to prevent encountering shortages of topsoil.

The proposed mining footprint could be, and currently is used for crop farming activities. The lost opportunities of alternative land use which the mine will eliminate is however not significant relative to the benefits of the proposed mining activity.

9.3.3.4. Impacts on Flora

The specialist flora report is available in **Appendix 8**.

Mucina & Rutherford (2006) classified the area as Eastern Highveld Grassland, comprising slightly to moderately undulating plains, including some low hills and pan depressions. The vegetation is short, dense grassland dominated by the usual Highveld grass composition with small scattered rocky outcrops with wiry, sour grasses, and some woody species.

The soils are red to yellow sandy soils found on shales and sandstones of the Madzaringwe Formation. This vegetation unit has a strongly seasonal summer rainfall with very dry winters. Incidence of frost is expected from 13 to 42 days but higher at high elevations.

The Eastern Highveld Grassland vegetation unit is considered a Protected Ecosystem in accordance with the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).

Four vegetation study units were identified on the study site:

- Wetland vegetation;
- Cultivated fields;
- *Eragrostis – Helichrysum* grassland; and
- Mixed vegetation of farming and mining areas.

The flora study found that the part of the Wetland Vegetation unit and the *Eragrostis – Helichrysum* grassland study unit, are deemed sensitive. The rest of the study site comprises secondary grassland and farming areas and is not deemed sensitive.

No Red List, Orange List or protected species were recorded on the study site.

9.3.3.5. Impacts on Fauna

The specialist fauna reports are available in **Appendix 8**.

The mammal study found that the proposed mining activities will affect the remaining mammals recorded from the site. However, it is argued that this is of little consequence since species richness has been seriously depleted and the *Crocidura* species are not endangered. The proposed mining on the terrestrial portion of the site will not impact much more on species richness or the depleted ecological functionality. The wetland system is the main corridor for immigration of species and the integrity of the wetland system is critical.

Connectivity is near unhindered, but in the terrestrial habitat from the region the environment has been cleared by agriculture and mining. From a mammal perspective no areas were identified as a high sensitivity.

The avifaunal study found that most of the Red Data avifaunal species that are likely to occur in the study area are only likely to move through the area on rare occasions due to the fragmented state and surrounding disturbed areas. Some of the habitat systems, however, offer suitable habitat for Red Data avifaunal species during optimal conditions. Most of the aquatic habitat with their buffers, as delineated by an aquatic specialist, should be regarded as highly sensitive and should be kept free from any development or any form of disturbance. Natural grassland along these wetland systems should also be regarded as sensitive to offer suitable foraging habitat for aquatic Red Data avifaunal species. Not only are these areas sensitive for Red Data avifaunal species but also for all other avifaunal species that occur or are likely to occur within the study area.

The herpetological study found that the Olifants River drainage lines are sensitive ecological systems. A 100 meter buffer must be conserved next to the water courses. Measures will have to be taken to stop water pollution of the Olifants River drainage lines. The removal of exotic trees along the drainage lines will increase the water quality and the habitat of water-dependent herpetofauna.

The possibility exists that individuals of the giant bullfrog and coppery grass lizard occur on the study site.

The terrestrial habitat quality has been jeopardised by former agricultural activities and exotic plants. Water pollution and invasive plants threaten the integrity of the drainage line.

If the mining should go ahead, a very important indirect effect would be the likely impact that the proposed mining activities might have on the water quality of the Olifants River and wetlands due to the waste water and surface water runoff. However no real objection can be raised against the mining if the integrity of the Olifants River and wetlands are not jeopardised in any way by the mining activities.

The Invertebrate study found that wetlands on site have habitat that is suitable for supporting breeding populations of the Marsh Sylph. Both sexes of this species of butterfly drink from flowers and the larvae feed on marsh grasses, and the High sensitivity areas comprises of grasses with ample flowering plants. A 50-200m buffer has been allocated to the sensitive

areas in the north of the study site. It is essential that the wetland areas and at least a 50m buffer be preserved to conserve the habitat of the *M. meninx*.

9.3.3.6. Impacts on Groundwater

Operational Phase

Groundwater Quantity (groundwater level drawdown)

The mine floor elevation is below the general groundwater level thus causing groundwater inflows into the opencast mining areas from the surrounding aquifers during operations. The mining areas will have to be actively dewatered to ensure a safe working environment. Abstraction of groundwater that seeps into the mine areas will cause dewatering of the surrounding aquifers and an associated decrease in 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, vertical infiltration of the recharging water, the size of the mining area, and the aquifer transmissivity amongst others. The 3-D numerical groundwater flow model was used to simulate the development of the drawdown cone over time in the study area. The latest mining schedules (at the time of investigation) also taken in consideration when calculating the drawdown.

During the operational phase, it is expected that the main impact on the groundwater environment will be de-watering of the surrounding aquifer. The OC1, OC2, OC3, OC3A, OC4 and OC6 opencasts will be mined at various stages. For this investigation it has been assumed mining will take place between 2017 and 2027. The smaller opencasts on the eastern part of the site, targeting the No. 1, 2 and 4 seams, will be mined from 2019. The larger opencasts on the western part of the site targeting the No. 4 seam will be mined in 2019 - 2037 (OC4 & OC6).

However, the model results indicate groundwater drawdown will be limited to small areas surrounding the opencasts due to the water collected in the underground voids of the old TNC colliery. This limits the drawdown effects of the proposed opencasts. As the operational phase is limited to maximum 10 years, the limited drawdown effects will be short term. The following deductions can be made:

- Groundwater levels will likely only be lowered in relatively small areas surrounding the proposed opencasts due to the influence of the existing underground voids;
- However, the underground voids are numerically modelled as river-cells which feed groundwater into the opencasts while mining continues. The modelling calculations did

not incorporate potential lowering of water levels in the underground voids due to the mining activities, nor did it include potential preferential pathways between existing underground voids and proposed opencasts;

- Base flow to some of the tributaries of the Olifants River crossing the site could be affected and reduced due to the dewatering of the opencasts; and
- No privately owned boreholes are likely to be impact by lowering of groundwater levels.

Groundwater Quantity (Mine Inflow volumes)

The mine inflows were calculated using the model as described in the report. These volumes do not take into account potential inflows from the existing underground voids of the TNC Colliery, which will be discussed in the next section. Initial peaks in groundwater inflows at the start of mining of each opencast due to storage depletion in the surrounding aquifer.

Total groundwater inflow for the 2 Seam mine without additional groundwater inflow through pillars will be between ~ 150 m3/d and ~1 500 m3/d with inflows increasing as the year progresses due to the mining of several opencasts at different times. The mining activities cease towards the latter half of 2027.

Inflows into the opencast mining operations will likely be higher than calculated with the numerical model due to the presence of underground voids in areas adjacent to some of the opencasts. Block 1, Block 2, and Block 6 are likely to receive additional inflows from adjacent underground voids though barrier pillars.

Spreadsheet calculations were used to estimate additional inflows to opencasts from underground voids. Based on information received from the client an 18 m barrier pillar will be left between the existing underground voids and flooded opencasts and the proposed opencasts, and this was used as input into the calculations. Groundwater inflow calculations were based on this width to determine the sensitivity of the inflows based on the pillar width.

Based on Packer test results of the No. 2 Seam (Hodgson & Krantz, 1998) and aquifer test results as part of this study 0.1 m/day was considered a good estimate for the hydraulic conductivity of the No. 2 seam. However impacts of the historic and proposed mining activities could be significantly increase the hydraulic conductivity of the barrier pillars. Therefore conductivities for the pillars of 0.1, 0.5 and 1 m/day were used as input into the calculations.

It was found in the GCS 2016 study that the pillar width has a minimal effect when compared to hydraulic conductivity.

Inflows including the potential inflows from adjacent mining areas were estimated for Block 1, Block 2, Block 2A and Block 6. A pillar width of 18 m and a hydraulic conductivity of 0.1 m/day was assumed.

With the inclusion of pillar inflows the total inflows are higher for the whole 11 years of mining. Inflows vary between ~370 and ~1 900 m3/d.
Inflows from adjacent mining areas could increase if the hydraulic conductivity of the coal seam is higher than 0.1 m/d. This can be the case as hydraulic conductivities as high as 0.5 m/day for the No. 2 coal seam have been reported (Hodgson & Krantz, 1998). In addition, mining activities such as blasting could impact on pillar hydraulic conductivities.

Therefore hydraulic conductivities of 0.5 and 1 m/d were used for an estimated range of inflows through the pillars. The inflows with a k of 1 m/d should be considered as a worst case scenario and measures should be taken to deal with inflows of this order.

Mining of the opencasts should be done with caution given the close proximity of the proposed workings to TNC underground, flooded opencasts and potential inaccuracies in the extents of the underground voids. There is a high risk of increased groundwater inflows due to barrier pillar failure or (partly) mining of these pillars and mitigation measures should be implemented to address this risk. The mine should also ensure that sufficient pumping capacity is available to manage any sudden inrushes to prevent loss of life and equipment damage.

Groundwater Quality (Contamination of the surrounding aquifers)
The life of mine for the proposed mining at the 2 Seam Pty Ltd Mine is planned until 2027. This allows time for chemical reactions to take place in the mined out areas, overburden dumps and other potential pollution sources to produce ARD conditions. Groundwater flow directions will be directed towards the mining areas due to the mine dewatering. Therefore, contamination will be contained within the mining areas, and little contamination will be able to migrate away from the mining area. Any water balancing dams and/or pollution control dams should be lined, thereby preventing contamination of the underlying aquifers.

Due to the possibility of high inflows from underground voids and pillar barriers it is likely the water balance for the site will show large volumes of excess water on-site abstracted from the opencasts.

9.3.3.7. Impacts of Freshwater resources

The specialist surface water report is available as **Appendix 9**. The specialist report included an assessment of existing clean and dirty water management infrastructure.

According to the Water Research Commission (WRC) study of the Water Resources of South Africa (WR 2012), the Vlaklaagte OC6 Project falls within the Olifants River Water Management Area (WMA 4) and more specifically within Quaternary Catchment B11B, with the following catchment characteristics:

- Mean Annual Precipitation (MAP) : 688mm
- Mean Annual Evaporation (MAE) : 1 550mm
- Mean Annual Runoff (MAR) : 23.65 mil m3
- Rain Zone : B1A
- Evaporation Zone : 4A

The confluence of the tributary and the Olifants River is on RE of the farm Clydesdale 483 IS.

The Vlaklaagte OC6 Project is in close proximity to the Olifants River and the western wetland system is a small tributary of the Olifants River and flows from south-west to north-east. The Western stream of the Vlaklaagte OC6 Project has a catchment area of ±6.69 km².

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The quantified impact that the Vlaklaagte Block OC6 Opencast will have on the Quaternary Catchment Yield is minimal during the operational phase. The opencast area will be rehabilitated to ensure a free draining profile as close as possible to pre-mining topography. This will result in no loss of surface run-off post-closure.

The major impacts associated with the whole project are as follows:

- Water quality

Water quality impacts are due to a change in natural conditions and enhancement of pollution from sources. On a regional scale, due to a decrease in runoff, the dilution of other pollution sources is affected. Therefore, a reduction in runoff could result in a more pronounced pollution effect.

- Catchment yield and hydrology

The affected stream will be affected due to a reduction in runoff. Polluted water that would naturally flow to the stream is contained on site.

The potential impacts could be grouped in the following:

- Stream Flow Reduction
- Sediment Transport/ erosion
- Unstable River Banks
- Removal of Vegetation

- Deterioration of Water Quality

Stream Flow Reduction
The collection, storage and re-use of affected water from activities like the access roads, haul roads and opencast mining will decrease the run-off towards the tributary of the Olifants River. This will result in the reduction of stream flow in these streams/rivers and the total catchment yield.

Sediment Transport/ erosion
Paved and roof areas result in an increase in the volume and the speed of surface runoff. This results in a higher potential of soil erosion which will lead to increase in the sedimentation of local streams and the resultant deterioration in the water quality.

Unstable River Banks
Clean water will be diverted around dirty areas and the opencast operation. Drains and channels will be constructed to handle the clean water run-off. If these water management structures are not designed and constructed correctly, it can cause damage to stream/river banks where high volumes of water enter streams/river.

Removal of Vegetation
Due to the clearing of land of vegetation and topsoil for opencast mining, construction purposes, construction of access roads and construction camps, contaminated runoff from these areas may increase resulting in an increase of the volume of contaminated water that needs to be handled on the Vlaklaagte OC6 project footprint.

Deterioration of Water Quality
The opencast area must be considered as a dirty catchment area and all surface runoff from this area will be contaminated. There is a high potential of water quality impact from this activity if water is not contained.

The mining and hauling of coal, increases the probability of localised accidental spillages of hydrocarbons (diesel, oils etc.) from earthmoving and construction equipment and transport of equipment and personnel to and from the site. The impact will be contained to the site only and will be of a short duration as spillages can usually be remediated immediately. Accidental spillage from areas seen as dirty area will have a negative impact on the water quality of the natural surface water and will be collected and pumped to the PCD at Vlaklaagte Mine.

Run-off water from haul roads and spoil stockpiles can increase the salinity levels of the stream/river and should be minimized, contained and re-use as far as possible.

9.3.3.8. Impact on Wetlands and Aquatic Ecology

The specialist reports on wetlands and aquatic ecology are available in **Appendix 11**.

According to the **Wetland Ecological Assessment**, there are four key ecological impacts on the wetlands that are anticipated to occur namely,

- Loss of wetland habitat and ecological structure;
- Changes to the sociocultural and service provision;
- Impacts on the hydrology and sediment balance of the wetlands; and
- Impacts on water quality.

Various activities and development aspects may lead to these impacts, however, provided that the mitigation hierarchy is followed, some impacts can be avoided or adequately minimised where avoidance is not feasible. The mitigation measures provided in the report have been developed with the mitigation hierarchy in mind, and the implementation and strict adherence to these measures will assist in minimising the significance of impacts on the receiving environment.

As some of the site clearing and preparation activities will occur within the wetlands, these activities are considered to be of '**Medium**' risk significance to these wetlands. However, construction of the surface infrastructure is considered to be of a relatively short duration which will take place at selected localities within the southern portion of the UCVB wetland (complete removal of vegetation and ripping of top soil) and within the 32m NEMA Zone of Regulation of the CVB wetland.

The clean water trench proposed to divert clean water into the CVB wetland was determined to also pose a '**Medium**' risk significance to the wetland, during the construction and operation thereof. This trench will affect the surface and subsurface recharge of the CVB wetland. It is recommended that the trench outlet be constructed with energy dissipating structures to slow down the velocity of water entering the wetland. The area surrounding the outlet should also be re-seeded with indigenous wetland vegetation in order to limit erosion within the wetland.

In applying the risk assessment, it was assumed that the mitigation hierarchy as advocated by the DEA et al. would be followed, i.e. the impacts would first be avoided. As the proposed open cast pit is located within the UCVB wetland, which will be lost, this is not feasible. Unless its practical and feasible to reinstate this wetland post-closure (to at least a PES Category D condition), rehabilitation (post-closure) or offsetting thereof is recommended. As only a small

portion of the UCVB wetland would be lost, the residual impact is considered relatively small, however, a net loss of wetland resources is not avoidable (thus a '**High**' risk significance). If offsetting is considered, it is expected that the quantum of offsetting would be limited.

The open cast pit is also considered to cause alteration to the hydropedological flow drivers of the CVB wetland. Impacts to the subsurface flow (considered to be the main hydrological driver of this wetland), does pose a risk to the hydrological functioning to the CVB wetland. Mining within the wetland recharge soils should be reconsidered, as the CVB wetland is largely driven by subsurface flow, of which a portion thereof would be mined out as part of the open cast pit area. The overburden stockpile areas are also anticipated to hinder water infiltration or distribution across this wetland system (during all phases) due to the proposed overburden stockpile being located on soil resources defined as wetland recharge soils. If possible, the location of these stockpiles should be reconsidered. The overburden stockpiles should not be located on any soil considered to be of hydropedological importance to the wetlands, nor within the 100m GN704 Zone of Regulation of the wetlands.

Dewatering of the open cast pit is expected to occur. This poses a '**Medium**' risk significance on the hydrological regime of the remaining upstream portion of the UCVB wetland, by decreasing the level of the subsurface flow (draw down due to a cone of depression forming, and thus reduce the rate of recharge. Dewatering is, however, expected to occur at a very low rate, and thus, the likelihood of the impact of dewatering is expected to be of **Medium** risk significance.

It is the opinion of the freshwater ecologist that the proposed activities is not fatally flawed, since the loss of a portion of the UCVB wetland could be considered a low quantum of loss, in relation to the surrounding freshwater environment and considering its current ecological condition. Nevertheless, strict adherence to mitigation measures should be enforced, in order to ensure that the ecological integrity of the remaining freshwater environment is not further compromised.

9.3.3.9. Impacts on Air Quality

There is a number of activities/infrastructure associated with mining operations that have the potential to pollute the air. In the construction and decommissioning phases these activities are temporary in nature. The operational phase will present more long term activities and the closure phase will present final land forms that may have the potential to pollute the air through long term wind erosion.

The Vlaklaagte OC6 project is located in a region which is already exposed to a wide range of air pollution sources.

Dust is generated as a result of opencast mining operation, blasting and wind erosion from stockpiles and unpaved areas.

The potential impacts on air quality are discussed in **Table 30.**

9.3.3.10. Visual Impacts

The assessment of visual impacts takes the following issues into account: the pre-mining visual resource and the visibility, visual intrusion, sensitivity of viewing receptors, and visual exposure, associated with the mine.

The visual resource of the mine area is determined by considering landscape character, sense of place, and landscape quality. The pre-mining visual resource was considered to be of moderate to low value because the predominantly rural agricultural setting of the broader area is compromised by power lines, roads, telephone lines and mining activities neighboring the project area.

Visibility refers to the extent to which people in the surrounding areas will see the project. The mine can be seen from all directions.

Visual intrusion refers to the magnitude of the intrusion that the mine has on existing views. The visual intrusion of the mine is high during the operational phase, which can be reduced to a low intrusion with successful implementation of the requirements for rehabilitation and closure.

Sensitivity of visual receptors refers to the fact that the visual impact varies according to the sensitivity of the receptors in the project area. Although various third parties currently remain within a relatively close proximity of the area no issues regarding visual impacts have been raised. It must therefore be concluded that the visual impact is not a sensitive issue.

Visual exposure is the extent to which infrastructure and activities will appear in various views. It follows that the closer the infrastructure and activities, the greater the visual exposure.

Table 29: Impact Assessment – Office, change house, weighbridge and workshop

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Soil, Land Use and Land Capability										
Topsoil contamination with hydrocarbons and chemical compounds from mechanical equipment (C, O, D).	N	Medium Term	Site	Moderate	Moderate	Probable	Low	Moderate	Very Low	Diesel storage tanks should be bunded. Prevent any spills from occurring as far as possible.
Cease in land capability at pit, dumps, stockpiles and infrastructure footprints during mine construction and operation (C, O).	N	Long Term	Site	Very High	Moderate	Definite	High	Moderate	Low	No mitigation is possible during the construction and operational phase. Rehabilitation during decommissioning must be conducted as per approved closure and rehabilitation plan.
Cease in current land use at pit, dumps, stockpiles and infrastructure footprints during mine construction and operation (C, O).	N	Long Term	Site	Very High	Moderate	Definite	High	Moderate	Low	
Cease in agricultural production at pit, dumps, stockpiles and infrastructure footprints during mine construction and operation (C, O).	N	Long Term	Site	Very High	Moderate	Definite	High	Moderate	Low	
Flora										
Impact on the floral habitat integrity of the Low sensitivity area (C, O, D, Cl).	N	Medium Term	Local	Moderate	Moderate	Definite	Moderate	Moderate	Low	Any proposed mining surface infrastructure must be placed within low sensitivity areas as far as possible, as these areas are of low ecological importance.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Impact on the floral habitat integrity of the Wetland habitat (C, O, D, Cl).	N	Medium Term	Local	High	Moderate	Definite	High	Moderate	Low	Site offices, parking areas for mine vehicles, etc. should be confined to non-sensitive areas. Sensitive areas must be demarcated off and vehicles and personnel are not allowed to enter demarcated areas. No collection of floral SCC or medicinal floral species must be allowed by mining personnel. All Declared invasive species must be removed from the site. .
Floral Species of Conservation Concern within the Transformed Habitat unit (C, O, D, Cl.).	N	Medium Term	Local	Low to Moderate	High	Probable	Low	High	Very Low	No collection of floral SCC or medicinal floral species must be allowed by construction personnel.
Floral Species of Conservation Concern within the Wetland habitat (C, O, D, Cl).	N	Medium Term	Regional	High	Moderate	Highly Probable	Moderate	Moderate	Low	Dumping of rubble and other waste in the sensitive areas should be prevented through fencing or other management measures. These areas must be properly managed throughout the lifespan of the project in terms of fire, eradication of exotics and monitoring for Red List species to ensure continuous biodiversity.
Fauna										
Impact on faunal habitat integrity within low sensitivity area (C, O, D, Cl).	N	Medium Term	Local	High	Moderate	Definite	Moderate	Moderate	Low	Fires are strictly prohibited on site. Trapping, hunting or handling of fauna is strictly prohibited. Monitoring of rehabilitation should be conducted by a suitably qualified specialist.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Loss of wetland and riparian habitat and impact on ecological sensitive areas (C, O, D, Cl)	N	Medium Term	Local	High	Moderate to Low	Definite	High	Low	Moderate	Unless it's practical and feasible to reinstate the UCVB wetland post-closure (to at least a PES Category D), rehabilitation (post-closure) or offsetting thereof is recommended. If offsetting is considered, it is expected that the quantum of offsetting would be limited. Implement a monitoring programme to detect and prevent the pollution of soils, surface water and groundwater; Mining within the wetland recharge soils should be strongly reconsidered
Groundwater										
Pollution with hydrocarbons and chemical compounds from mechanical equipment and storage area. (C, O, D).	N	Permanent	Site	Low	Low	Unlikely	Very Low	Low	Very Low	Prevent spillage as far as possible and store fuel in bunded areas.
Freshwater Resources										
Site clearing (C).	N	Short Term	Site	Very High	Moderate	Definite	Moderate	Moderate	Low	The project footprint must be limited as much as possible (this includes clearing of vegetation, which must be restricted to what is essential).
Changes in natural surface water flow parameters.	N	Temporary	Site	Moderate	Moderate	Definite	Moderate	Moderate	Low	Mitigation measures the same as Error! Reference source not found..
Ancillary activities by construction personnel and employees during other phases (C, O, D).	N	Long Term	Site	High	High	Highly Probable	Moderate	High	Very Low	Mitigation measures the same as Error! Reference source not found.
Reduction in clean water runoff to the tributary of the Olifants river. (C, O).	N	Long Term	Regional	Very High	Moderate	Highly Probable	High	Moderate	Low	Surface water management plan must be implemented and maintained as designed.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Pollution with hydrocarbons and chemical compounds from mechanical equipment (C, O, D).	N	Medium Term	Local	High	High	Probable	Low	High	Very Low	Ensure proper storm water management designs and systems are in place.
Pollution due to uncontrolled releases from the mining footprint and infrastructure areas	N	Medium Term	Local	High	Low to Moderate	Probable	Moderate	High	Low	Ensure proper storm water management designs and systems are in place.
Potential invasion of alien/invasive species (C, O, D, Cl).	N	Permanent	Local	Moderate	High	Highly Probable	Moderate	High	Low	All disturbances caused by the construction activities must ensure that all recruited alien vegetation is eradicated, and that ongoing alien vegetation control is implemented.
Potential further habitat degradation (D, Cl).	N	Short Term	Site	Moderate	High	Probable	Low	High	Very Low	Rehabilitation must be conducted as stipulated in the closure and rehabilitation plan.
Noise and Blasting										
Noise generated by opencast mining activities, transport of materials and rehabilitation post-mining (C, O, D).	N	Long Term	Local	Low	Moderate	Probable	Low	Moderate	Very Low	Fit efficient silencers and enclose engine compartments.

9.3.4. Activity 4: Water Management Facilities

9.3.4.1. Impacts on Soils, Land Use and Land Capability

The specialist soils, land use and land capability report is available as **Appendix 7**.

Soil is a valuable resource that supports a variety of ecological functions. The mine has the potential to damage soil resources through physical disturbance and/or contamination. Contamination of soils also has the potential to impact both surface and groundwater resources.

Soil resources can be damaged and/or lost through:

- Loss of topsoil due to negligent stripping and stockpiling procedures at open pit and due to use of topsoil for construction purposes;
- Deterioration of topsoil quality due to contamination with underlying subsoil layers or rock formations;
- Decline in topsoil fertility due to mixing of soil's A and B horizons (upper and lower horizons) and due to possible mixing of different soil types;
- Compaction and decline in topsoil structure during stockpiling and topsoil re-placing;
- Compaction and sterilisation of undisturbed topsoil underneath stockpiles and dumps;
- Loss of topsoil through erosion at stockpiles, pit edges and rehabilitated areas; and
- Topsoil contamination with hydrocarbons and chemical compounds from mechanical equipment.

Stripping, stockpiling and replacing of topsoil has a very high impact on soil, land capability and land use and the procedures followed during execution of these actions directly influence the post-mining land capability and consequently determine the degree of deterioration from pre-mining to post-mining land capability. They also directly determine the possible post-mining land uses. Direct replacing of topsoil usually cannot take place in the first quarter of the mining process and therefore has to be stockpiled.

Five soil types, Hu1, Hu2, Av1, Av2 and Lo1 occur in the proposed open pit area and should be stripped at different depths and stockpiled as indicated in the specialist report. The soil types occur geographically in non-complex units and separate stockpiling of soil type groups are practical. The specialist report shows the soil types that should be stored on 3 stockpiles consisting of red well-drained soils, yellow brown moderately well-drained soils and grey poorly drained wetland soils. If required the soils can be stored in 1 continuous stockpile providing that the 3 soil type groups are not mixed.

The backfilled and levelled spoil surface should be covered with the stockpiled topsoil. Care should be taken to tip enough soil per square unit to reinstate the total required post mining soil depth at once. The replaced topsoil thickness (1.3 m) should be progressively monitored during replacement to verify if it is similar to the replacing depth provided in the specialist report and to prevent encountering shortages of topsoil.

The proposed mining footprint could be, and currently is used for crop farming activities. The lost opportunities of alternative land use which the mine will eliminate is however not significant relative to the benefits of the proposed mining activity.

9.3.4.2. Impacts on Flora

The specialist flora report is available in **Appendix 8**.

Mucina & Rutherford (2006) classified the area as Eastern Highveld Grassland, comprising slightly to moderately undulating plains, including some low hills and pan depressions. The vegetation is short, dense grassland dominated by the usual Highveld grass composition with small scattered rocky outcrops with wiry, sour grasses, and some woody species.

The soils are red to yellow sandy soils found on shales and sandstones of the Madzaringwe Formation. This vegetation unit has a strongly seasonal summer rainfall with very dry winters. Incidence of frost is expected from 13 to 42 days but higher at high elevations.

The Eastern Highveld Grassland vegetation unit is considered a Protected Ecosystem in accordance with the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).

Four vegetation study units were identified on the study site:

- Wetland vegetation;
- Cultivated fields;
- *Eragrostis – Helichrysum* grassland; and
- Mixed vegetation of farming and mining areas.

The flora study found that the part of the Wetland Vegetation unit and the *Eragrostis – Helichrysum* grassland study unit, are deemed sensitive. The rest of the study site comprises secondary grassland and farming areas and is not deemed sensitive.

No Red List, Orange List or protected species were recorded on the study site.

9.3.4.3. Impacts on Fauna

The specialist fauna reports are available in **Appendix 8**.

The mammal study found that the proposed mining activities will affect the remaining mammals recorded from the site. However, it is argued that this is of little consequence since species richness has been seriously depleted and the *Crocidura* species are not endangered. The proposed mining on the terrestrial portion of the site will not impact much more on species richness or the depleted ecological functionality. The wetland system is the main corridor for immigration of species and the integrity of the wetland system is critical.

Connectivity is near unhindered, but in the terrestrial habitat from the region the environment has been cleared by agriculture and mining. From a mammal perspective no areas were identified as a high sensitivity.

The avifaunal study found that most of the Red Data avifaunal species that are likely to occur in the study area are only likely to move through the area on rare occasions due to the fragmented state and surrounding disturbed areas. Some of the habitat systems, however, offer suitable habitat for Red Data avifaunal species during optimal conditions. Most of the aquatic habitat with their buffers, as delineated by an aquatic specialist, should be regarded as highly sensitive and should be kept free from any development or any form of disturbance. Natural grassland along these wetland systems should also be regarded as sensitive to offer suitable foraging habitat for aquatic Red Data avifaunal species. Not only are these areas sensitive for Red Data avifaunal species but also for all other avifaunal species that occur or are likely to occur within the study area.

The herpetological study found that the Olifants River drainage lines are sensitive ecological systems. A 100 meter buffer must be conserved next to the water courses. Measures will have to be taken to stop water pollution of the Olifants River drainage lines. The removal of exotic trees along the drainage lines will increase the water quality and the habitat of water-dependent herpetofauna.

The possibility exists that individuals of the giant bullfrog and coppery grass lizard occur on the study site.

The terrestrial habitat quality has been jeopardised by former agricultural activities and exotic plants. Water pollution and invasive plants threaten the integrity of the drainage line.

If the mining should go ahead, a very important indirect effect would be the likely impact that the proposed mining activities might have on the water quality of the Olifants River and wetlands due to the waste water and surface water runoff. However no real objection can be raised against the mining if the integrity of the Olifants River and wetlands are not jeopardised in any way by the mining activities.

The Invertebrate study found that wetlands on site have habitat that is suitable for supporting breeding populations of the Marsh Sylph. Both sexes of this species of butterfly drink from flowers and the larvae feed on marsh grasses, and the High sensitivity areas comprises of grasses with ample flowering plants. A 50-200m buffer has been allocated to the sensitive areas in the north of the study site. It is essential that the wetland areas and at least a 50m buffer be preserved to conserve the habitat of the *M. meninx*.

9.3.4.4. Impacts on Groundwater

Operational Phase

Groundwater Quantity (groundwater level drawdown)

The mine floor elevation is below the general groundwater level thus causing groundwater inflows into the opencast mining areas from the surrounding aquifers during operations. The mining areas will have to be actively dewatered to ensure a safe working environment. Abstraction of groundwater that seeps into the mine areas will cause dewatering of the surrounding aquifers and an associated decrease in 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, vertical infiltration of the recharging water, the size of the mining area, and the aquifer transmissivity amongst others. The 3-D numerical groundwater flow model was used to simulate the development of the drawdown cone over time in the study area. The latest mining schedules (at the time of investigation) also taken in consideration when calculating the drawdown.

During the operational phase, it is expected that the main impact on the groundwater environment will be de-watering of the surrounding aquifer. The OC1, OC2, OC3, OC3A, OC4 and OC6 opencasts will be mined at various stages. For this investigation it has been assumed mining will take place between 2017 and 2027. The smaller opencasts on the eastern part of the site, targeting the No. 1, 2 and 4 seams, will be mined from 2019. The larger opencasts on the western part of the site targeting the No. 4 seam will be mined in 2019 - 2037 (OC4 & OC6).

However, the model results indicate groundwater drawdown will be limited to small areas surrounding the opencasts due to the water collected in the underground voids of the old TNC colliery. This limits the drawdown effects of the proposed opencasts. As the operational phase is limited to maximum 10 years, the limited drawdown effects will be short term. The following deductions can be made:

- Groundwater levels will likely only be lowered in relatively small areas surrounding the proposed opencasts due to the influence of the existing underground voids;
- However, the underground voids are numerically modelled as river-cells which feed groundwater into the opencasts while mining continues. The modelling calculations did not incorporate potential lowering of water levels in the underground voids due to the mining activities, nor did it include potential preferential pathways between existing underground voids and proposed opencasts;
- Base flow to some of the tributaries of the Olifants River crossing the site could be affected and reduced due to the dewatering of the opencasts; and
- No privately owned boreholes are likely to be impact by lowering of groundwater levels.

Groundwater Quantity (Mine Inflow volumes)

The mine inflows were calculated using the model as described in the report. These volumes do not take into account potential inflows from the existing underground voids of the TNC Colliery, which will be discussed in the next section. Initial peaks in groundwater inflows at the start of mining of each opencast due to storage depletion in the surrounding aquifer.

Total groundwater inflow for the 2 Seam mine without additional groundwater inflow through pillars will be between ~ 150 m3/d and ~1 500 m3/d with inflows increasing as the year progresses due to the mining of several opencasts at different times. The mining activities cease towards the latter half of 2027.

Inflows into the opencast mining operations will likely be higher than calculated with the numerical model due to the presence of underground voids in areas adjacent to some of the opencasts. Block 1, Block 2, and Block 6 are likely to receive additional inflows from adjacent underground voids though barrier pillars.

Spreadsheet calculations were used to estimate additional inflows to opencasts from underground voids. Based on information received from the client an 18 m barrier pillar will be left between the existing underground voids and flooded opencasts and the proposed opencasts, and this was used as input into the calculations. Groundwater inflow calculations were based on this width to determine the sensitivity of the inflows based on the pillar width.

Based on Packer test results of the No. 2 Seam (Hodgson & Krantz, 1998) and aquifer test results as part of this study 0.1 m/day was considered a good estimate for the hydraulic conductivity of the No. 2 seam. However impacts of the historic and proposed mining activities could be significantly increase the hydraulic conductivity of the barrier pillars. Therefore conductivities for the pillars of 0.1, 0.5 and 1 m/day were used as input into the calculations.

It was found in the GCS 2016 study that the pillar width has a minimal effect when compared to hydraulic conductivity.

Inflows including the potential inflows from adjacent mining areas were estimated for Block 1, Block 2, Block 2A and Block 6. A pillar width of 18 m and a hydraulic conductivity of 0.1 m/day was assumed.

With the inclusion of pillar inflows the total inflows are higher for the whole 11 years of mining. Inflows vary between ~370 and ~1 900 m3/d.
Inflows from adjacent mining areas could increase if the hydraulic conductivity of the coal seam is higher than 0.1 m/d. This can be the case as hydraulic conductivities as high as 0.5 m/day for the No. 2 coal seam have been reported (Hodgson & Krantz, 1998). In addition, mining activities such as blasting could impact on pillar hydraulic conductivities.

Therefore hydraulic conductivities of 0.5 and 1 m/d were used for an estimated range of inflows through the pillars. The inflows with a k of 1 m/d should be considered as a worst case scenario and measures should be taken to deal with inflows of this order.

Mining of the opencasts should be done with caution given the close proximity of the proposed workings to TNC underground, flooded opencasts and potential inaccuracies in the extents of the underground voids. There is a high risk of increased groundwater inflows due to barrier pillar failure or (partly) mining of these pillars and mitigation measures should be implemented to address this risk. The mine should also ensure that sufficient pumping capacity is available to manage any sudden inrushes to prevent loss of life and equipment damage.

<u>Groundwater Quality (Contamination of the surrounding aquifers)</u>
The life of mine for the proposed mining at the 2 Seam Pty Ltd Mine is planned until 2027. This allows time for chemical reactions to take place in the mined out areas, overburden dumps and other potential pollution sources to produce ARD conditions. Groundwater flow directions will be directed towards the mining areas due to the mine dewatering. Therefore, contamination will

be contained within the mining areas, and little contamination will be able to migrate away from the mining area. Any water balancing dams and/or pollution control dams should be lined, thereby preventing contamination of the underlying aquifers.

Due to the possibility of high inflows from underground voids and pillar barriers it is likely the water balance for the site will show large volumes of excess water on-site abstracted from the opencasts.

9.3.4.5. Impacts of Freshwater resources

The specialist surface water report is available as **Appendix 9**. The specialist report included an assessment of existing clean and dirty water management infrastructure.

According to the Water Research Commission (WRC) study of the Water Resources of South Africa (WR 2012), the Vlaklaagte OC6 Project falls within the Olifants River Water Management Area (WMA 4) and more specifically within Quaternary Catchment B11B, with the following catchment characteristics:

- Mean Annual Precipitation (MAP) : 688mm
- Mean Annual Evaporation (MAE) : 1 550mm
- Mean Annual Runoff (MAR) : 23.65 mil m3
- Rain Zone : B1A
- Evaporation Zone : 4A

The confluence of the tributary and the Olifants River is on RE of the farm Clydesdale 483 IS.

The Vlaklaagte OC6 Project is in close proximity to the Olifants River and the western wetland system is a small tributary of the Olifants River and flows from south-west to north-east. The Western stream of the Vlaklaagte OC6 Project has a catchment area of ±6.69 km².

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The quantified impact that the Vlaklaagte Block OC6 Opencast will have on the Quaternary Catchment Yield is minimal during the operational phase. The opencast area will be rehabilitated to ensure a free draining profile as close as possible to pre-mining topography. This will result in no loss of surface run-off post-closure.

The major impacts associated with the whole project are as follows:

- Water quality

Water quality impacts are due to a change in natural conditions and enhancement of pollution from sources. On a regional scale, due to a decrease in runoff, the dilution of other pollution

sources is affected. Therefore, a reduction in runoff could result in a more pronounced pollution effect.

- Catchment yield and hydrology

The affected stream will be affected due to a reduction in runoff. Polluted water that would naturally flow to the stream is contained on site.

The potential impacts could be grouped in the following:

- Stream Flow Reduction
- Sediment Transport/ erosion
- Unstable River Banks
- Removal of Vegetation
- Deterioration of Water Quality

Stream Flow Reduction
The collection, storage and re-use of affected water from activities like the access roads, haul roads and opencast mining will decrease the run-off towards the tributary of the Olifants River. This will result in the reduction of stream flow in these streams/rivers and the total catchment yield.

Sediment Transport/ erosion
Paved and roof areas result in an increase in the volume and the speed of surface runoff. This results in a higher potential of soil erosion which will lead to increase in the sedimentation of local streams and the resultant deterioration in the water quality.

Unstable River Banks
Clean water will be diverted around dirty areas and the opencast operation. Drains and channels will be constructed to handle the clean water run-off. If these water management structures are not designed and constructed correctly, it can cause damage to stream/river banks where high volumes of water enter streams/river.

Removal of Vegetation
Due to the clearing of land of vegetation and topsoil for opencast mining, construction purposes, construction of access roads and construction camps, contaminated runoff from these areas may increase resulting in an increase of the volume of contaminated water that needs to be handled on the Vlaklaagte OC6 project footprint.

Deterioration of Water Quality

The opencast area must be considered as a dirty catchment area and all surface runoff from this area will be contaminated. There is a high potential of water quality impact from this activity if water is not contained.

The mining and hauling of coal, increases the probability of localised accidental spillages of hydrocarbons (diesel, oils etc.) from earthmoving and construction equipment and transport of equipment and personnel to and from the site. The impact will be contained to the site only and will be of a short duration as spillages can usually be remediated immediately. Accidental spillage from areas seen as dirty area will have a negative impact on the water quality of the natural surface water and will be collected and pumped to the PCD at Vlaklaagte Mine.

Run-off water from haul roads and spoil stockpiles can increase the salinity levels of the stream/river and should be minimized, contained and re-use as far as possible.

9.3.4.6. Impact on Wetlands and Aquatic Ecology

The specialist reports on wetlands and aquatic ecology are available in **Appendix 11**.

According to the **Wetland Ecological Assessment**, there are four key ecological impacts on the wetlands that are anticipated to occur namely,

- Loss of wetland habitat and ecological structure;
- Changes to the sociocultural and service provision;
- Impacts on the hydrology and sediment balance of the wetlands; and
- Impacts on water quality.

Various activities and development aspects may lead to these impacts, however, provided that the mitigation hierarchy is followed, some impacts can be avoided or adequately minimised where avoidance is not feasible. The mitigation measures provided in the report have been developed with the mitigation hierarchy in mind, and the implementation and strict adherence to these measures will assist in minimising the significance of impacts on the receiving environment.

As some of the site clearing and preparation activities will occur within the wetlands, these activities are considered to be of '**Medium**' risk significance to these wetlands. However, construction of the surface infrastructure is considered to be of a relatively short duration which will take place at selected localities within the southern portion of the UCVB wetland (complete

removal of vegetation and ripping of top soil) and within the 32m NEMA Zone of Regulation of the CVB wetland.

The clean water trench proposed to divert clean water into the CVB wetland was determined to also pose a '**Medium**' risk significance to the wetland, during the construction and operation thereof. This trench will affect the surface and subsurface recharge of the CVB wetland. It is recommended that the trench outlet be constructed with energy dissipating structures to slow down the velocity of water entering the wetland. The area surrounding the outlet should also be re-seeded with indigenous wetland vegetation in order to limit erosion within the wetland.

In applying the risk assessment, it was assumed that the mitigation hierarchy as advocated by the DEA et al. would be followed, i.e. the impacts would first be avoided. As the proposed open cast pit is located within the UCVB wetland, which will be lost, this is not feasible. Unless its practical and feasible to reinstate this wetland post-closure (to at least a PES Category D condition), rehabilitation (post-closure) or offsetting thereof is recommended. As only a small portion of the UCVB wetland would be lost, the residual impact is considered relatively small, however, a net loss of wetland resources is not avoidable (thus a '**High**' risk significance). If offsetting is considered, it is expected that the quantum of offsetting would be limited.

The open cast pit is also considered to cause alteration to the hydropedological flow drivers of the CVB wetland. Impacts to the subsurface flow (considered to be the main hydrological driver of this wetland), does pose a risk to the hydrological functioning to the CVB wetland. Mining within the wetland recharge soils should be reconsidered, as the CVB wetland is largely driven by subsurface flow, of which a portion thereof would be mined out as part of the open cast pit area. The overburden stockpile areas are also anticipated to hinder water infiltration or distribution across this wetland system (during all phases) due to the proposed overburden stockpile being located on soil resources defined as wetland recharge soils. If possible, the location of these stockpiles should be reconsidered. The overburden stockpiles should not be located on any soil considered to be of hydropedological importance to the wetlands, nor within the 100m GN704 Zone of Regulation of the wetlands.

Dewatering of the open cast pit is expected to occur. This poses a '**Medium**' risk significance on the hydrological regime of the remaining upstream portion of the UCVB wetland, by decreasing the level of the subsurface flow (draw down due to a cone of depression forming, and thus reduce the rate of recharge. Dewatering is, however, expected to occur at a very low rate, and thus, the likelihood of the impact of dewatering is expected to be of **Medium** risk significance.

It is the opinion of the freshwater ecologist that the proposed activities is not fatally flawed, since the loss of a portion of the UCVB wetland could be considered a low quantum of loss, in relation to the surrounding freshwater environment and considering its current ecological condition. Nevertheless, strict adherence to mitigation measures should be enforced, in order to ensure that the ecological integrity of the remaining freshwater environment is not further compromised.

9.3.4.7. Impacts on Air Quality

There is a number of activities/infrastructure associated with mining operations that have the potential to pollute the air. In the construction and decommissioning phases these activities are temporary in nature. The operational phase will present more long term activities and the closure phase will present final land forms that may have the potential to pollute the air through long term wind erosion.

The Vlaklaagte OC6 project is located in a region which is already exposed to a wide range of air pollution sources.

Dust is generated as a result of opencast mining operation, blasting and wind erosion from stockpiles and unpaved areas.

The potential impacts on air quality are discussed in **Table 31.**

9.3.4.8. Impacts on Heritage

The Phase I HIA study for the proposed Vlaklaagte Block OC6 Project revealed the following types and ranges of heritage resources as outlined in Section 3 of the National Heritage Resources Act (No 25 of 1999) in and near the Project Area, namely:

- A graveyard.

The 4 graves belong to:

(1) Anna Maria J. Pretorius (born Roos) who was born in 1886 and died in 1944

(2) Matthys Johannes Nicolaas Swart who was born in 1882 and died in 1919

(3) Anna Elizabeth Magrieta Lourens (born De Wet) who was born in 1907. No death date on stone

(4) Matthys Johannes Lourens who was born in 1905 and passed away in 1960.

Graves always carry a High Significance Rating from a Cultural Heritage point of view and should be handled with care. As these graves are older than 60 years of age they are protected by the National Heritage Resources Act as well and should be protected in situ if possible. If the grave site and graves on it cannot be avoided by the proposed mining development then they can be exhumed and relocated after all due processed have been followed. This will include detailed social consultation to try and contact any living descendants of the deceased in order to obtain their consent for the exhumations & relocations and obtaining permits from SAHRA, local, provincial and national authorities before the exhumation and relocation work can be conducted.

The graveyard was geo-referenced and mapped.

Table 30: Impact Assessment – Water Management Facilities

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Topography										
Alteration of the topography due to mining and the proposed infrastructure (C, O, D, Cl).	N	Long Term	Site	High	Moderate	Definite	High	Moderate	Low	Disturbances to natural areas must be minimised.
Additional disturbance of physical and landscape features (C, O, D, Cl).	N	Long Term	Site	High	Moderate	Definite	High	Moderate	Low	
Soil, Land Use and Land Capability										
Loss of topsoil due to negligent stripping and stockpiling procedures at open pit and due to use of topsoil for construction purposes.	N	Permanent	Site	High	Very High	Definite	Very Low	High	Very Low	Soil types should be stripped at depth and stockpiled as indicated on the soil stripping plan.
Topsoil contamination with hydrocarbons and chemical compounds from mechanical equipment (C, O, D).	N	Medium Term	Site	Moderate	Moderate	Probable	Low	Moderate	Very Low	Diesel storage tanks should be bunded. Prevent any spills from occurring as far as possible.
Cease in land capability at pit, dumps, stockpiles and infrastructure footprints during mine construction and operation (C, O).	N	Long Term	Site	Very High	Moderate	Definite	High	Moderate	Low	No mitigation is possible during the construction and operational phase. Rehabilitation during decommissioning must be conducted as per approved closure and rehabilitation plan.
Cease in current land use at pit, dumps, stockpiles and infrastructure footprints during mine construction and operation (C, O).	N	Long Term	Site	Very High	Moderate	Definite	High	Moderate	Low	

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Cease in agricultural production at pit, dumps, stockpiles and infrastructure footprints during mine construction and operation (C, O).	N	Long Term	Site	Very High	Moderate	Definite	High	Moderate	Low	
Flora										
Impact on the floral habitat integrity of the Low sensitivity area (C, O, D, Cl).	N	Medium Term	Local	Moderate	Moderate	Definite	Moderate	Moderate	Low	Any proposed mining surface infrastructure must be placed within low sensitivity areas as far as possible, as these areas are of low ecological importance.
Impact on the floral habitat integrity of the Wetland habitat (C, O, D, Cl).	N	Medium Term	Local	High	Moderate	Definite	High	Moderate	Low	Site offices, parking areas for mine vehicles, etc. should be confined to non-sensitive areas. Sensitive areas must be demarcated off and vehicles and personnel are not allowed to enter demarcated areas. No collection of floral SCC or medicinal floral species must be allowed by mining personnel. All Declared invasive species must be removed from the site.
Floral Species of Conservation Concern within the Transformed Habitat unit (C, O, D, Cl.).	N	Medium Term	Local	Low to Moderate	High	Probable	Low	High	Very Low	No collection of floral SCC or medicinal floral species must be allowed by construction personnel.
Floral Species of Conservation Concern within the Wetland habitat (C, O, D, Cl).	N	Medium Term	Regional	High	Moderate	Highly Probable	Moderate	Moderate	Low	Dumping of rubble and other waste in the sensitive areas should be prevented through fencing or other management measures. These areas must be properly managed throughout the lifespan of the project in terms of fire, eradication of exotics and monitoring for Red List species to ensure continuous biodiversity.
Fauna										

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Impact on faunal habitat integrity within low sensitivity area (C, O, D, Cl).	N	Medium Term	Local	High	Moderate	Definite	Moderate	Moderate	Low	Fires are strictly prohibited on site. Trapping, hunting or handling of fauna is strictly prohibited. Monitoring of rehabilitation should be conducted by a suitably qualified specialist.
Loss of wetland and riparian habitat and impact on ecological sensitive areas (C, O, D, Cl)	N	Medium Term	Local	High	Moderate to Low	Definite	High	Low	Moderate	Unless it's practical and feasible to reinstate the UCVB wetland post-closure (to at least a PES Category D), rehabilitation (post-closure) or offsetting thereof is recommended. If offsetting is considered, it is expected that the quantum of offsetting would be limited. Implement a monitoring programme to detect and prevent the pollution of soils, surface water and groundwater; Mining within the wetland recharge soils should be strongly reconsidered.
Faunal Species of Conservation Concern within the Wetland habitat (C, O).	N	Long Term	National	Very High	Moderate	Probable	High	Moderate	Moderate	If the giant bullfrog, coppery grass lizard or any herpetological species are encountered or exposed during the mining activities, they should be removed and relocated to natural areas in the vicinity. The wetlands, sensitive areas and buffers must be excluded from mining activities as far as possible.
Faunal Species of Conservation Concern within the Wetland habitat (D, Clo).	N	Medium Term	National	Very High	Moderate	Definite	High	Moderate	Moderate	Unless it's practical and feasible to reinstate the UCVB wetland post-closure (to at least a PES Category D), rehabilitation (post-closure) or offsetting thereof is recommended. If offsetting is considered, it is expected that the quantum of offsetting would be limited.
Groundwater										
Impacts on ground water quality due to poor quality seepage from the pollution source areas (C).	N	Long Term	Site	Low	Low	Low	Low	Moderate	Very Low	Appropriate lining and monitoring of the pollution source areas.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Impacts on groundwater quality due to poor quality seepage from the pollution source areas (O).	N	Permanent	Site	Low	Low	Low	Low	Moderate	Very Low	Appropriate lining and monitoring of the pollution source areas.
Freshwater Resources										
Impacts on surface water quality due to poor quality seepage from the pollution source areas (C).	N	Long Term	Site	Low	Low	Low	Low	Moderate	Very Low	Appropriate lining and monitoring of the pollution source areas.
Site clearing (C).	N	Short Term	Site	Very High	Moderate	Definite	Moderate	Moderate	Low	The project footprint must be limited as much as possible (this includes clearing of vegetation, which must be restricted to what is essential).
Development of pollution control diversion berms, sumps, pipelines and channels (C).	N	Short Term	Site	Very High	Moderate	Highly Probable	Moderate	Moderate	Low	Good clean and dirty water separation and management protocol as per GN 704 should be followed at all times.
Ancillary activities by construction personnel and employees during other phases (C, O, D).	N	Long Term	Site	High	High	Highly Probable	Moderate	High	Very Low	Surface water management plan must be implemented and maintained as designed.
Possible discharge from dirty water system (O, D).	N	Short Term	Local	Very High	High	Highly Probable	Moderate	High	Very Low	The clean and dirty water systems should be constructed and managed in such a way that they are not likely to experience spills more than once in 50 years.
Changes in natural surface water flow parameters. (C, O, Clo)	N	Temporary	Site	Moderate	Moderate	Definite	Moderate	Moderate	Low	Surface water management plan must be implemented and maintained as designed.
Reduction in clean water runoff to the tributary of the Olifants river. (C, O).	N	Long Term	Regional	Very High	Moderate	Definite	High	Moderate	Low	Surface water management plan must be implemented and maintained as designed. Rehabilitation should be continuously and be free draining to maximise clean runoff
Reduction in water quality due to the release of suspended solids	N	Medium Term	Local	High	High	Probable	Low	High	Very Low	Ensure proper storm water management designs and systems are in place.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Pollution due to uncontrolled releases from the mining footprint and infrastructure areas	N	Medium Term	Local	High	Low to Moderate	Probable	Moderate	High	Low	Ensure proper storm water management designs and systems are in place.
Potential invasion of alien/invasive species (C, O, D, Cl).	N	Permanent	Local	Moderate	High	Highly Probable	Moderate	High	Low	All disturbances caused by the construction activities must ensure that all recruited alien vegetation is eradicated, and that ongoing alien vegetation control is implemented.
Decant of contaminated water from the mine into the receiving environment (D, Cl).	N	Permanent	Regional	Very High	Moderate	Definite	Very High	Moderate	Moderate	A detailed water balance be calculated for the mine and that the expected decant points and decant qualities are determined. Water influx into the mining areas should be kept to the absolute minimum possible. 2 Seam must do investigations to the most effective way to treat water on site if needed at the end of LoM. The installation of an RO plant should be seen as a last option.
Potential further habitat degradation (D, Cl).	N	Short Term	Site	Moderate	High	Probable	Low	High	Very Low	Rehabilitation must be conducted as stipulated in the closure and rehabilitation plan.
Air Quality										
Dust will be generated by construction activities. Exposed surfaces from the removal of vegetation are susceptible to erosional forces including wind. Construction vehicles and machinery moving along roads will generate dust (C).	N	Temporary	Local	Moderate	High	Probable	Low	High	Very Low	Minimise extent of disturbed areas. Do dust suppression on all roads.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Dust will be generated by rehabilitation activities. Exposed surfaces are susceptible to erosional forces including wind. Vehicles and machinery moving along roads will generate dust (D, Cl).	N	Temporary	Local	Moderate	High	Probable	Low	High	Very Low	Ensure site is restored to pre-mining conditions. Do seeding of rehabilitated areas as soon as possible. Do dust suppression on all roads.
Noise and Blasting										
Noise generated by opencast mining activities, transport of materials and rehabilitation post-mining (C, D).	N	Long Term	Local	Low	Moderate	Probable	Low	Moderate	Very Low	Fit efficient silencers and enclose engine compartments.

9.3.5. Activity 5: Stockpiles

9.3.5.1. Impacts on Geology

Mining by definition is the extraction of a natural resource and does have a destructive impact on the geology of an area. For the DMR and the owner of a mining right is the maximum exploitation of the natural resource of the utmost importance. Therefor is the loss and sterilisation of the mineral resource through the placement of infrastructure an important impact. The optimised placement and minimisation of mining infrastructure project is the best mitigation to this impact.

The potential impacts on geology are discussed in **Table 32**.

9.3.5.2. Impacts on Topography

Opencast mining does in its nature have a significant impact on the topography of an area, especially during the operational phase of the project.

Hazardous excavations and infrastructure include all structures into or off which third parties and animals can fall and be harmed. Hazardous excavations and infrastructure occur in all mine phases from construction through operation to decommissioning and closure. In the construction and decommissioning phases these hazardous excavations and infrastructure are temporary in nature, usually existing for a few weeks to a few months. The operational phase will present more long term hazardous excavations and infrastructure and the closure phase might present final land forms that are considered hazardous. These can include possible surface subsidence due to settling of backfill material.

The potential impacts on topography are discussed in **Table 31**.

9.3.5.3. Impacts on Soils, Land Use and Land Capability

The specialist soils, land use and land capability report is available as **Appendix 7**.

Soil is a valuable resource that supports a variety of ecological functions. The mine has the potential to damage soil resources through physical disturbance and/or contamination. Contamination of soils also has the potential to impact both surface and groundwater resources.

Soil resources can be damaged and/or lost through:

- Loss of topsoil due to negligent stripping and stockpiling procedures at open pit and due to use of topsoil for construction purposes;

- Deterioration of topsoil quality due to contamination with underlying subsoil layers or rock formations;
- Decline in topsoil fertility due to mixing of soil's A and B horizons (upper and lower horizons) and due to possible mixing of different soil types;
- Compaction and decline in topsoil structure during stockpiling and topsoil re-placing;
- Compaction and sterilisation of undisturbed topsoil underneath stockpiles and dumps;
- Loss of topsoil through erosion at stockpiles, pit edges and rehabilitated areas; and
- Topsoil contamination with hydrocarbons and chemical compounds from mechanical equipment.

Stripping, stockpiling and replacing of topsoil has a very high impact on soil, land capability and land use and the procedures followed during execution of these actions directly influence the post-mining land capability and consequently determine the degree of deterioration from pre-mining to post-mining land capability. They also directly determine the possible post-mining land uses. Direct replacing of topsoil usually cannot take place in the first quarter of the mining process and therefore has to be stockpiled.

Five soil types, Hu1, Hu2, Av1, Av2 and Lo1 occur in the proposed open pit area and should be stripped at different depths and stockpiled as indicated in the specialist report. The soil types occur geographically in non-complex units and separate stockpiling of soil type groups are practical. The specialist report shows the soil types that should be stored on 3 stockpiles consisting of red well-drained soils, yellow brown moderately well-drained soils and grey poorly drained wetland soils. If required the soils can be stored in 1 continuous stockpile providing that the 3 soil type groups are not mixed.

The backfilled and levelled spoil surface should be covered with the stockpiled topsoil. Care should be taken to tip enough soil per square unit to reinstate the total required post mining soil depth at once. The replaced topsoil thickness (1.3 m) should be progressively monitored during replacement to verify if it is similar to the replacing depth provided in the specialist report and to prevent encountering shortages of topsoil.

The proposed mining footprint could be, and currently is used for crop farming activities. The lost opportunities of alternative land use which the mine will eliminate is however not significant relative to the benefits of the proposed mining activity.

9.3.5.4. Impacts on Flora

The specialist flora report is available in **Appendix 8**.

Mucina & Rutherford (2006) classified the area as Eastern Highveld Grassland, comprising slightly to moderately undulating plains, including some low hills and pan depressions. The vegetation is short, dense grassland dominated by the usual Highveld grass composition with small scattered rocky outcrops with wiry, sour grasses, and some woody species.

The soils are red to yellow sandy soils found on shales and sandstones of the Madzaringwe Formation. This vegetation unit has a strongly seasonal summer rainfall with very dry winters. Incidence of frost is expected from 13 to 42 days but higher at high elevations.

The Eastern Highveld Grassland vegetation unit is considered a Protected Ecosystem in accordance with the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).

Four vegetation study units were identified on the study site:

- Wetland vegetation;
- Cultivated fields;
- *Eragrostis – Helichrysum* grassland; and
- Mixed vegetation of farming and mining areas.

The flora study found that the part of the Wetland Vegetation unit and the *Eragrostis – Helichrysum* grassland study unit, are deemed sensitive. The rest of the study site comprises secondary grassland and farming areas and is not deemed sensitive.

No Red List, Orange List or protected species were recorded on the study site.

9.3.5.5. Impacts on Fauna

The specialist fauna reports are available in **Appendix 8**.

The mammal study found that the proposed mining activities will affect the remaining mammals recorded from the site. However, it is argued that this is of little consequence since species richness has been seriously depleted and the *Crocidura* species are not endangered. The proposed mining on the terrestrial portion of the site will not impact much more on species richness or the depleted ecological functionality. The wetland system is the main corridor for immigration of species and the integrity of the wetland system is critical.

Connectivity is near unhindered, but in the terrestrial habitat from the region the environment has been cleared by agriculture and mining. From a mammal perspective no areas were identified as a high sensitivity.

The avifaunal study found that most of the Red Data avifaunal species that are likely to occur in the study area are only likely to move through the area on rare occasions due to the fragmented state and surrounding disturbed areas. Some of the habitat systems, however, offer suitable habitat for Red Data avifaunal species during optimal conditions. Most of the aquatic habitat with their buffers, as delineated by an aquatic specialist, should be regarded as highly sensitive and should be kept free from any development or any form of disturbance. Natural grassland along these wetland systems should also be regarded as sensitive to offer suitable foraging habitat for aquatic Red Data avifaunal species. Not only are these areas sensitive for Red Data avifaunal species but also for all other avifaunal species that occur or are likely to occur within the study area.

The herpetological study found that the Olifants River drainage lines are sensitive ecological systems. A 100 meter buffer must be conserved next to the water courses. Measures will have to be taken to stop water pollution of the Olifants River drainage lines. The removal of exotic trees along the drainage lines will increase the water quality and the habitat of water-dependent herpetofauna.

The possibility exists that individuals of the giant bullfrog and coppery grass lizard occur on the study site.

The terrestrial habitat quality has been jeopardised by former agricultural activities and exotic plants. Water pollution and invasive plants threaten the integrity of the drainage line.

If the mining should go ahead, a very important indirect effect would be the likely impact that the proposed mining activities might have on the water quality of the Olifants River and wetlands due to the waste water and surface water runoff. However no real objection can be raised against the mining if the integrity of the Olifants River and wetlands are not jeopardised in any way by the mining activities.

The Invertebrate study found that wetlands on site have habitat that is suitable for supporting breeding populations of the Marsh Sylph. Both sexes of this species of butterfly drink from flowers and the larvae feed on marsh grasses, and the High sensitivity areas comprises of grasses with ample flowering plants. A 50-200m buffer has been allocated to the sensitive

areas in the north of the study site. It is essential that the wetland areas and at least a 50m buffer be preserved to conserve the habitat of the *M. meninx*.

9.3.5.6. Impacts on Groundwater

Operational Phase

Groundwater Quantity (groundwater level drawdown)

The mine floor elevation is below the general groundwater level thus causing groundwater inflows into the opencast mining areas from the surrounding aquifers during operations. The mining areas will have to be actively dewatered to ensure a safe working environment. Abstraction of groundwater that seeps into the mine areas will cause dewatering of the surrounding aquifers and an associated decrease in 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, vertical infiltration of the recharging water, the size of the mining area, and the aquifer transmissivity amongst others. The 3-D numerical groundwater flow model was used to simulate the development of the drawdown cone over time in the study area. The latest mining schedules (at the time of investigation) also taken in consideration when calculating the drawdown.

During the operational phase, it is expected that the main impact on the groundwater environment will be de-watering of the surrounding aquifer. The OC1, OC2, OC3, OC3A, OC4 and OC6 opencasts will be mined at various stages. For this investigation it has been assumed mining will take place between 2017 and 2027. The smaller opencasts on the eastern part of the site, targeting the No. 1, 2 and 4 seams, will be mined from 2019. The larger opencasts on the western part of the site targeting the No. 4 seam will be mined in 2019 - 2037 (OC4 & OC6).

However, the model results indicate groundwater drawdown will be limited to small areas surrounding the opencasts due to the water collected in the underground voids of the old TNC colliery. This limits the drawdown effects of the proposed opencasts. As the operational phase is limited to maximum 10 years, the limited drawdown effects will be short term. The following deductions can be made:

- Groundwater levels will likely only be lowered in relatively small areas surrounding the proposed opencasts due to the influence of the existing underground voids;
- However, the underground voids are numerically modelled as river-cells which feed groundwater into the opencasts while mining continues. The modelling calculations did

not incorporate potential lowering of water levels in the underground voids due to the mining activities, nor did it include potential preferential pathways between existing underground voids and proposed opencasts;

- Base flow to some of the tributaries of the Olifants River crossing the site could be affected and reduced due to the dewatering of the opencasts; and
- No privately owned boreholes are likely to be impact by lowering of groundwater levels.

Groundwater Quantity (Mine Inflow volumes)

The mine inflows were calculated using the model as described in the report. These volumes do not take into account potential inflows from the existing underground voids of the TNC Colliery, which will be discussed in the next section. Initial peaks in groundwater inflows at the start of mining of each opencast due to storage depletion in the surrounding aquifer.

Total groundwater inflow for the 2 Seam mine without additional groundwater inflow through pillars will be between ~ 150 m3/d and ~1 500 m3/d with inflows increasing as the year progresses due to the mining of several opencasts at different times. The mining activities cease towards the latter half of 2027.

Inflows into the opencast mining operations will likely be higher than calculated with the numerical model due to the presence of underground voids in areas adjacent to some of the opencasts. Block 1, Block 2, and Block 6 are likely to receive additional inflows from adjacent underground voids though barrier pillars.

Spreadsheet calculations were used to estimate additional inflows to opencasts from underground voids. Based on information received from the client an 18 m barrier pillar will be left between the existing underground voids and flooded opencasts and the proposed opencasts, and this was used as input into the calculations. Groundwater inflow calculations were based on this width to determine the sensitivity of the inflows based on the pillar width.

Based on Packer test results of the No. 2 Seam (Hodgson & Krantz, 1998) and aquifer test results as part of this study 0.1 m/day was considered a good estimate for the hydraulic conductivity of the No. 2 seam. However impacts of the historic and proposed mining activities could be significantly increase the hydraulic conductivity of the barrier pillars. Therefore conductivities for the pillars of 0.1, 0.5 and 1 m/day were used as input into the calculations.

It was found in the GCS 2016 study that the pillar width has a minimal effect when compared to hydraulic conductivity.

Inflows including the potential inflows from adjacent mining areas were estimated for Block 1, Block 2, Block 2A and Block 6. A pillar width of 18 m and a hydraulic conductivity of 0.1 m/day was assumed.

With the inclusion of pillar inflows the total inflows are higher for the whole 11 years of mining. Inflows vary between ~370 and ~1 900 m3/d.
Inflows from adjacent mining areas could increase if the hydraulic conductivity of the coal seam is higher than 0.1 m/d. This can be the case as hydraulic conductivities as high as 0.5 m/day for the No. 2 coal seam have been reported (Hodgson & Krantz, 1998). In addition, mining activities such as blasting could impact on pillar hydraulic conductivities.

Therefore hydraulic conductivities of 0.5 and 1 m/d were used for an estimated range of inflows through the pillars. The inflows with a k of 1 m/d should be considered as a worst case scenario and measures should be taken to deal with inflows of this order.

Mining of the opencasts should be done with caution given the close proximity of the proposed workings to TNC underground, flooded opencasts and potential inaccuracies in the extents of the underground voids. There is a high risk of increased groundwater inflows due to barrier pillar failure or (partly) mining of these pillars and mitigation measures should be implemented to address this risk. The mine should also ensure that sufficient pumping capacity is available to manage any sudden inrushes to prevent loss of life and equipment damage.

Groundwater Quality (Contamination of the surrounding aquifers)

The life of mine for the proposed mining at the 2 Seam Pty Ltd Mine is planned until 2027. This allows time for chemical reactions to take place in the mined out areas, overburden dumps and other potential pollution sources to produce ARD conditions. Groundwater flow directions will be directed towards the mining areas due to the mine dewatering. Therefore, contamination will be contained within the mining areas, and little contamination will be able to migrate away from the mining area. Any water balancing dams and/or pollution control dams should be lined, thereby preventing contamination of the underlying aquifers.

Due to the possibility of high inflows from underground voids and pillar barriers it is likely the water balance for the site will show large volumes of excess water on-site abstracted from the opencasts.

Mine Water Decant

For opencast mining the decant point can be established as the lowest topographical point of the pit outline at the end of life of mine. When the active dewatering of the blocks has ceased,

groundwater levels will rebound. As the backfilled opencasts flood, decant will occur when the groundwater level recovers to above the lowest surface elevation of the pit. This can occur long after the end of life of mine and is referred to as the time-to-decant.

Based on the current groundwater levels at the site, decant is only likely to occur in Block 1. This is because this opencast is found within a low lying area of the site which is in close proximity to a tributary of the Olifants River. For all other opencasts it is unlikely that decant will occur as groundwater levels in the area are significantly influenced by the historic mining activities at the site, and overall groundwater levels are subdued. Therefore, the probability of decant from the backfilled opencast Block OC6 is low, and moderate for Block 1.

9.3.5.7. Impacts of Freshwater resources

The specialist surface water report is available as **Appendix 9**. The specialist report included an assessment of existing clean and dirty water management infrastructure.

According to the Water Research Commission (WRC) study of the Water Resources of South Africa (WR 2012), the Vlaklaagte OC6 Project falls within the Olifants River Water Management Area (WMA 4) and more specifically within Quaternary Catchment B11B, with the following catchment characteristics:

- Mean Annual Precipitation (MAP) : 688mm
- Mean Annual Evaporation (MAE) : 1 550mm
- Mean Annual Runoff (MAR) : 23.65 mil m3
- Rain Zone : B1A
- Evaporation Zone : 4A

The confluence of the tributary and the Olifants River is on RE of the farm Clydesdale 483 IS.

The Vlaklaagte OC6 Project is in close proximity to the Olifants River and the western wetland system is a small tributary of the Olifants River and flows from south-west to north-east. The Western stream of the Vlaklaagte OC6 Project has a catchment area of ±6.69 km².

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The quantified impact that the Vlaklaagte Block OC6 Opencast will have on the Quaternary Catchment Yield is minimal during the operational phase. The opencast area will be rehabilitated to ensure a free draining profile as close as possible to pre-mining topography. This will result in no loss of surface run-off post-closure.

The major impacts associated with the whole project are as follows:

- Water quality

Water quality impacts are due to a change in natural conditions and enhancement of pollution from sources. On a regional scale, due to a decrease in runoff, the dilution of other pollution sources is affected. Therefore, a reduction in runoff could result in a more pronounced pollution effect.

- Catchment yield and hydrology

The affected stream will be affected due to a reduction in runoff. Polluted water that would naturally flow to the stream is contained on site.

The potential impacts could be grouped in the following:

- Stream Flow Reduction
- Sediment Transport/ erosion
- Unstable River Banks
- Removal of Vegetation
- Deterioration of Water Quality

Stream Flow Reduction

The collection, storage and re-use of affected water from activities like the access roads, haul roads and opencast mining will decrease the run-off towards the tributary of the Olifants River. This will result in the reduction of stream flow in these streams/rivers and the total catchment yield.

Sediment Transport/ erosion

Paved and roof areas result in an increase in the volume and the speed of surface runoff. This results in a higher potential of soil erosion which will lead to increase in the sedimentation of local streams and the resultant deterioration in the water quality.

Unstable River Banks

Clean water will be diverted around dirty areas and the opencast operation. Drains and channels will be constructed to handle the clean water run-off. If these water management structures are not designed and constructed correctly, it can cause damage to stream/river banks where high volumes of water enter streams/river.

Removal of Vegetation

Due to the clearing of land of vegetation and topsoil for opencast mining, construction purposes, construction of access roads and construction camps, contaminated runoff from these areas may increase resulting in an increase of the volume of contaminated water that needs to be handled on the Vlaklaagte OC6 project footprint.

Deterioration of Water Quality
The opencast area must be considered as a dirty catchment area and all surface runoff from this area will be contaminated. There is a high potential of water quality impact from this activity if water is not contained.

The mining and hauling of coal, increases the probability of localised accidental spillages of hydrocarbons (diesel, oils etc.) from earthmoving and construction equipment and transport of equipment and personnel to and from the site. The impact will be contained to the site only and will be of a short duration as spillages can usually be remediated immediately. Accidental spillage from areas seen as dirty area will have a negative impact on the water quality of the natural surface water and will be collected and pumped to the PCD at Vlaklaagte Mine.

Run-off water from spoil stockpiles can increase the salinity levels of the stream/river and should be minimized, contained and re-use as far as possible.

GCS was requested to conduct a waste classification on two waste samples to confirm the type of waste contained in these facilities and to determine the type of barrier to be used for each of the facilities in accordance with Article 636.

Both of the waste samples classify as a Waste Type 3, based on the findings of the TC and LC results. The required containment barrier according to Regulation 636 as listed in Government Gazette No 36784 for a Waste Type 3 waste is a Class C containment barrier.

9.3.5.8. Impact on Wetlands and Aquatic Ecology

The specialist reports on wetlands and aquatic ecology are available in **Appendix 11**.

According to the **Wetland Ecological Assessment**, there are four key ecological impacts on the wetlands that are anticipated to occur namely,

- Loss of wetland habitat and ecological structure;
- Changes to the sociocultural and service provision;
- Impacts on the hydrology and sediment balance of the wetlands; and
- Impacts on water quality.

Various activities and development aspects may lead to these impacts, however, provided that the mitigation hierarchy is followed, some impacts can be avoided or adequately minimised where avoidance is not feasible. The mitigation measures provided in the report have been

developed with the mitigation hierarchy in mind, and the implementation and strict adherence to these measures will assist in minimising the significance of impacts on the receiving environment.

As some of the site clearing and preparation activities will occur within the wetlands, these activities are considered to be of '**Medium**' risk significance to these wetlands. However, construction of the surface infrastructure is considered to be of a relatively short duration which will take place at selected localities within the southern portion of the UCVB wetland (complete removal of vegetation and ripping of top soil) and within the 32m NEMA Zone of Regulation of the CVB wetland.

The clean water trench proposed to divert clean water into the CVB wetland was determined to also pose a '**Medium**' risk significance to the wetland, during the construction and operation thereof. This trench will affect the surface and subsurface recharge of the CVB wetland. It is recommended that the trench outlet be constructed with energy dissipating structures to slow down the velocity of water entering the wetland. The area surrounding the outlet should also be re-seeded with indigenous wetland vegetation in order to limit erosion within the wetland.

In applying the risk assessment, it was assumed that the mitigation hierarchy as advocated by the DEA et al. would be followed, i.e. the impacts would first be avoided. As the proposed open cast pit is located within the UCVB wetland, which will be lost, this is not feasible. Unless its practical and feasible to reinstate this wetland post-closure (to at least a PES Category D condition), rehabilitation (post-closure) or offsetting thereof is recommended. As only a small portion of the UCVB wetland would be lost, the residual impact is considered relatively small, however, a net loss of wetland resources is not avoidable (thus a '**High**' risk significance). If offsetting is considered, it is expected that the quantum of offsetting would be limited.

The open cast pit is also considered to cause alteration to the hydropedological flow drivers of the CVB wetland. Impacts to the subsurface flow (considered to be the main hydrological driver of this wetland), does pose a risk to the hydrological functioning to the CVB wetland. Mining within the wetland recharge soils should be reconsidered, as the CVB wetland is largely driven by subsurface flow, of which a portion thereof would be mined out as part of the open cast pit area. The overburden stockpile areas are also anticipated to hinder water infiltration or distribution across this wetland system (during all phases) due to the proposed overburden stockpile being located on soil resources defined as wetland recharge soils. If possible, the location of these stockpiles should be reconsidered. The overburden stockpiles should not be

located on any soil considered to be of hydropedological importance to the wetlands, nor within the 100m GN704 Zone of Regulation of the wetlands.

Dewatering of the open cast pit is expected to occur. This poses a '**Medium**' risk significance on the hydrological regime of the remaining upstream portion of the UCVB wetland, by decreasing the level of the subsurface flow (draw down due to a cone of depression forming, and thus reduce the rate of recharge. Dewatering is, however, expected to occur at a very low rate, and thus, the likelihood of the impact of dewatering is expected to be of **Medium** risk significance.

It is the opinion of the freshwater ecologist that the proposed activities is not fatally flawed, since the loss of a portion of the UCVB wetland could be considered a low quantum of loss, in relation to the surrounding freshwater environment and considering its current ecological condition. Nevertheless, strict adherence to mitigation measures should be enforced, in order to ensure that the ecological integrity of the remaining freshwater environment is not further compromised.

9.3.5.9. Impacts on Air Quality

There is a number of activities/infrastructure associated with mining operations that have the potential to pollute the air. In the construction and decommissioning phases these activities are temporary in nature. The operational phase will present more long term activities and the closure phase will present final land forms that may have the potential to pollute the air through long term wind erosion.

The Vlaklaagte OC6 project is located in a region which is already exposed to a wide range of air pollution sources.

Dust is generated as a result of opencast mining operation, blasting and wind erosion from stockpiles and unpaved areas.

The potential impacts on air quality are discussed in **Table 32.**

9.3.5.10. Impacts on Heritage

The Phase I HIA study for the proposed Vlaklaagte Block OC6 Project revealed the following types and ranges of heritage resources as outlined in Section 3 of the National Heritage Resources Act (No 25 of 1999) in and near the Project Area, namely:

- A graveyard.

The 4 graves belong to:

(1) Anna Maria J. Pretorius (born Roos) who was born in 1886 and died in 1944

(2) Matthys Johannes Nicolaas Swart who was born in 1882 and died in 1919

(3) Anna Elizabeth Magrieta Lourens (born De Wet) who was born in 1907. No death date on stone

(4) Matthys Johannes Lourens who was born in 1905 and passed away in 1960.

Graves always carry a High Significance Rating from a Cultural Heritage point of view and should be handled with care. As these graves are older than 60 years of age they are protected by the National Heritage Resources Act as well and should be protected in situ if possible. If the grave site and graves on it cannot be avoided by the proposed mining development then they can be exhumed and relocated after all due processed have been followed. This will include detailed social consultation to try and contact any living descendants of the deceased in order to obtain their consent for the exhumations & relocations and obtaining permits from SAHRA, local, provincial and national authorities before the exhumation and relocation work can be conducted.

The graveyard was geo-referenced and mapped.

9.3.5.11. Visual Impacts

The assessment of visual impacts takes the following issues into account: the pre-mining visual resource and the visibility, visual intrusion, sensitivity of viewing receptors, and visual exposure, associated with the mine.

The visual resource of the mine area is determined by considering landscape character, sense of place, and landscape quality. The pre-mining visual resource was considered to be of moderate to low value because the predominantly rural agricultural setting of the broader area is compromised by power lines, roads, telephone lines and mining activities neighboring the project area.

Visibility refers to the extent to which people in the surrounding areas will see the project. The mine can be seen from all directions.

Visual intrusion refers to the magnitude of the intrusion that the mine has on existing views. The visual intrusion of the mine is high during the operational phase, which can be reduced to a low intrusion with successful implementation of the requirements for rehabilitation and closure.

Sensitivity of visual receptors refers to the fact that the visual impact varies according to the sensitivity of the receptors in the project area. Although various third parties currently remain within a relatively close proximity of the area no issues regarding visual impacts have been raised. It must therefore be concluded that the visual impact is not a sensitive issue.

Visual exposure is the extent to which infrastructure and activities will appear in various views. It follows that the closer the infrastructure and activities, the greater the visual exposure.

Table 31: Impact Assessment – Stockpiles

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Geology										
Topography										
Alteration of the topography due to mining and the proposed infrastructure (C, O, D, Cl).	N	Long Term	Site	High	Moderate	Definite	High	Moderate	Low	Disturbances to natural areas must be minimised.
Additional disturbance of physical and landscape features (C, O, D, Cl).	N	Long Term	Site	High	Moderate	Definite	High	Moderate	Low	
Soil, Land Use and Land Capability										
Loss of natural soil horizons, soil as growth medium and soil productivity due to the open pit mining and construction of associated infrastructure. (C, O, D, Cl).	N	Long Term	Site	High	Moderate	Definite	Moderate	High	Very Low	Soil types should be stripped at depth and stockpiled as indicated on the soil stripping plan.
Loss of topsoil due to negligent stripping and stockpiling procedures at open pit and due to use of topsoil for construction purposes.	N	Permanent	Site	Moderate	Moderate	Definite	Moderate	High	Very Low	Soil types should be stripped at depth and stockpiled as indicated on the soil stripping plan.
Deterioration of topsoil quality due to contamination with underlying subsoil layers or rock formations	N	Long Term	Site	High	High	Definite	Low	High	Very Low	Soil types should be stripped at depth and stockpiled as indicated on the soil stripping plan.
Compaction and decline in topsoil structure during stockpiling and topsoil re-placing	N	Medium Term	Site	High	High	Definite	Low	High	Very Low	Handling of stripped topsoil should be minimized to ensure soil's structure does not deteriorate and traffic on stockpile should be avoided to prevent compaction.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Compaction and sterilisation of undisturbed topsoil underneath stockpiles and dumps.	N	Medium Term	Site	High	Moderate	Definite	Moderate	Moderate	Low	The cleaned footprint should be deep cross-ripped to alleviate compaction caused by the stockpiles or dumps and related activities
Loss of topsoil through erosion at stockpiles, pit edges and rehabilitated areas	N	Medium Term	Site	High	Moderate	Probable	Low	High	Very Low	Ensure proper storm water management designs and systems are in place
Topsoil contamination with hydrocarbons and chemical compounds from mechanical equipment (C, O, D).	N	Medium Term	Site	Moderate	Moderate	Probable	Low	Moderate	Very Low	Prevent any spills from occurring as far as possible. Spills should be cleaned up as soon as possible.
Cease in land capability at pit, dumps, stockpiles and infrastructure footprints during mine construction and operation (C, O).	N	Long Term	Site	Very High	Moderate	Definite	High	Moderate	Low	No mitigation is possible during the construction and operational phase. Rehabilitation during decommissioning must be conducted as per approved closure and rehabilitation plan.
Cease in current land use at pit, dumps, stockpiles and infrastructure footprints during mine construction and operation (C, O).	N	Long Term	Site	Very High	Moderate	Definite	High	Moderate	Low	
Cease in agricultural production at pit, dumps, stockpiles and infrastructure footprints during mine construction and operation (C, O).	N	Long Term	Site	Very High	Moderate	Definite	High	Moderate	Low	
Flora										
Impact on the floral habitat integrity of the Low sensitivity area (C, O, D, Cl).	N	Medium Term	Local	Moderate	Moderate	Definite	Moderate	Moderate	Low	Any proposed mining surface infrastructure must be placed within low sensitivity areas as far as possible, as these areas are of low ecological importance.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Impact on the floral habitat integrity of the Wetland habitat (C, O, D, Cl).	N	Medium Term	Local	High	Moderate	Definite	High	Moderate	Low	Site offices, parking areas for mine vehicles, etc. should be confined to non-sensitive areas. Sensitive areas must be demarcated off and vehicles and personnel are not allowed to enter demarcated areas. No collection of floral SCC or medicinal floral species must be allowed by mining personnel. All Declared invasive species must be removed from the site. .
Floral Species of Conservation Concern within the Transformed Habitat unit (C, O, D, Cl.).	N	Medium Term	Local	Low to Moderate	High	Probable	Low	High	Very Low	No collection of floral SCC or medicinal floral species must be allowed by construction personnel.
Floral Species of Conservation Concern within the Wetland habitat (C, O, D, Cl).	N	Medium Term	Regional	High	Moderate	Highly Probable	Moderate	Moderate	Low	Dumping of rubble and other waste in the sensitive areas should be prevented through fencing or other management measures. These areas must be properly managed throughout the lifespan of the project in terms of fire, eradication of exotics and monitoring for Red List species to ensure continuous biodiversity.
Fauna										
Impact on faunal habitat integrity within low sensitivity area (C, O, D, Cl).	N	Medium Term	Local	Moderate	Moderate	Definite	Moderate	Moderate	Low	Fires are strictly prohibited on site. Trapping, hunting or handling of fauna is strictly prohibited. Monitoring of rehabilitation should be conducted by a suitably qualified specialist.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Loss of wetland and riparian habitat and impact on ecological sensitive areas (C, O, D, Cl)	N	Medium Term	Local	High	Moderate to Low	Definite	High	Low	Moderate	Unless it's practical and feasible to reinstate the UCVB wetland post-closure (to at least a PES Category D), rehabilitation (post-closure) or offsetting thereof is recommended. If offsetting is considered, it is expected that the quantum of offsetting would be limited. Implement a monitoring programme to detect and prevent the pollution of soils, surface water and groundwater; Mining within the wetland recharge soils should be strongly reconsidered
Faunal Species of Conservation Concern within the Wetland habitat (C, O).	N	Long Term	National	Very High	Moderate	Probable	High	Moderate	Moderate	If the giant bullfrog, coppery grass lizard or any herpetological species are encountered or exposed during the mining activities, they should be removed and relocated to natural areas in the vicinity. The wetlands, sensitive areas and buffers must be excluded from mining activities as far as possible.
Faunal Species of Conservation Concern within the Wetland habitat (D, Clo).	N	Medium Term	National	Very High	Moderate	Definite	High	Moderate	Moderate	Unless it's practical and feasible to reinstate the UCVB wetland post-closure (to at least a PES Category D), rehabilitation (post-closure) or offsetting thereof is recommended. If offsetting is considered, it is expected that the quantum of offsetting would be limited.
Groundwater										
Impacts on groundwater quality due to poor quality seepage from the mining area (O).	N	Permanent	Local	Moderate	Low	Definite	High	High	Low	Construct appropriate lining as per waste classification in specialist report.
Freshwater Resources										

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Site clearing (C).	N	Short Term	Site	Very High	Moderate	Definite	Moderate	Moderate	Low	The project footprint must be limited as much as possible (this includes clearing of vegetation, which must be restricted to what is essential).
Changes in natural surface water flow parameters.	N	Medium Term	Site	Moderate	Moderate	Definite	Moderate	Moderate	Low	Disturbances to natural areas must be minimized. Rehabilitation must be free draining.
Ancillary activities by construction personnel and employees during other phases (C, O, D).	N	Long Term	Site	High	High	Highly Probable	Moderate	High	Very Low	Site offices, parking areas for mine vehicles, etc. should be confined to non-sensitive areas. Sensitive areas must be demarcated off and vehicles and personnel are not allowed to enter demarcated areas. Disturbances to natural areas must be minimized. Awareness training must be done with all employees and contractors.
Reduction in clean water runoff to the tributary of the Olifants river. (O).	N	Short Term	Regional	Very High	Moderate	Definite	High	Moderate	Low	Surface water management plan must be implemented and maintained as designed.
Reduction in water quality due to the release of suspended solids.	N	Short Term	Local	Moderate	Low	Probable	Moderate	High	Very Low	
Pollution due to uncontrolled releases from the mining footprint and infrastructure areas	N	Short Term	Local	Moderate	Low	Probable	Moderate	High	Very Low	
Air Quality										
Dust will be generated by construction activities. Exposed surfaces from the removal of vegetation are susceptible to erosional forces including wind. Construction vehicles and machinery moving along roads will generate dust (C).	N	Medium Term	Local	Moderate	High	Probable	Low	High	Very Low	Minimise extent of disturbed areas.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Dust will be generated by materials handling activities, blasting and drilling, vehicle entrainment and wind erosion due to burden stockpile (O).	N	Medium Term	Local	Moderate	Low	Probable	Moderate	Moderate	Low	Water sprayers at materials handling points. Minimise extent of disturbed area and rehabilitate un-utilised area as soon as possible.
Dust will be generated by rehabilitation activities. Exposed surfaces are susceptible to erosional forces including wind. Vehicles and machinery moving along roads will generate dust (D, Cl).	N	Medium Term	Local	Moderate	High	Probable	Low	High	Very Low	Ensure site is restored to pre-mining conditions.
Health impacts due to fine particulate emissions and gaseous emissions.	N	Medium Term	Local	High	High	Probable	Low	Low	Low	Conduct dust suppression. Keep vehicles in a good condition. Do regular medical inspections on employees and contractors.
Visual										
Visual intrusion of mining activities, impacting on the sense of place (C, O).	N	Long Term	Site	Moderate	Moderate	Definite	Moderate	Moderate	Low	Mitigation is not possible during operations. Rehabilitate to resemble pre-mining conditions as close as possible.

9.3.6. Activity 7: Roads

9.3.6.1. Impacts on Geology

Mining by definition is the extraction of a natural resource and does have a destructive impact on the geology of an area. For the DMR and the owner of a mining right is the maximum exploitation of the natural resource of the utmost importance. Therefor is the loss and sterilisation of the mineral resource through the placement of infrastructure an important impact. The optimised placement and minimisation of mining infrastructure project is the best mitigation to this impact.

The potential impacts on geology are discussed in **Table 32**.

9.3.6.2. Impacts on Topography

Opencast mining does in its nature have a significant impact on the topography of an area, especially during the operational phase of the project.

Hazardous excavations and infrastructure include all structures into or off which third parties and animals can fall and be harmed. Hazardous excavations and infrastructure occur in all mine phases from construction through operation to decommissioning and closure. In the construction and decommissioning phases these hazardous excavations and infrastructure are temporary in nature, usually existing for a few weeks to a few months. The operational phase will present more long term hazardous excavations and infrastructure and the closure phase might present final land forms that are considered hazardous. These can include possible surface subsidence due to settling of backfill material.

The potential impacts on topography are discussed in **Table 32**.

9.3.6.3. Impacts on Soils, Land Use and Land Capability

The specialist soils, land use and land capability report is available as **Appendix 7**.

Soil is a valuable resource that supports a variety of ecological functions. The mine has the potential to damage soil resources through physical disturbance and/or contamination. Contamination of soils also has the potential to impact both surface and groundwater resources.

Soil resources can be damaged and/or lost through:

- Loss of topsoil due to negligent stripping and stockpiling procedures at open pit and due to use of topsoil for construction purposes;

- Deterioration of topsoil quality due to contamination with underlying subsoil layers or rock formations;
- Decline in topsoil fertility due to mixing of soil's A and B horizons (upper and lower horizons) and due to possible mixing of different soil types;
- Compaction and decline in topsoil structure during stockpiling and topsoil re-placing;
- Compaction and sterilisation of undisturbed topsoil underneath stockpiles and dumps;
- Loss of topsoil through erosion at stockpiles, pit edges and rehabilitated areas; and
- Topsoil contamination with hydrocarbons and chemical compounds from mechanical equipment.

Stripping, stockpiling and replacing of topsoil has a very high impact on soil, land capability and land use and the procedures followed during execution of these actions directly influence the post-mining land capability and consequently determine the degree of deterioration from pre-mining to post-mining land capability. They also directly determine the possible post-mining land uses. Direct replacing of topsoil usually cannot take place in the first quarter of the mining process and therefore has to be stockpiled.

Five soil types, Hu1, Hu2, Av1, Av2 and Lo1 occur in the proposed open pit area and should be stripped at different depths and stockpiled as indicated in the specialist report. The soil types occur geographically in non-complex units and separate stockpiling of soil type groups are practical. The specialist report shows the soil types that should be stored on 3 stockpiles consisting of red well-drained soils, yellow brown moderately well-drained soils and grey poorly drained wetland soils. If required the soils can be stored in 1 continuous stockpile providing that the 3 soil type groups are not mixed.

The backfilled and levelled spoil surface should be covered with the stockpiled topsoil. Care should be taken to tip enough soil per square unit to reinstate the total required post mining soil depth at once. The replaced topsoil thickness (1.3 m) should be progressively monitored during replacement to verify if it is similar to the replacing depth provided in the specialist report and to prevent encountering shortages of topsoil.

The proposed mining footprint could be, and currently is used for crop farming activities. The lost opportunities of alternative land use which the mine will eliminate is however not significant relative to the benefits of the proposed mining activity.

9.3.6.4. Impacts on Flora

The specialist flora report is available in **Appendix 8**.

Mucina & Rutherford (2006) classified the area as Eastern Highveld Grassland, comprising slightly to moderately undulating plains, including some low hills and pan depressions. The vegetation is short, dense grassland dominated by the usual Highveld grass composition with small scattered rocky outcrops with wiry, sour grasses, and some woody species.

The soils are red to yellow sandy soils found on shales and sandstones of the Madzaringwe Formation. This vegetation unit has a strongly seasonal summer rainfall with very dry winters. Incidence of frost is expected from 13 to 42 days but higher at high elevations.

The Eastern Highveld Grassland vegetation unit is considered a Protected Ecosystem in accordance with the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).

Four vegetation study units were identified on the study site:

- Wetland vegetation;
- Cultivated fields;
- *Eragrostis – Helichrysum* grassland; and
- Mixed vegetation of farming and mining areas.

The flora study found that the part of the Wetland Vegetation unit and the *Eragrostis – Helichrysum* grassland study unit, are deemed sensitive. The rest of the study site comprises secondary grassland and farming areas and is not deemed sensitive.

No Red List, Orange List or protected species were recorded on the study site.

9.3.6.5. Impacts on Fauna

The specialist fauna reports are available in **Appendix 8**.

The mammal study found that the proposed mining activities will affect the remaining mammals recorded from the site. However, it is argued that this is of little consequence since species richness has been seriously depleted and the *Crocidura* species are not endangered. The proposed mining on the terrestrial portion of the site will not impact much more on species richness or the depleted ecological functionality. The wetland system is the main corridor for immigration of species and the integrity of the wetland system is critical.

Connectivity is near unhindered, but in the terrestrial habitat from the region the environment has been cleared by agriculture and mining. From a mammal perspective no areas were identified as a high sensitivity.

The avifaunal study found that most of the Red Data avifaunal species that are likely to occur in the study area are only likely to move through the area on rare occasions due to the fragmented state and surrounding disturbed areas. Some of the habitat systems, however, offer suitable habitat for Red Data avifaunal species during optimal conditions. Most of the aquatic habitat with their buffers, as delineated by an aquatic specialist, should be regarded as highly sensitive and should be kept free from any development or any form of disturbance. Natural grassland along these wetland systems should also be regarded as sensitive to offer suitable foraging habitat for aquatic Red Data avifaunal species. Not only are these areas sensitive for Red Data avifaunal species but also for all other avifaunal species that occur or are likely to occur within the study area.

The herpetological study found that the Olifants River drainage lines are sensitive ecological systems. A 100 meter buffer must be conserved next to the water courses. Measures will have to be taken to stop water pollution of the Olifants River drainage lines. The removal of exotic trees along the drainage lines will increase the water quality and the habitat of water-dependent herpetofauna.

The possibility exists that individuals of the giant bullfrog and coppery grass lizard occur on the study site.

The terrestrial habitat quality has been jeopardised by former agricultural activities and exotic plants. Water pollution and invasive plants threaten the integrity of the drainage line.

If the mining should go ahead, a very important indirect effect would be the likely impact that the proposed mining activities might have on the water quality of the Olifants River and wetlands due to the waste water and surface water runoff. However no real objection can be raised against the mining if the integrity of the Olifants River and wetlands are not jeopardised in any way by the mining activities.

The Invertebrate study found that wetlands on site have habitat that is suitable for supporting breeding populations of the Marsh Sylph. Both sexes of this species of butterfly drink from flowers and the larvae feed on marsh grasses, and the High sensitivity areas comprises of grasses with ample flowering plants. A 50-200m buffer has been allocated to the sensitive

areas in the north of the study site. It is essential that the wetland areas and at least a 50m buffer be preserved to conserve the habitat of the *M. meninx*.

9.3.6.6. Impacts on Groundwater

Operational Phase

Groundwater Quantity (groundwater level drawdown)

The mine floor elevation is below the general groundwater level thus causing groundwater inflows into the opencast mining areas from the surrounding aquifers during operations. The mining areas will have to be actively dewatered to ensure a safe working environment. Abstraction of groundwater that seeps into the mine areas will cause dewatering of the surrounding aquifers and an associated decrease in 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, vertical infiltration of the recharging water, the size of the mining area, and the aquifer transmissivity amongst others. The 3-D numerical groundwater flow model was used to simulate the development of the drawdown cone over time in the study area. The latest mining schedules (at the time of investigation) also taken in consideration when calculating the drawdown.

During the operational phase, it is expected that the main impact on the groundwater environment will be de-watering of the surrounding aquifer. The OC1, OC2, OC3, OC3A, OC4 and OC6 opencasts will be mined at various stages. For this investigation it has been assumed mining will take place between 2017 and 2027. The smaller opencasts on the eastern part of the site, targeting the No. 1, 2 and 4 seams, will be mined from 2019. The larger opencasts on the western part of the site targeting the No. 4 seam will be mined in 2019 - 2037 (OC4 & OC6).

However, the model results indicate groundwater drawdown will be limited to small areas surrounding the opencasts due to the water collected in the underground voids of the old TNC colliery. This limits the drawdown effects of the proposed opencasts. As the operational phase is limited to maximum 10 years, the limited drawdown effects will be short term. The following deductions can be made:

- Groundwater levels will likely only be lowered in relatively small areas surrounding the proposed opencasts due to the influence of the existing underground voids;
- However, the underground voids are numerically modelled as river-cells which feed groundwater into the opencasts while mining continues. The modelling calculations did

not incorporate potential lowering of water levels in the underground voids due to the mining activities, nor did it include potential preferential pathways between existing underground voids and proposed opencasts;

- Base flow to some of the tributaries of the Olifants River crossing the site could be affected and reduced due to the dewatering of the opencasts; and
- No privately owned boreholes are likely to be impact by lowering of groundwater levels.

Groundwater Quantity (Mine Inflow volumes)

The mine inflows were calculated using the model as described in the report. These volumes do not take into account potential inflows from the existing underground voids of the TNC Colliery, which will be discussed in the next section. Initial peaks in groundwater inflows at the start of mining of each opencast due to storage depletion in the surrounding aquifer.

Total groundwater inflow for the 2 Seam mine without additional groundwater inflow through pillars will be between ~ 150 m3/d and ~1 500 m3/d with inflows increasing as the year progresses due to the mining of several opencasts at different times. The mining activities cease towards the latter half of 2027.

Inflows into the opencast mining operations will likely be higher than calculated with the numerical model due to the presence of underground voids in areas adjacent to some of the opencasts. Block 1, Block 2, and Block 6 are likely to receive additional inflows from adjacent underground voids though barrier pillars.

Spreadsheet calculations were used to estimate additional inflows to opencasts from underground voids. Based on information received from the client an 18 m barrier pillar will be left between the existing underground voids and flooded opencasts and the proposed opencasts, and this was used as input into the calculations. Groundwater inflow calculations were based on this width to determine the sensitivity of the inflows based on the pillar width.

Based on Packer test results of the No. 2 Seam (Hodgson & Krantz, 1998) and aquifer test results as part of this study 0.1 m/day was considered a good estimate for the hydraulic conductivity of the No. 2 seam. However impacts of the historic and proposed mining activities could be significantly increase the hydraulic conductivity of the barrier pillars. Therefore conductivities for the pillars of 0.1, 0.5 and 1 m/day were used as input into the calculations.

It was found in the GCS 2016 study that the pillar width has a minimal effect when compared to hydraulic conductivity.

Inflows including the potential inflows from adjacent mining areas were estimated for Block 1, Block 2, Block 2A and Block 6. A pillar width of 18 m and a hydraulic conductivity of 0.1 m/day was assumed.

With the inclusion of pillar inflows the total inflows are higher for the whole 11 years of mining. Inflows vary between ~370 and ~1 900 m3/d.
Inflows from adjacent mining areas could increase if the hydraulic conductivity of the coal seam is higher than 0.1 m/d. This can be the case as hydraulic conductivities as high as 0.5 m/day for the No. 2 coal seam have been reported (Hodgson & Krantz, 1998). In addition, mining activities such as blasting could impact on pillar hydraulic conductivities.

Therefore hydraulic conductivities of 0.5 and 1 m/d were used for an estimated range of inflows through the pillars. The inflows with a k of 1 m/d should be considered as a worst case scenario and measures should be taken to deal with inflows of this order.

Mining of the opencasts should be done with caution given the close proximity of the proposed workings to TNC underground, flooded opencasts and potential inaccuracies in the extents of the underground voids. There is a high risk of increased groundwater inflows due to barrier pillar failure or (partly) mining of these pillars and mitigation measures should be implemented to address this risk. The mine should also ensure that sufficient pumping capacity is available to manage any sudden inrushes to prevent loss of life and equipment damage.

Groundwater Quality (Contamination of the surrounding aquifers)
The life of mine for the proposed mining at the 2 Seam Pty Ltd Mine is planned until 2027. This allows time for chemical reactions to take place in the mined out areas, overburden dumps and other potential pollution sources to produce ARD conditions. Groundwater flow directions will be directed towards the mining areas due to the mine dewatering. Therefore, contamination will be contained within the mining areas, and little contamination will be able to migrate away from the mining area. Any water balancing dams and/or pollution control dams should be lined, thereby preventing contamination of the underlying aquifers.

Due to the possibility of high inflows from underground voids and pillar barriers it is likely the water balance for the site will show large volumes of excess water on-site abstracted from the opencasts.

9.3.6.7. Impacts of Freshwater resources

The specialist surface water report is available as **Appendix 9**. The specialist report included an assessment of existing clean and dirty water management infrastructure.

According to the Water Research Commission (WRC) study of the Water Resources of South Africa (WR 2012), the Vlaklaagte OC6 Project falls within the Olifants River Water Management Area (WMA 4) and more specifically within Quaternary Catchment B11B, with the following catchment characteristics:

- Mean Annual Precipitation (MAP) : 688mm
- Mean Annual Evaporation (MAE) : 1 550mm
- Mean Annual Runoff (MAR) : 23.65 mil m3
- Rain Zone : B1A
- Evaporation Zone : 4A

The confluence of the tributary and the Olifants River is on RE of the farm Clydesdale 483 IS.

The Vlaklaagte OC6 Project is in close proximity to the Olifants River and the western wetland system is a small tributary of the Olifants River and flows from south-west to north-east. The Western stream of the Vlaklaagte OC6 Project has a catchment area of ±6.69 km².

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The quantified impact that the Vlaklaagte Block OC6 Opencast will have on the Quaternary Catchment Yield is minimal during the operational phase. The opencast area will be rehabilitated to ensure a free draining profile as close as possible to pre-mining topography. This will result in no loss of surface run-off post-closure.

The major impacts associated with the whole project are as follows:

- Water quality

Water quality impacts are due to a change in natural conditions and enhancement of pollution from sources. On a regional scale, due to a decrease in runoff, the dilution of other pollution sources is affected. Therefore, a reduction in runoff could result in a more pronounced pollution effect.

- Catchment yield and hydrology

The affected stream will be affected due to a reduction in runoff. Polluted water that would naturally flow to the stream is contained on site.

The potential impacts could be grouped in the following:

- Stream Flow Reduction
- Sediment Transport/ erosion
- Unstable River Banks
- Removal of Vegetation

- Deterioration of Water Quality

Stream Flow Reduction
The collection, storage and re-use of affected water from activities like the access roads, haul roads and opencast mining will decrease the run-off towards the tributary of the Olifants River. This will result in the reduction of stream flow in these streams/rivers and the total catchment yield.

Sediment Transport/ erosion
Paved and roof areas result in an increase in the volume and the speed of surface runoff. This results in a higher potential of soil erosion which will lead to increase in the sedimentation of local streams and the resultant deterioration in the water quality.

Unstable River Banks
Clean water will be diverted around dirty areas and the opencast operation. Drains and channels will be constructed to handle the clean water run-off. If these water management structures are not designed and constructed correctly, it can cause damage to stream/river banks where high volumes of water enter streams/river.

Removal of Vegetation
Due to the clearing of land of vegetation and topsoil for opencast mining, construction purposes, construction of access roads and construction camps, contaminated runoff from these areas may increase resulting in an increase of the volume of contaminated water that needs to be handled on the Vlaklaagte OC6 project footprint.

Deterioration of Water Quality
The opencast area must be considered as a dirty catchment area and all surface runoff from this area will be contaminated. There is a high potential of water quality impact from this activity if water is not contained.

The mining and hauling of coal, increases the probability of localised accidental spillages of hydrocarbons (diesel, oils etc.) from earthmoving and construction equipment and transport of equipment and personnel to and from the site. The impact will be contained to the site only and will be of a short duration as spillages can usually be remediated immediately. Accidental spillage from areas seen as dirty area will have a negative impact on the water quality of the natural surface water and will be collected and pumped to the PCD at Vlaklaagte Mine.

Run-off water from haul roads and spoil stockpiles can increase the salinity levels of the stream/river and should be minimized, contained and re-use as far as possible.

9.3.6.8. Impact on Wetlands and Aquatic Ecology

The specialist reports on wetlands and aquatic ecology are available in **Appendix 11**.

According to the **Wetland Ecological Assessment**, there are four key ecological impacts on the wetlands that are anticipated to occur namely,

- Loss of wetland habitat and ecological structure;
- Changes to the sociocultural and service provision;
- Impacts on the hydrology and sediment balance of the wetlands; and
- Impacts on water quality.

Various activities and development aspects may lead to these impacts, however, provided that the mitigation hierarchy is followed, some impacts can be avoided or adequately minimised where avoidance is not feasible. The mitigation measures provided in the report have been developed with the mitigation hierarchy in mind, and the implementation and strict adherence to these measures will assist in minimising the significance of impacts on the receiving environment.

As some of the site clearing and preparation activities will occur within the wetlands, these activities are considered to be of '**Medium**' risk significance to these wetlands. However, construction of the surface infrastructure is considered to be of a relatively short duration which will take place at selected localities within the southern portion of the UCVB wetland (complete removal of vegetation and ripping of top soil) and within the 32m NEMA Zone of Regulation of the CVB wetland.

The clean water trench proposed to divert clean water into the CVB wetland was determined to also pose a '**Medium**' risk significance to the wetland, during the construction and operation thereof. This trench will affect the surface and subsurface recharge of the CVB wetland. It is recommended that the trench outlet be constructed with energy dissipating structures to slow down the velocity of water entering the wetland. The area surrounding the outlet should also be re-seeded with indigenous wetland vegetation in order to limit erosion within the wetland.

In applying the risk assessment, it was assumed that the mitigation hierarchy as advocated by the DEA et al. would be followed, i.e. the impacts would first be avoided. As the proposed open cast pit is located within the UCVB wetland, which will be lost, this is not feasible. Unless its practical and feasible to reinstate this wetland post-closure (to at least a PES Category D condition), rehabilitation (post-closure) or offsetting thereof is recommended. As only a small

portion of the UCVB wetland would be lost, the residual impact is considered relatively small, however, a net loss of wetland resources is not avoidable (thus a '**High**' risk significance). If offsetting is considered, it is expected that the quantum of offsetting would be limited.

The open cast pit is also considered to cause alteration to the hydropedological flow drivers of the CVB wetland. Impacts to the subsurface flow (considered to be the main hydrological driver of this wetland), does pose a risk to the hydrological functioning to the CVB wetland. Mining within the wetland recharge soils should be reconsidered, as the CVB wetland is largely driven by subsurface flow, of which a portion thereof would be mined out as part of the open cast pit area. The overburden stockpile areas are also anticipated to hinder water infiltration or distribution across this wetland system (during all phases) due to the proposed overburden stockpile being located on soil resources defined as wetland recharge soils. If possible, the location of these stockpiles should be reconsidered. The overburden stockpiles should not be located on any soil considered to be of hydropedological importance to the wetlands, nor within the 100m GN704 Zone of Regulation of the wetlands.

Dewatering of the open cast pit is expected to occur. This poses a '**Medium**' risk significance on the hydrological regime of the remaining upstream portion of the UCVB wetland, by decreasing the level of the subsurface flow (draw down due to a cone of depression forming, and thus reduce the rate of recharge. Dewatering is, however, expected to occur at a very low rate, and thus, the likelihood of the impact of dewatering is expected to be of **Medium** risk significance.

It is the opinion of the freshwater ecologist that the proposed activities is not fatally flawed, since the loss of a portion of the UCVB wetland could be considered a low quantum of loss, in relation to the surrounding freshwater environment and considering its current ecological condition. Nevertheless, strict adherence to mitigation measures should be enforced, in order to ensure that the ecological integrity of the remaining freshwater environment is not further compromised.

9.3.6.9. Impacts on Air Quality

There is a number of activities/infrastructure associated with mining operations that have the potential to pollute the air. In the construction and decommissioning phases these activities are temporary in nature. The operational phase will present more long term activities and the closure phase will present final land forms that may have the potential to pollute the air through long term wind erosion.

The Vlaklaagte OC6 project is located in a region which is already exposed to a wide range of air pollution sources.

Dust is generated as a result of opencast mining operation, blasting and wind erosion from stockpiles and unpaved areas.

The potential impacts on air quality are discussed in **Table 34.**

9.3.6.10. Impacts on Heritage

The Phase I HIA study for the proposed Vlaklaagte Block OC6 Project revealed the following types and ranges of heritage resources as outlined in Section 3 of the National Heritage Resources Act (No 25 of 1999) in and near the Project Area, namely:

- A graveyard.

The 4 graves belong to:

(1) Anna Maria J. Pretorius (born Roos) who was born in 1886 and died in 1944

(2) Matthys Johannes Nicolaas Swart who was born in 1882 and died in 1919

(3) Anna Elizabeth Magrieta Lourens (born De Wet) who was born in 1907. No death date on stone

(4) Matthys Johannes Lourens who was born in 1905 and passed away in 1960.

Graves always carry a High Significance Rating from a Cultural Heritage point of view and should be handled with care. As these graves are older than 60 years of age they are protected by the National Heritage Resources Act as well and should be protected in situ if possible. If the grave site and graves on it cannot be avoided by the proposed mining development then they can be exhumed and relocated after all due processed have been followed. This will include detailed social consultation to try and contact any living descendants of the deceased in order to obtain their consent for the exhumations & relocations and obtaining permits from SAHRA, local, provincial and national authorities before the exhumation and relocation work can be conducted.

The graveyard was geo-referenced and mapped.

9.3.6.11. Visual Impacts

The assessment of visual impacts takes the following issues into account: the pre-mining visual resource and the visibility, visual intrusion, sensitivity of viewing receptors, and visual exposure, associated with the mine.

The visual resource of the mine area is determined by considering landscape character, sense of place, and landscape quality. The pre-mining visual resource was considered to be of moderate to low value because the predominantly rural agricultural setting of the broader area is compromised by power lines, roads, telephone lines and mining activities neighboring the project area.

Visibility refers to the extent to which people in the surrounding areas will see the project. The mine can be seen from all directions.

Visual intrusion refers to the magnitude of the intrusion that the mine has on existing views. The visual intrusion of the mine is high during the operational phase, which can be reduced to a low intrusion with successful implementation of the requirements for rehabilitation and closure.

Sensitivity of visual receptors refers to the fact that the visual impact varies according to the sensitivity of the receptors in the project area. Although various third parties currently remain within a relatively close proximity of the area no issues regarding visual impacts have been raised. It must therefore be concluded that the visual impact is not a sensitive issue.

Visual exposure is the extent to which infrastructure and activities will appear in various views. It follows that the closer the infrastructure and activities, the greater the visual exposure.

Table 32: Impact Assessment – Roads

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Geology										
Topography										
Alteration of the topography due to mining and the proposed infrastructure (C, O, D, Cl).	N	Long Term	Site	High	Moderate	Definite	High	Moderate	Low	Disturbances to natural areas must be minimised.
Additional disturbance of physical and landscape features (C, O, D, Cl).	N	Long Term	Site	High	Moderate	Definite	High	Moderate	Low	
Soil, Land Use and Land Capability										
Loss of natural soil horizons, soil as growth medium and soil productivity due to the open pit mining and construction of associated infrastructure. (C, O, D, Cl).	N	Long Term	Site	Moderate	High	Definite	Moderate	High	Low	Soil types should be stripped at depth and stockpiled as indicated on the soil stripping plan.
Loss of topsoil due to negligent stripping and stockpiling procedures at open pit and due to use of topsoil for construction purposes.	N	Permanent	Site	Moderate	Moderate	Definite	Moderate	High	Very Low	Soil types should be stripped at depth and stockpiled as indicated on the soil stripping plan.
Deterioration of topsoil quality due to contamination with underlying subsoil layers or rock formations	N	Long Term	Site	High	High	Definite	Low	High	Very Low	Soil types should be stripped at depth and stockpiled as indicated on the soil stripping plan.
Compaction and sterilisation of undisturbed topsoil	N	Medium Term	Site	High	Moderate	Definite	Moderate	Moderate	Low	The cleaned footprint should be deep cross-ripped to alleviate compaction caused by the stockpiles or dumps and related activities

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Topsoil contamination with hydrocarbons and chemical compounds from mechanical equipment (C, O, D).	N	Medium Term	Site	Moderate	Moderate	Probable	Low	Moderate	Very Low	Diesel storage tanks should be bunded. Prevent any spills from occurring as far as possible.
Cease in land capability at pit, dumps, stockpiles and infrastructure footprints during mine construction and operation (C, O).	N	Long Term	Site	Very High	Moderate	Definite	High	Moderate	Low	No mitigation is possible during the construction and operational phase. Rehabilitation during decommissioning must be conducted as per approved closure and rehabilitation plan.
Cease in current land use at pit, dumps, stockpiles and infrastructure footprints during mine construction and operation (C, O).	N	Long Term	Site	Very High	Moderate	Definite	High	Moderate	Low	
Cease in agricultural production at pit, dumps, stockpiles and infrastructure footprints during mine construction and operation (C, O).	N	Long Term	Site	Very High	Moderate	Definite	High	Moderate	Low	
Flora										
Impact on the floral habitat integrity of the Low sensitivity area (C, O, D, Cl).	N	Medium Term	Local	Moderate	Moderate	Definite	Moderate	Moderate	Low	Any proposed mining surface infrastructure must be placed within low sensitivity areas as far as possible, as these areas are of low ecological importance.
Impact on the floral habitat integrity of the Wetland habitat (C, O, D, Cl).	N	Medium Term	Local	High	Moderate	Definite	High	Moderate	Low	Site offices, parking areas for mine vehicles, etc. should be confined to non-sensitive areas. Sensitive areas must be demarcated off and vehicles and personnel are not allowed to enter demarcated areas. No collection of floral SCC or medicinal floral species must be allowed by mining personnel. All Declared invasive species must be removed from the site. .

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Floral Species of Conservation Concern within the Transformed Habitat unit (C, O, D, Cl.).	N	Medium Term	Local	Low to Moderate	High	Probable	Low	High	Very Low	No collection of floral SCC or medicinal floral species must be allowed by construction personnel.
Floral Species of Conservation Concern within the Wetland habitat (C, O, D, Cl).	N	Medium Term	Regional	High	Moderate	Highly Probable	Moderate	Moderate	Low	Dumping of rubble and other waste in the sensitive areas should be prevented through fencing or other management measures. These areas must be properly managed throughout the lifespan of the project in terms of fire, eradication of exotics and monitoring for Red List species to ensure continuous biodiversity.
Fauna										
Impact on faunal habitat integrity within low sensitivity area (C, O, D, Cl).	N	Medium Term	Local	Moderate	Moderate	Definite	Moderate	Moderate	Low	Fires are strictly prohibited on site. Trapping, hunting or handling of fauna is strictly prohibited. Monitoring of rehabilitation should be conducted by a suitably qualified specialist.
Loss of wetland and riparian habitat and impact on ecological sensitive areas (C, O, D, Cl)	N	Medium Term	Local	High	Moderate to Low	Definite	High	Low	Moderate	Unless it's practical and feasible to reinstate the UCVB wetland post-closure (to at least a PES Category D), rehabilitation (post-closure) or offsetting thereof is recommended. If offsetting is considered, it is expected that the quantum of offsetting would be limited. Implement a monitoring programme to detect and prevent the pollution of soils, surface water and groundwater; Mining within the wetland recharge soils should be strongly reconsidered

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Faunal Species of Conservation Concern within the Wetland habitat (C, O).	N	Long Term	National	Very High	Moderate	Probable	High	Moderate	Moderate	If the giant bullfrog, coppery grass lizard or any herpetological species are encountered or exposed during the mining activities, they should be removed and relocated to natural areas in the vicinity. The wetlands, sensitive areas and buffers must be excluded from mining activities as far as possible.
Faunal Species of Conservation Concern within the Wetland habitat (D, Clo).	N	Medium Term	National	Very High	Moderate	Definite	High	Moderate	Moderate	Unless it's practical and feasible to reinstate the UCVB wetland post-closure (to at least a PES Category D), rehabilitation (post-closure) or offsetting thereof is recommended. If offsetting is considered, it is expected that the quantum of offsetting would be limited.
Groundwater										
Impacts on groundwater quality due to poor quality seepage from the mining area (C, O).	N	Permanent	Site	Low	Low	Unlikely	Very Low	Low	Very Low	All roads should be constructed with non-carbonaceous material and coal spills should be cleaned as soon as possible.
Freshwater Resources										
Site clearing (C).	N	Short Term	Site	Very High	Moderate	Definite	Moderate	Moderate	Low	The project footprint must be limited as much as possible (this includes clearing of vegetation, which must be restricted to what is essential).
Changes in natural surface water flow parameters.	N	Temporary	Site	Moderate	Moderate	Definite	Moderate	Moderate	Low	Disturbances to natural areas must be minimized. Rehabilitation must be free draining.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Ancillary activities by construction personnel and employees during other phases (C, O, D).	N	Long Term	Site	High	High	Highly Probable	Moderate	High	Very Low	Site offices, parking areas for mine vehicles, etc. should be confined to non-sensitive areas. Sensitive areas must be demarcated off and vehicles and personnel are not allowed to enter demarcated areas. Disturbances to natural areas must be minimized. Awareness training must be done with all employees and contractors.
Reduction in clean water runoff to the tributary of the Olifants river. (C, O).	N	Long Term	Regional	Very High	Moderate	Highly Probable	High	Moderate	Low	Surface water management plan must be implemented and maintained as designed.
Reduction in water quality due to the release of suspended solids	N	Medium Term	Local	Moderate	High	Probable	Low	High	Very Low	Ensure proper storm water management designs and systems are in place.
Pollution due to uncontrolled releases from the mining footprint and infrastructure areas	N	Medium Term	Local	High	Low to Moderate	Probable	Moderate	High	Low	Ensure proper storm water management designs and systems are in place.
Potential invasion of alien/invasive species (C, O, D, Cl).	N	Permanent	Local	Moderate	High	Highly Probable	Moderate	High	Low	All disturbances caused by the construction activities must ensure that all recruited alien vegetation is eradicated, and that ongoing alien vegetation control is implemented.
Potential further habitat degradation (D, Cl).	N	Short Term	Site	Moderate	High	Probable	Low	High	Very Low	Rehabilitation must be conducted as stipulated in the closure and rehabilitation plan.
Air Quality										
Dust will be generated by construction activities. Exposed surfaces from the removal of vegetation are susceptible to erosional forces including wind. Construction vehicles and machinery moving along roads will generate dust (C, O, D).	N	Medium Term	Local	Moderate	High	Probable	Low	High	Very Low	Minimise extent of disturbed areas. Dust should be suppressed by spraying roads with water.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Dust will be generated by rehabilitation activities. Exposed surfaces are susceptible to erosional forces including wind. Vehicles and machinery moving along roads will generate dust (D, Cl).	N	Medium Term	Local	Moderate	High	Probable	Low	High	Very Low	Ensure site is restored to pre-mining conditions.
Health impacts due to fine particulate emissions and gaseous emissions.	N	Medium Term	Local	High	High	Probable	Low	Low	Low	Conduct dust suppression. Keep vehicles in a good condition. Do regular medical inspections on employees and contractors.
Visual										
Visual intrusion of mining activities, impacting on the sense of place (C, O).	N	Long Term	Site	Moderate	Moderate	Definite	Moderate	Moderate	Low	Mitigation is not possible during operations. Rehabilitate to resemble pre-mining conditions as close as possible.

9.3.7. Activity 8: Rehabilitation

9.3.7.1. Impacts on Geology

Mining by definition is the extraction of a natural resource and does have a destructive impact on the geology of an area. For the DMR and the owner of a mining right is the maximum exploitation of the natural resource of the utmost importance. Therefor is the loss and sterilisation of the mineral resource through the placement of infrastructure an important impact. The optimised placement and minimisation of mining infrastructure project is the best mitigation to this impact.

The potential impacts on geology are discussed in **Table 33**.

9.3.7.2. Impacts on Topography

Opencast mining does in its nature have a significant impact on the topography of an area, especially during the operational phase of the project.

Hazardous excavations and infrastructure include all structures into or off which third parties and animals can fall and be harmed. Hazardous excavations and infrastructure occur in all mine phases from construction through operation to decommissioning and closure. In the construction and decommissioning phases these hazardous excavations and infrastructure are temporary in nature, usually existing for a few weeks to a few months. The operational phase will present more long term hazardous excavations and infrastructure and the closure phase might present final land forms that are considered hazardous. These can include possible surface subsidence due to settling of backfill material.

The potential impacts on topography are discussed in **Table 33**.

9.3.7.3. Impacts on Soils, Land Use and Land Capability

The specialist soils, land use and land capability report is available as **Appendix 7**.

Soil is a valuable resource that supports a variety of ecological functions. The mine has the potential to damage soil resources through physical disturbance and/or contamination. Contamination of soils also has the potential to impact both surface and groundwater resources.

Soil resources can be damaged and/or lost through:

- Loss of topsoil due to negligent stripping and stockpiling procedures at open pit and due to use of topsoil for construction purposes;

- Deterioration of topsoil quality due to contamination with underlying subsoil layers or rock formations;
- Decline in topsoil fertility due to mixing of soil's A and B horizons (upper and lower horizons) and due to possible mixing of different soil types;
- Compaction and decline in topsoil structure during stockpiling and topsoil re-placing;
- Compaction and sterilisation of undisturbed topsoil underneath stockpiles and dumps;
- Loss of topsoil through erosion at stockpiles, pit edges and rehabilitated areas; and
- Topsoil contamination with hydrocarbons and chemical compounds from mechanical equipment.

Stripping, stockpiling and replacing of topsoil has a very high impact on soil, land capability and land use and the procedures followed during execution of these actions directly influence the post-mining land capability and consequently determine the degree of deterioration from pre-mining to post-mining land capability. They also directly determine the possible post-mining land uses. Direct replacing of topsoil usually cannot take place in the first quarter of the mining process and therefore has to be stockpiled.

Five soil types, Hu1, Hu2, Av1, Av2 and Lo1 occur in the proposed open pit area and should be stripped at different depths and stockpiled as indicated in the specialist report. The soil types occur geographically in non-complex units and separate stockpiling of soil type groups are practical. The specialist report shows the soil types that should be stored on 3 stockpiles consisting of red well-drained soils, yellow brown moderately well-drained soils and grey poorly drained wetland soils. If required the soils can be stored in 1 continuous stockpile providing that the 3 soil type groups are not mixed.

The backfilled and levelled spoil surface should be covered with the stockpiled topsoil. Care should be taken to tip enough soil per square unit to reinstate the total required post mining soil depth at once. The replaced topsoil thickness (1.3 m) should be progressively monitored during replacement to verify if it is similar to the replacing depth provided in the specialist report and to prevent encountering shortages of topsoil.

The proposed mining footprint could be, and currently is used for crop farming activities. The lost opportunities of alternative land use which the mine will eliminate is however not significant relative to the benefits of the proposed mining activity.

9.3.7.4. Impacts on Flora

The specialist flora report is available in **Appendix 8**.

Mucina & Rutherford (2006) classified the area as Eastern Highveld Grassland, comprising slightly to moderately undulating plains, including some low hills and pan depressions. The vegetation is short, dense grassland dominated by the usual Highveld grass composition with small scattered rocky outcrops with wiry, sour grasses, and some woody species.

The soils are red to yellow sandy soils found on shales and sandstones of the Madzaringwe Formation. This vegetation unit has a strongly seasonal summer rainfall with very dry winters. Incidence of frost is expected from 13 to 42 days but higher at high elevations.

The Eastern Highveld Grassland vegetation unit is considered a Protected Ecosystem in accordance with the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).

Four vegetation study units were identified on the study site:

- Wetland vegetation;
- Cultivated fields;
- *Eragrostis – Helichrysum* grassland; and
- Mixed vegetation of farming and mining areas.

The flora study found that the part of the Wetland Vegetation unit and the *Eragrostis – Helichrysum* grassland study unit, are deemed sensitive. The rest of the study site comprises secondary grassland and farming areas and is not deemed sensitive.

No Red List, Orange List or protected species were recorded on the study site.

9.3.7.5. Impacts on Fauna

The specialist fauna reports are available in **Appendix 8**.

The mammal study found that the proposed mining activities will affect the remaining mammals recorded from the site. However, it is argued that this is of little consequence since species richness has been seriously depleted and the *Crocidura* species are not endangered. The proposed mining on the terrestrial portion of the site will not impact much more on species richness or the depleted ecological functionality. The wetland system is the main corridor for immigration of species and the integrity of the wetland system is critical.

Connectivity is near unhindered, but in the terrestrial habitat from the region the environment has been cleared by agriculture and mining. From a mammal perspective no areas were identified as a high sensitivity.

The avifaunal study found that most of the Red Data avifaunal species that are likely to occur in the study area are only likely to move through the area on rare occasions due to the fragmented state and surrounding disturbed areas. Some of the habitat systems, however, offer suitable habitat for Red Data avifaunal species during optimal conditions. Most of the aquatic habitat with their buffers, as delineated by an aquatic specialist, should be regarded as highly sensitive and should be kept free from any development or any form of disturbance. Natural grassland along these wetland systems should also be regarded as sensitive to offer suitable foraging habitat for aquatic Red Data avifaunal species. Not only are these areas sensitive for Red Data avifaunal species but also for all other avifaunal species that occur or are likely to occur within the study area.

The herpetological study found that the Olifants River drainage lines are sensitive ecological systems. A 100 meter buffer must be conserved next to the water courses. Measures will have to be taken to stop water pollution of the Olifants River drainage lines. The removal of exotic trees along the drainage lines will increase the water quality and the habitat of water-dependent herpetofauna.

The possibility exists that individuals of the giant bullfrog and coppery grass lizard occur on the study site.

The terrestrial habitat quality has been jeopardised by former agricultural activities and exotic plants. Water pollution and invasive plants threaten the integrity of the drainage line.

If the mining should go ahead, a very important indirect effect would be the likely impact that the proposed mining activities might have on the water quality of the Olifants River and wetlands due to the waste water and surface water runoff. However no real objection can be raised against the mining if the integrity of the Olifants River and wetlands are not jeopardised in any way by the mining activities.

The Invertebrate study found that wetlands on site have habitat that is suitable for supporting breeding populations of the Marsh Sylph. Both sexes of this species of butterfly drink from flowers and the larvae feed on marsh grasses, and the High sensitivity areas comprises of grasses with ample flowering plants. A 50-200m buffer has been allocated to the sensitive

areas in the north of the study site. It is essential that the wetland areas and at least a 50m buffer be preserved to conserve the habitat of the *M. meninx*.

9.3.7.6. Impacts on Groundwater

Operational Phase

Groundwater Quantity (groundwater level drawdown)

The mine floor elevation is below the general groundwater level thus causing groundwater inflows into the opencast mining areas from the surrounding aquifers during operations. The mining areas will have to be actively dewatered to ensure a safe working environment. Abstraction of groundwater that seeps into the mine areas will cause dewatering of the surrounding aquifers and an associated decrease in 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, vertical infiltration of the recharging water, the size of the mining area, and the aquifer transmissivity amongst others. The 3-D numerical groundwater flow model was used to simulate the development of the drawdown cone over time in the study area. The latest mining schedules (at the time of investigation) also taken in consideration when calculating the drawdown.

During the operational phase, it is expected that the main impact on the groundwater environment will be de-watering of the surrounding aquifer. The OC1, OC2, OC3, OC3A, OC4 and OC6 opencasts will be mined at various stages. For this investigation it has been assumed mining will take place between 2017 and 2027. The smaller opencasts on the eastern part of the site, targeting the No. 1, 2 and 4 seams, will be mined from 2019. The larger opencasts on the western part of the site targeting the No. 4 seam will be mined in 2019 - 2037 (OC4 & OC6).

However, the model results indicate groundwater drawdown will be limited to small areas surrounding the opencasts due to the water collected in the underground voids of the old TNC colliery. This limits the drawdown effects of the proposed opencasts. As the operational phase is limited to maximum 10 years, the limited drawdown effects will be short term. The following deductions can be made:

- Groundwater levels will likely only be lowered in relatively small areas surrounding the proposed opencasts due to the influence of the existing underground voids;
- However, the underground voids are numerically modelled as river-cells which feed groundwater into the opencasts while mining continues. The modelling calculations did

not incorporate potential lowering of water levels in the underground voids due to the mining activities, nor did it include potential preferential pathways between existing underground voids and proposed opencasts;

- Base flow to some of the tributaries of the Olifants River crossing the site could be affected and reduced due to the dewatering of the opencasts; and
- No privately owned boreholes are likely to be impact by lowering of groundwater levels.

Groundwater Quantity (Mine Inflow volumes)

The mine inflows were calculated using the model as described in the report. These volumes do not take into account potential inflows from the existing underground voids of the TNC Colliery, which will be discussed in the next section. Initial peaks in groundwater inflows at the start of mining of each opencast due to storage depletion in the surrounding aquifer.

Total groundwater inflow for the 2 Seam mine without additional groundwater inflow through pillars will be between ~ 150 m3/d and ~1 500 m3/d with inflows increasing as the year progresses due to the mining of several opencasts at different times. The mining activities cease towards the latter half of 2027.

Inflows into the opencast mining operations will likely be higher than calculated with the numerical model due to the presence of underground voids in areas adjacent to some of the opencasts. Block 1, Block 2, and Block 6 are likely to receive additional inflows from adjacent underground voids though barrier pillars.

Spreadsheet calculations were used to estimate additional inflows to opencasts from underground voids. Based on information received from the client an 18 m barrier pillar will be left between the existing underground voids and flooded opencasts and the proposed opencasts, and this was used as input into the calculations. Groundwater inflow calculations were based on this width to determine the sensitivity of the inflows based on the pillar width.

Based on Packer test results of the No. 2 Seam (Hodgson & Krantz, 1998) and aquifer test results as part of this study 0.1 m/day was considered a good estimate for the hydraulic conductivity of the No. 2 seam. However impacts of the historic and proposed mining activities could be significantly increase the hydraulic conductivity of the barrier pillars. Therefore conductivities for the pillars of 0.1, 0.5 and 1 m/day were used as input into the calculations.

It was found in the GCS 2016 study that the pillar width has a minimal effect when compared to hydraulic conductivity.

Inflows including the potential inflows from adjacent mining areas were estimated for Block 1, Block 2, Block 2A and Block 6. A pillar width of 18 m and a hydraulic conductivity of 0.1 m/day was assumed.

With the inclusion of pillar inflows the total inflows are higher for the whole 11 years of mining. Inflows vary between ~370 and ~1 900 m3/d.
Inflows from adjacent mining areas could increase if the hydraulic conductivity of the coal seam is higher than 0.1 m/d. This can be the case as hydraulic conductivities as high as 0.5 m/day for the No. 2 coal seam have been reported (Hodgson & Krantz, 1998). In addition, mining activities such as blasting could impact on pillar hydraulic conductivities.

Therefore hydraulic conductivities of 0.5 and 1 m/d were used for an estimated range of inflows through the pillars. The inflows with a k of 1 m/d should be considered as a worst case scenario and measures should be taken to deal with inflows of this order.

Mining of the opencasts should be done with caution given the close proximity of the proposed workings to TNC underground, flooded opencasts and potential inaccuracies in the extents of the underground voids. There is a high risk of increased groundwater inflows due to barrier pillar failure or (partly) mining of these pillars and mitigation measures should be implemented to address this risk. The mine should also ensure that sufficient pumping capacity is available to manage any sudden inrushes to prevent loss of life and equipment damage.

Groundwater Quality (Contamination of the surrounding aquifers)
The life of mine for the proposed mining at the 2 Seam Pty Ltd Mine is planned until 2027. This allows time for chemical reactions to take place in the mined out areas, overburden dumps and other potential pollution sources to produce ARD conditions. Groundwater flow directions will be directed towards the mining areas due to the mine dewatering. Therefore, contamination will be contained within the mining areas, and little contamination will be able to migrate away from the mining area. Any water balancing dams and/or pollution control dams should be lined, thereby preventing contamination of the underlying aquifers.

Due to the possibility of high inflows from underground voids and pillar barriers it is likely the water balance for the site will show large volumes of excess water on-site abstracted from the opencasts.

Post Closure Phase
Groundwater Quality

Once the mining has ceased, ARD is likely to form given the unsaturated conditions in the opencasts 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.

The contaminant plumes emanating from the rehabilitated opencasts will have a cumulative impact on the groundwater quality as seen in the post mining simulations (**Figure 34 and Figure 35**). The migration of contaminated water from the opencasts has been simulated for 50 and 100 years after mine closure (i.e. it is assumed that all opencast have been rehabilitated and backfilled).

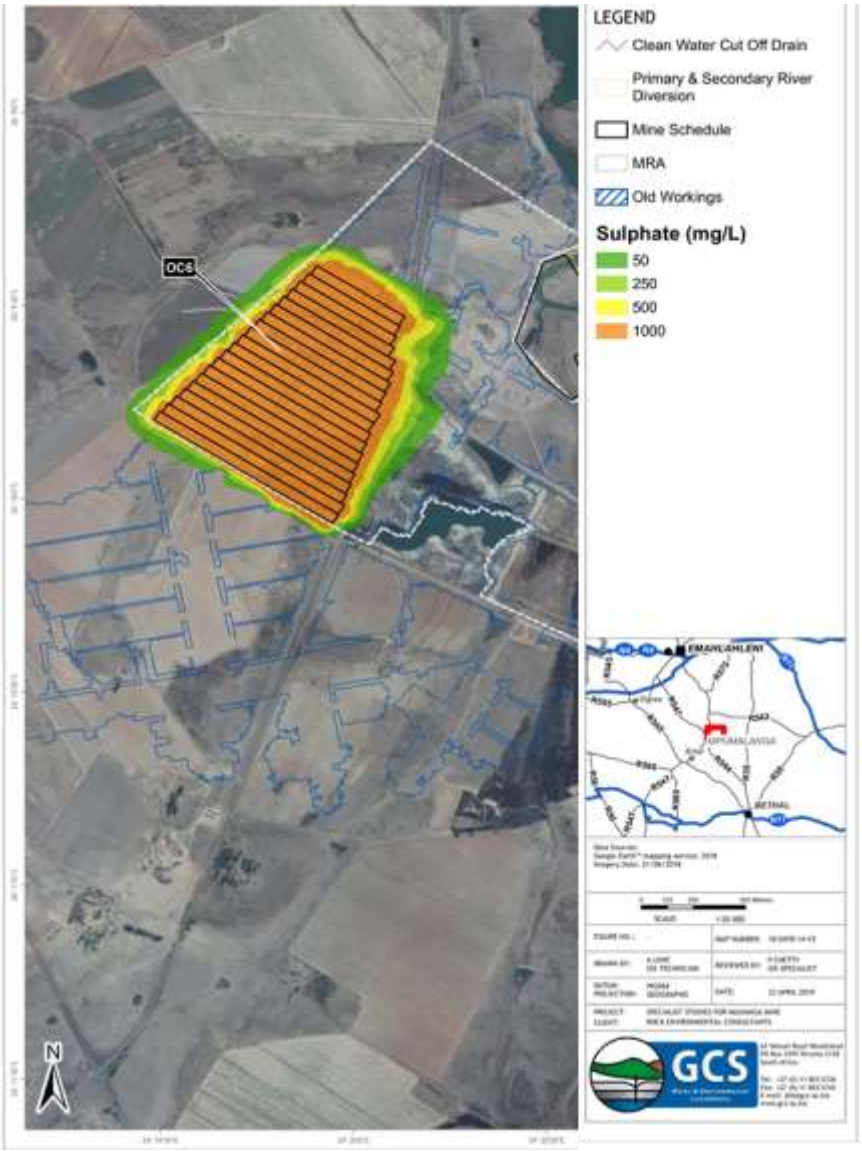

Figure 33: Simulated Sulphate contaminant plume – 50 years post closure

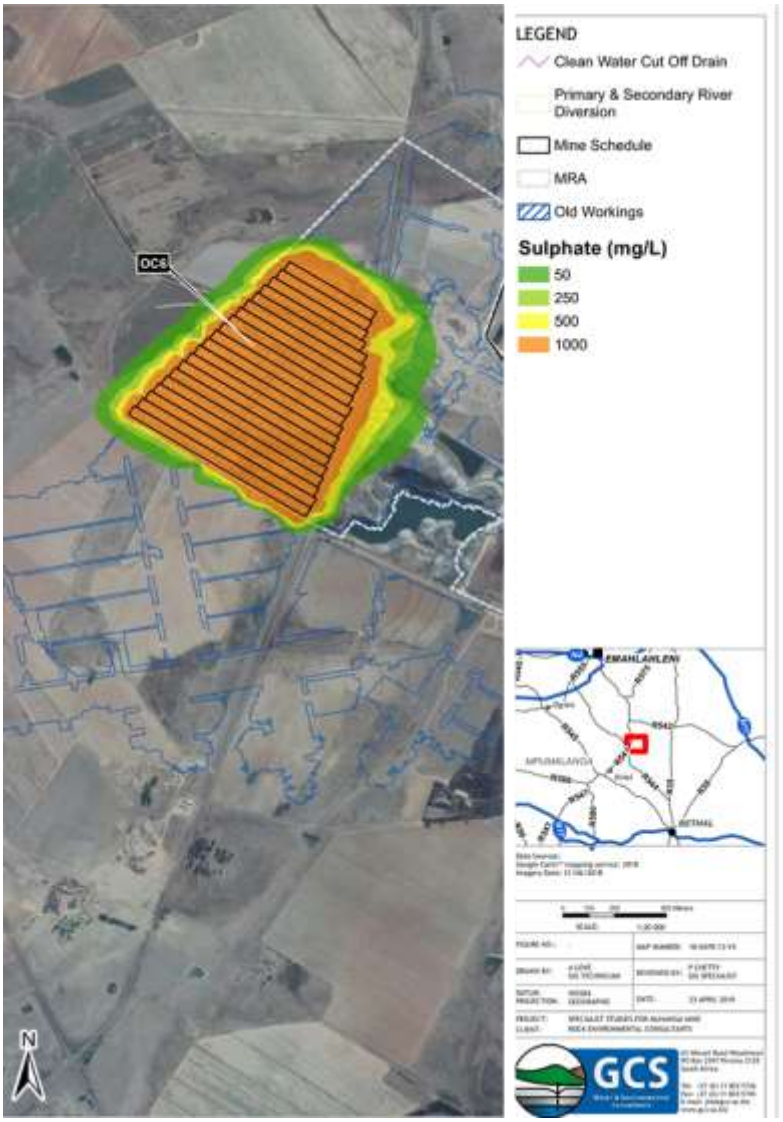

Figure 34: Simulated Sulphate contaminant plume – 100 years post closure

The contaminant plume emanating from Block OC6 will move in a north-north-westerly direction towards the Olifants River. The contaminant concentration is likely to increase over time as the plume develops. Based on the geochemical assessment the sulphate concentration is expected to increase from 500 to 3000 mg/l during the first 20 years post-closure and stabilise at 3000 mg/l for the period 20 – 100 years post-closure at the mining block.

No privately owned boreholes located in the Karoo lithologies are likely to be impacted based on the impact simulations. However shallow contaminated seepage may impact on the tributaries of the Olifants River, and water quality monitoring in the tributaries is proposed.

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.

Mine Water Decant

For opencast mining the decant point can be established as the lowest topographical point of the pit outline at the end of life of mine. When the active dewatering of the blocks has ceased, groundwater levels will rebound. As the backfilled opencasts flood, decant will occur when the groundwater level recovers to above the lowest surface elevation of the pit. This can occur long after the end of life of mine and is referred to as the time-to-decant.

Based on the current groundwater levels at the site, decant is only likely to occur in Block 1. This is because this opencast is found within a low lying area of the site which is in close proximity to a tributary of the Olifants River. For all other opencasts it is unlikely that decant will occur as groundwater levels in the area are significantly influenced by the historic mining activities at the site, and overall groundwater levels are subdued. Therefore, the probability of decant from the backfilled opencast Block OC6 is low, and moderate for Block 1.

9.3.7.7. Impacts of Freshwater resources

The specialist surface water report is available as **Appendix 9**. The specialist report included an assessment of existing clean and dirty water management infrastructure.

According to the Water Research Commission (WRC) study of the Water Resources of South Africa (WR 2012), the Vlaklaagte OC6 Project falls within the Olifants River Water Management Area (WMA 4) and more specifically within Quaternary Catchment B11B, with the following catchment characteristics:

- Mean Annual Precipitation (MAP) : 688mm
- Mean Annual Evaporation (MAE) : 1 550mm
- Mean Annual Runoff (MAR) : 23.65 mil m3
- Rain Zone : B1A
- Evaporation Zone : 4A

The confluence of the tributary and the Olifants River is on RE of the farm Clydesdale 483 IS.

The Vlaklaagte OC6 Project is in close proximity to the Olifants River and the western wetland system is a small tributary of the Olifants River and flows from south-west to north-east. The Western stream of the Vlaklaagte OC6 Project has a catchment area of ±6.69 km².

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The quantified impact that the Vlaklaagte Block OC6 Opencast will have on the Quaternary Catchment Yield is minimal during the operational phase. The opencast area will be rehabilitated to ensure a free draining profile as close as possible to pre-mining topography. This will result in no loss of surface run-off post-closure.

The major impacts associated with the whole project are as follows:

- Water quality

Water quality impacts are due to a change in natural conditions and enhancement of pollution from sources. On a regional scale, due to a decrease in runoff, the dilution of other pollution sources is affected. Therefore, a reduction in runoff could result in a more pronounced pollution effect.

- Catchment yield and hydrology

The affected stream will be affected due to a reduction in runoff. Polluted water that would naturally flow to the stream is contained on site.

The potential impacts could be grouped in the following:

- Stream Flow Reduction
- Sediment Transport/ erosion
- Unstable River Banks
- Removal of Vegetation
- Deterioration of Water Quality

Stream Flow Reduction
The collection, storage and re-use of affected water from activities like the access roads, haul roads and opencast mining will decrease the run-off towards the tributary of the Olifants River. This will result in the reduction of stream flow in these streams/rivers and the total catchment yield.

Sediment Transport/ erosion
Paved and roof areas result in an increase in the volume and the speed of surface runoff. This results in a higher potential of soil erosion which will lead to increase in the sedimentation of local streams and the resultant deterioration in the water quality.

Unstable River Banks
Clean water will be diverted around dirty areas and the opencast operation. Drains and channels will be constructed to handle the clean water run-off. If these water management structures are not designed and constructed correctly, it can cause damage to stream/river banks where high volumes of water enter streams/river.

Removal of Vegetation
Due to the clearing of land of vegetation and topsoil for opencast mining, construction purposes, construction of access roads and construction camps, contaminated runoff from these areas may increase resulting in an increase of the volume of contaminated water that needs to be handled on the Vlaklaagte OC6 project footprint.

Deterioration of Water Quality
The opencast area must be considered as a dirty catchment area and all surface runoff from this area will be contaminated. There is a high potential of water quality impact from this activity if water is not contained.

The mining and hauling of coal, increases the probability of localised accidental spillages of hydrocarbons (diesel, oils etc.) from earthmoving and construction equipment and transport of equipment and personnel to and from the site. The impact will be contained to the site only and will be of a short duration as spillages can usually be remediated immediately. Accidental spillage from areas seen as dirty area will have a negative impact on the water quality of the natural surface water and will be collected and pumped to the PCD at Vlaklaagte Mine.

Run-off water from haul roads and spoil stockpiles can increase the salinity levels of the stream/river and should be minimized, contained and re-use as far as possible.

9.3.7.8. Impact on Wetlands and Aquatic Ecology

The specialist reports on wetlands and aquatic ecology are available in **Appendix 11**.

According to the **Wetland Ecological Assessment**, there are four key ecological impacts on the wetlands that are anticipated to occur namely,

- Loss of wetland habitat and ecological structure;
- Changes to the sociocultural and service provision;
- Impacts on the hydrology and sediment balance of the wetlands; and
- Impacts on water quality.

Various activities and development aspects may lead to these impacts, however, provided that the mitigation hierarchy is followed, some impacts can be avoided or adequately minimised where avoidance is not feasible. The mitigation measures provided in the report have been developed with the mitigation hierarchy in mind, and the implementation and strict adherence to these measures will assist in minimising the significance of impacts on the receiving environment.

As some of the site clearing and preparation activities will occur within the wetlands, these activities are considered to be of '**Medium**' risk significance to these wetlands. However, construction of the surface infrastructure is considered to be of a relatively short duration which will take place at selected localities within the southern portion of the UCVB wetland (complete removal of vegetation and ripping of top soil) and within the 32m NEMA Zone of Regulation of the CVB wetland.

The clean water trench proposed to divert clean water into the CVB wetland was determined to also pose a '**Medium**' risk significance to the wetland, during the construction and operation thereof. This trench will affect the surface and subsurface recharge of the CVB wetland. It is recommended that the trench outlet be constructed with energy dissipating structures to slow down the velocity of water entering the wetland. The area surrounding the outlet should also be re-seeded with indigenous wetland vegetation in order to limit erosion within the wetland.

In applying the risk assessment, it was assumed that the mitigation hierarchy as advocated by the DEA et al. would be followed, i.e. the impacts would first be avoided. As the proposed open cast pit is located within the UCVB wetland, which will be lost, this is not feasible. Unless its practical and feasible to reinstate this wetland post-closure (to at least a PES Category D condition), rehabilitation (post-closure) or offsetting thereof is recommended. As only a small portion of the UCVB wetland would be lost, the residual impact is considered relatively small, however, a net loss of wetland resources is not avoidable (thus a '**High**' risk significance). If offsetting is considered, it is expected that the quantum of offsetting would be limited.

The open cast pit is also considered to cause alteration to the hydropedological flow drivers of the CVB wetland. Impacts to the subsurface flow (considered to be the main hydrological driver of this wetland), does pose a risk to the hydrological functioning to the CVB wetland. Mining within the wetland recharge soils should be reconsidered, as the CVB wetland is largely driven by subsurface flow, of which a portion thereof would be mined out as part of the open cast pit area. The overburden stockpile areas are also anticipated to hinder water infiltration or distribution across this wetland system (during all phases) due to the proposed overburden stockpile being located on soil resources defined as wetland recharge soils. If possible, the location of these stockpiles should be reconsidered. The overburden stockpiles should not be located on any soil considered to be of hydropedological importance to the wetlands, nor within the 100m GN704 Zone of Regulation of the wetlands.

Dewatering of the open cast pit is expected to occur. This poses a '**Medium**' risk significance on the hydrological regime of the remaining upstream portion of the UCVB wetland, by decreasing the level of the subsurface flow (draw down due to a cone of depression forming, and thus reduce the rate of recharge. Dewatering is, however, expected to occur at a very low rate, and thus, the likelihood of the impact of dewatering is expected to be of **Medium** risk significance.

It is the opinion of the freshwater ecologist that the proposed activities is not fatally flawed, since the loss of a portion of the UCVB wetland could be considered a low quantum of loss, in relation to the surrounding freshwater environment and considering its current ecological condition. Nevertheless, strict adherence to mitigation measures should be enforced, in order to ensure that the ecological integrity of the remaining freshwater environment is not further compromised.

9.3.7.9. Impacts on Air Quality

There is a number of activities/infrastructure associated with mining operations that have the potential to pollute the air. In the construction and decommissioning phases these activities are temporary in nature. The operational phase will present more long term activities and the closure phase will present final land forms that may have the potential to pollute the air through long term wind erosion.

The Vlaklaagte OC6 project is located in a region which is already exposed to a wide range of air pollution sources.

Dust is generated as a result of opencast mining operation, blasting and wind erosion from stockpiles and unpaved areas.

The potential impacts on air quality are discussed in **Table 35.**

9.3.7.10. Visual Impacts

The assessment of visual impacts takes the following issues into account: the pre-mining visual resource and the visibility, visual intrusion, sensitivity of viewing receptors, and visual exposure, associated with the mine.

The visual resource of the mine area is determined by considering landscape character, sense of place, and landscape quality. The pre-mining visual resource was considered to be of moderate to low value because the predominantly rural agricultural setting of the broader area

is compromised by power lines, roads, telephone lines and mining activities neighboring the project area.

Visibility refers to the extent to which people in the surrounding areas will see the project. The mine can be seen from all directions.

Visual intrusion refers to the magnitude of the intrusion that the mine has on existing views. The visual intrusion of the mine is high during the operational phase, which can be reduced to a low intrusion with successful implementation of the requirements for rehabilitation and closure.

Sensitivity of visual receptors refers to the fact that the visual impact varies according to the sensitivity of the receptors in the project area. Although various third parties currently remain within a relatively close proximity of the area no issues regarding visual impacts have been raised. It must therefore be concluded that the visual impact is not a sensitive issue.

Visual exposure is the extent to which infrastructure and activities will appear in various views. It follows that the closer the infrastructure and activities, the greater the visual exposure.

Table 33: Impact Assessment – Rehabilitation

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Topography										
Alteration of the topography due to mining and the proposed infrastructure (C, O, D, Cl).	N	Long Term	Site	High	Moderate	Definite	High	Moderate	Low	Disturbances to natural areas must be minimised.
Topography can be rehabilitated to resemble the pre-mining environment as close as possible (D, Cl).	P	Permanent	Site	High	N/A	Definite	Moderate	-	-	Rehabilitation must be conducted as stipulated in the closure and rehabilitation plan.
Soil, Land Use and Land Capability										
Topsoil contamination with hydrocarbons and chemical compounds from mechanical equipment (C, O, D).	N	Medium Term	Site	Moderate	Moderate	Probable	Low	Moderate	Very Low	Prevent any spills from occurring as far as possible.
Land use, land capability and agricultural potential can be restored to agreed post-mining use (D, Cl).	P	Permanent	Site	High	Moderate	Definite	High	-	-	No mitigation is possible during the construction and operational phase. Rehabilitation during decommissioning must be consulted as per approved closure and rehabilitation plan.
Flora										
Impact on the floral habitat integrity of the Low sensitivity area (C, O, D, Cl).	N	Medium Term	Local	Moderate	Moderate	Definite	Moderate	Moderate	Low	Any proposed mining surface infrastructure must be placed within low sensitivity areas as far as possible, as these areas are of low ecological importance.
Impact on the floral habitat integrity of the Wetland habitat (C, O, D, Cl).	N	Medium Term	Local	High	Moderate	Definite	High	Moderate	Low	Site offices, parking areas for mine vehicles, etc. should be confined to non-sensitive areas. Sensitive areas must be demarcated off and vehicles and personnel are not allowed to enter demarcated areas. No collection of floral SCC or medicinal floral species must be allowed by mining personnel. All Declared invasive species must be removed from the site. .

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Floral Species of Conservation Concern within the Transformed Habitat unit (C, O, D, Cl.).	N	Medium Term	Local	Low to Moderate	High	Probable	Low	High	Very Low	No collection of floral SCC or medicinal floral species must be allowed by construction personnel.
Floral Species of Conservation Concern within the Wetland habitat (C, O, D, Cl).	N	Medium Term	Regional	High	Moderate	Highly Probable	Moderate	Moderate	Low	Dumping of rubble and other waste in the sensitive areas should be prevented through fencing or other management measures. These areas must be properly managed throughout the lifespan of the project in terms of fire, eradication of exotics and monitoring for Red List species to ensure continuous biodiversity.
Fauna										
Impact on faunal habitat integrity within low sensitivity area (C, O, D, Cl).	N	Medium Term	Local	Moderate	Moderate	Definite	Moderate	Moderate	Low	Fires are strictly prohibited on site. Trapping, hunting or handling of fauna is strictly prohibited. Monitoring of rehabilitation should be conducted by a suitably qualified specialist.
Loss of wetland and riparian habitat and impact on ecological sensitive areas (C, O, D, Cl)	N	Medium Term	Local	High	Moderate to Low	Definite	High	Low	Moderate	Unless it's practical and feasible to reinstate the UCVB wetland post-closure (to at least a PES Category D), rehabilitation (post-closure) or offsetting thereof is recommended. If offsetting is considered, it is expected that the quantum of offsetting would be limited. Implement a monitoring programme to detect and prevent the pollution of soils, surface water and groundwater; Mining within the wetland recharge soils should be strongly reconsidered

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Faunal Species of Conservation Concern within the Wetland habitat (C, O).	N	Long Term	National	Very High	Moderate	Probable	High	Moderate	Moderate	If the giant bullfrog, coppery grass lizard or any herpetological species are encountered or exposed during the mining activities, they should be removed and relocated to natural areas in the vicinity. The wetlands, sensitive areas and buffers must be excluded from mining activities as far as possible.
Faunal Species of Conservation Concern within the Wetland habitat (D, Clo).	N	Medium Term	National	Very High	Moderate	Definite	High	Moderate	Moderate	Unless it's practical and feasible to reinstate the UCVB wetland post-closure (to at least a PES Category D), rehabilitation (post-closure) or offsetting thereof is recommended. If offsetting is considered, it is expected that the quantum of offsetting would be limited.
Groundwater										
Impacts on groundwater volumes due to active dewatering of the mining area (O).	N	Medium Term	Local	Low to Moderate	Moderate	Definite	Moderate	Low	Moderate	Keeping the workings dry is necessary for mining and mitigation is not possible. No users are currently likely to be affected. Long term groundwater level monitoring is proposed to compare measured groundwater levels to modelling results.
Recovery of groundwater level after dewatering stopped (D, Cl).	P	Permanent	Regional	High	Low	Definite	Very High	-	-	
Freshwater Resources										
Impacts on surface water and wetland volumes due to active dewatering of the mining area (C).	N	Medium Term	Local	Low to Moderate	Moderate	Definite	Moderate	Low	Moderate	Mining within the wetland recharge soils should be strongly reconsidered, as the wetland is largely driven by surface runoff and subsurface (interflow) flow.
Changes in natural surface water flow parameters.	N	Medium Term	Site	Moderate	Moderate	Definite	Moderate	Moderate	Low	Disturbances to natural areas must be minimized. Rehabilitation must be free draining.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Ancillary activities by construction personnel and employees during other phases (C, O, D).	N	Medium Term	Site	Moderate	High	Probable	Moderate	High	Very Low	Site offices, parking areas for mine vehicles, etc. should be confined to non-sensitive areas. Sensitive areas must be demarcated off and vehicles and personnel are not allowed to enter demarcated areas. Disturbances to natural areas must be minimized. Awareness training must be done with all employees and contractors.
Reduction in clean water runoff to the tributary of the Olifants river. (C, O).	N	Medium Term	Regional	Moderate	Moderate	Definite	High	Moderate	Low	Surface water management plan must be implemented and maintained as designed. Rehabilitation must be free draining.
Reduction in water quality due to the release of suspended solids	N	Medium Term	Local	Moderate	High	Probable	Low	High	Very Low	Ensure proper storm water management designs and systems are in place.
Potential invasion of alien/invasive species (C, O, D, Cl).	N	Permanent	Local	Moderate	High	Highly Probable	Moderate	High	Low	All disturbances caused by the construction activities must ensure that all recruited alien vegetation is eradicated, and that ongoing alien vegetation control is implemented.
Decant of contaminated water from the mine into the receiving environment (D, Cl).	N	Permanent	Local	High	Low	Probable	Very High	Moderate	Moderate	According to specialist chances of decant at OC6 is very low. It is very difficult to mitigate against AMD. Typically mitigation measures follow one of two routes (or a combination of both): 1) Limiting the amount of water entering the voids left by the mined out areas can be achieved by replacing spoils in such a manner as to be free-draining and preventing the collection and pooling of water on rehabilitated mined land. 2) Treating of decanting mine water to acceptable water quality levels can be achieved by the installation of a treatment plant. The necessity and feasibility of treating the decanting water should be investigated and treatment implemented if necessary.
Potential further habitat degradation (D, Cl).	N	Short Term	Site	Moderate	High	Probable	Low	High	Very Low	Rehabilitation must be conducted as stipulated in the closure and rehabilitation plan.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Air Quality										
Dust will be generated by rehabilitation activities. Exposed surfaces are susceptible to erosional forces including wind. Vehicles and machinery moving along roads will generate dust (D, Cl).	N	Temporary	Local	Moderate	High	Probable	Low	High	Very Low	Ensure site is restored to pre-mining conditions.
Health impacts due to fine particulate emissions and gaseous emissions.	N	Medium Term	Local	High	High	Probable	Low	Low	Low	Conduct dust suppression. Keep vehicles in a good condition. Do regular medical inspections on employees and contractors.
Noise and Blasting										
Noise generated by rehabilitation post-mining (D).	N	Short Term	Local	Low	High	Probable	Low	Moderate	Very Low	No blasting expected during decommissioning phase. Keep all operations to day time hours**.**
Visual										
Aesthetic value will increase once all infrastructure has been removed and rehabilitation has commenced (D, PC).	P	Permanent	Site	Low to Moderate	N/A	Definite	Moderate	-	-	-

It is not possible to always predict what activities will have an impact on the socio-economic environment or cultural/heritage aspects. As a result of this, the cultural and heritage as well as socio economic mitigation measures will not be discussed per activity but in general.

Socio-economic impacts:

Temporary employment during construction

Based on the current approach for construction at Vlaklaagte Block OC6 will take approximately 2 months. During this time, it is expected that workers will be temporarily employed for this purpose. This has an impact on wage earnings in the construction sector.

Security of employment and household income

Vlaklaagte employs approximately 110 employees and contractors. These employees will have security of employment and steady income for an additional +/- 9 years.

Expanded timeframe for generating of revenue and contributing to the GDP

The development will ensure that the generation of revenue is expanded by 6-8 years and the continued subsequent contribution to the Gross Domestic Product of the Local, Provincial and National Economy.

Impacts related to archaeological and cultural interest:

According to the Heritage Impact Assessment, no heritage resources (historical remains or graveyards) will be affected by the project as none was encountered. There is a possibility that graves or archeological artefacts are unearthed during construction, but this is considered unlikely.

Table 34: General Impacts – Heritage, Cultural and Socio-economic mitigation measures

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Archaeological and Cultural Interest										
Encountering graves/archeological artefacts unearthed during construction (C, O).	N	Permanent	Site	Moderate	Low	Definate	Very Low	Low	Very Low	Graves identified need to be re-located according to legislation. This will include detailed social consultation to try and contact any living descendants of the deceased in order to obtain their consent for the exhumations & relocations and obtaining permits from SAHRA, local, provincial and national authorities before the exhumation and relocation work can be conducted. If any graves or archeological artefacts are exposed during construction, SAHRA must be notified. All development activities must be stopped and an archeologist should be called in to determine proper mitigation measures.
Socio-economic										
Impacts on natural resources (C, O).	N	Long Term	Local	High	Low	Definite	High	Low	High	Ensure that complaints are dealt with and that compensation as well as mitigation is in place.
Loss of productive land and land use (C, O).	N	Long Term	Local	High	Low	Definite	High	High	Low	Surface area belong to the minerals right holder. Rehabilitation will be conducted to at least grazing status.
Increase in crime (C, O)	N	Medium Term	Local	High	High	Probable	Low	High	Very Low	Workers should be urged to recognize and report suspicious activity and signs of burglary and be informed of crime prevention measures that they themselves can take.
Creation of temporary employment during construction (C).	P	Short Term	Local	High	Low	Definite	High	-	-	Source the maximum number of employees from the local area for temporary and permanent job opportunities.
Creation of new employment opportunities and improved household income (O).	P	Medium Term	Local	High	Low	Definite	High	-	-	Implementation of Human Resource Development Programmes to develop skills of employees.
Generation of revenue and GDP contribution (O).	P	Medium Term	Local	High	Low	Definite	High	-	-	Optimize local involvement in on-mine business opportunities to maximize local economic growth.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Retrenchments during decommissioning and closure (D, PC).	N	Short Term	Regional	High	Low	Definite	High	Low	Moderate	Implement portable skills development programmes to enable retrenched employees to find alternative employment.
Human resource development and community investment (C, O).	P	Long Term	Local	High	Low	Highly Probable	High	-	-	Optimize local involvement in on-mine business opportunities to maximize local economic growth.
Local economic and infrastructure development (O).	P	Long Term	Local	High	Low	Highly Probable	High	-	-	Implement portable skills development programmes to enable retrenched employees to find alternative employment.

9.4. Cumulative and Latent Impacts

9.4.1. Climate

No impacts on climate can be directly attributed to the proposed development. However, activities of the proposed project have the means to contribute to climate change by its direct activities and by the usage of the products resulting of the mining activities (i.e. coal burning in power stations for generation of electricity). The challenge to lower greenhouse gasses is still ongoing and forms part of worldwide discussions such as at the United Nations' Annual Conference of the Parties (COP).

Table 35: Climate Cumulative Impacts

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
The proposed development has the means to contribute to climate change by its direct activities and indirect activities such as emissions contributing to greenhouses gases (C, O, Cl).	N	Long Term	International	Very High	Moderate	Definite	Very High	Moderate	Moderate	• Dust suppression must be conducted on-site. • Vehicles, machinery and equipment must be maintained.

9.4.2. Terrestrial Ecology

Possible latent impact was identified that may result from the proposed mine development.

Table 36: Terrestrial Cumulative Impacts

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Loss of floral and faunal habitat (C, O, D).	N	Long Term	Local	High	Moderate	Highly Probable	Moderate	Moderate	Low	Mitigation measures the same as Error! Reference source not found. for fauna and flora.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Loss of and altered floral and faunal species diversity (C, O, D).	N	Long Term	Local	High	Moderate	Highly Probable	Moderate	Moderate	Low	The wetlands, sensitive areas and buffers must be excluded from mining activities as far as possible. No roads or infrastructure must go through these sensitive areas.
Loss of preferred breeding and feeding habitat for faunal SCC (C, O, D).	N	Long Term	Local	High	Moderate	Highly Probable	Moderate	Moderate	Low	
Alien and invasive floral species proliferation (C, O, D, Cl).	N	Long Term	Local	High	Moderate	Highly Probable	Moderate	Moderate	Low	All Declared invasive species must be removed from the site.
Disturbed areas are unlikely to be rehabilitated to pre-development conditions of ecological functioning and loss of faunal habitat and species diversity will most likely be permanent (D, Cl).	N	Permanent	Local	Very High	Moderate	Probable	Moderate	Moderate	Low	Implement mitigation measures as per specialist reports and EMPr.

9.4.3. Freshwater Ecology

Possible latent impact was identified that may result from the proposed mine development.

Table 37: Freshwater Resources Cumulative Impacts

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
Encroachment of alien vegetation into the wetland, especially if desiccation of the wetland occurs as a result of mining activities, thus creating a favourable environment for terrestrial pioneer species (C, O, D).	N	Long Term	Local	Very High	Moderate	Highly Probable	Moderate	Moderate	Low	All Declared invasive species must be removed from the site.
The compaction of soils as a result of mining activities will continue to affect run-off patterns and thus the hydraulic regime of the surrounding area (C, O, D).	N	Long Term	Local	Very High	Moderate	Highly Probable	Moderate	Moderate	Low	The cleaned footprint should be deep cross-ripped to alleviate compaction caused by the stockpiles or dumps and related activities. Seeding with indigenous grasses must be done on all disturbed areas.
Decant from the mine may occur, especially as water levels may no longer be monitored in, and water will not be pumped from, underground mine workings post-closure. This decant poses a risk to the receiving environment due to the likely high levels of toxicants and low pH of the water being decanted (O, D, Cl).	N	Long Term	Local	Very High	Moderate	Highly Probable	Moderate	Moderate	Low	According to specialist chances of decant at OC6 is very low. It is very difficult to mitigate against AMD. Typically mitigation measures follow one of two routes (or a combination of both): 1) Limiting the amount of water entering the voids left by the mined out areas can be achieved by replacing spoils in such a manner as to be free-draining and preventing the collection and pooling of water on rehabilitated mined land. 2) Treating of decanting mine water to acceptable water quality levels can be achieved by the installation of a treatment plant. The necessity and feasibility of treating the decanting water should be investigated and treatment implemented if necessary.

Impact Phase: C = Construction, O = Operational, D = Decommissioning, Clo = Post-closure/Closure	Nature	Duration	Extent	Magnitude	Reversibility	Probability	Impact significance	Mitigation efficiency	Impact Significance (Post Mitigation)	Summary of Mitigation Measures
The potential for subsidence remains post-closure and, as discussed above, will significantly alter the geomorphology and thus the hydrology of the wetland if it were to occur (D, Cl).	N	Long Term	Local	Very High	Moderate	Highly Probable	Moderate	Moderate	Low	Monitoring of rehabilitation areas should be done for at least 3 years after closure to ensure possible subsidence is identified and rectified.
Disturbed areas are unlikely to be rehabilitated to pre-development conditions of ecological functioning and loss of faunal habitat and species diversity will most likely be permanent (D, Cl).	N	Permanent	Local	Very High	Moderate	Probable	Moderate	Moderate	Low	Implement mitigation measures as per specialist reports and EMPr.

9.5. Positive and Negative Impacts of the Proposed Activity and Alternatives

9.5.1. Proposed Activity

The nature of each impact, whether positive or negative, was stated as such in **Section 9**. As can be seen most of the activities are rated as negative impacts. These are related to the environmental sphere of the assessment. Some positive impacts were predicted in the socio-economic sphere and marked as such.

Unfortunately, the planned activities are of a destructive nature and hence, all the negative impacts associated with the project. However, with care and responsible actions taken by the applicant, the significance of the impacts could be largely reduced and brought down to acceptable standards. Where this is not the case, the mine will make provision to ensure alternative mitigation measures to reduce or manage the impact for it to become acceptable.

Sensitive environmental features have been considered with the site layout design and were avoided as far as practically possible.

9.5.2. Activity Alternatives. Motivation where no Alternative Sites were Considered and Statement Motivating the Alternative Development Location.

All alternatives were assessed as discussed in **Section 6** and associated sub-sections.

10. Environmental Impact Statement

10.1. Impacts on Geology

The Vlaklaagte Block OC6 Project will change the lithology of the areas where mining is done and where the shaft will be developed via opencast mining. There are no mitigation measures to prevent that.

10.2. Impacts on Topography

The infrastructure that will be constructed is likely to materially affect the local topography. The opencast mining section will also affect local topography. Effective rehabilitation can limit this impact.

10.3. Impacts on Soils, Land Use and Land Capability

Land capability and land use within the development footprint will permanently cease. Soil will be impacted by means of possible contamination, deterioration of quality as a result of disturbances, compaction, erosion and loss of fertility as a result of mining and associated activities.

10.4. Impacts on Terrestrial Biodiversity

The main impacts on the terrestrial biodiversity result from the construction activities, contamination of environments (via seepage, spills, leakages and decant), ineffective rehabilitation and increased human activity. The development will lead to loss of vegetation, disturbances/loss of faunal species and the proliferation of alien species. The impacts can be mitigated to acceptable levels with the implementation of proper mitigation measures.

10.5. Impacts on Freshwater Resources

The activities associated with the construction phase of the proposed Vlaklaagte Mine Block OC6 carry medium risks, whilst both the operational and post-closure phases trigger a high-risk significance, even with strict mitigation measures being taken into account. The only aspect, which, triggered a low risk significance, was the potential for further habitat degradation as a result of closure activities such as infilling, due to the fact that the habitat will already be severely degraded by closure stage.

The impact assessment identified several negative impacts as a result of the proposed opencast mining activity on the delineated wetland systems, which include:

- Increased sedimentation as a result of erosion;
- Soil and water contamination as a result of hydrocarbons spills and leaks;
- Loss of catchment yield;
- Subsidence;

- Loss of habitat and biodiversity;
- Changes in species composition;
- Altered flow regimes;
- Littering;
- Alien invasive species proliferation;
- Decant;
- Contamination of water resources as a result of AMD and seepage.

If the infrastructure were to be moved outside of the wetland boundary and at least the 32 m zone of regulation as required by the National Environmental Management Act (Act no. 107 of 1998), this would reduce the severity of many of the activities associated with the construction, operational and post-closure phases of the proposed Vlaklaagte Block OC6 mining area and thus will reduce the risk of these activities to the wetland.

It is the opinion of the freshwater ecologist that the application of the risk reduction rule to the risk assessment as defined in Regulation GN 509 is not considered justified due to the high ecological importance and sensitivity of the system. Furthermore, even if the risk reduction rule were applied, the operational and post-closure phases of the mine would still trigger a high-risk significance.

10.6. Impacts on Groundwater

The proposed developments could impact on the surrounding groundwater environment:

- Dewatering of the opencast and underground mine and the associated impacts on the surrounding groundwater environment;
- Contaminant migration away from the mining area;
- Impacts on surface water flow volumes due to mine dewatering and the possible reduction in baseflow contribution to the streams / wetlands;
- Impacts on the surface water quality due to contaminant migration away from the mining area (opencast and underground mine as well as surface infrastructure); and
- Potential decant from the mining area.

10.7. Impacts on Air Quality

Construction normally comprises a series of different operations including land clearing, topsoil removal, road grading, material loading and hauling, stockpiling, grading, bulldozing and compaction. All these activities will result in dust generation. Opencast operations will result in air quality deterioration by means of blasting, stockpiling, erosion, materials handling and vehicle use. Underground operations will deteriorate air quality by means of materials handling, conveying of coal and upcast ventilation.

10.8. Impacts related to Noise

There are no sensitive receptors indicated within 500 m from the nearest property boundary, the noise impact during daytime will therefore be none. No noise impact is predicted. Noise will also be generated during construction and during the movement of vehicles/machinery.

10.9. Socio-economic Impacts

Vlaklaagte Block OC6 will employ approximately 10 permanent employees (excluding central services) and 100 opencast mining contractor employees. A total of 100 employment opportunities will be created.

The project will cause negative impacts, which need to be compensated for, mitigated, and managed.

Although the proposed Vlaklaagte Block OC6 Project will have a potential negative impact on land use and land capability, the positive contributions from sustained employment and revenue generation will significantly outweigh these over a period of 9 years of operational life.

10.10. Impacts on Archaeological and Cultural Interest

The Phase I HIA study for the proposed Vlaklaagte Block OC6 Project revealed the following types and ranges of heritage resources as outlined in Section 3 of the National Heritage Resources Act (No 25 of 1999) in and near the Project Area, namely:

- A graveyard.

As these graves are older than 60 years of age they are protected by the National Heritage Resources Act as well and should be protected in situ if possible. If the grave site and graves on it cannot be avoided by the proposed mining development then they can be exhumed and relocated after all due processed have been followed. This will include detailed social consultation to try and contact any living descendants of the deceased in order to obtain their consent for the exhumations & relocations and obtaining permits from SAHRA, local, provincial and national authorities before the exhumation and relocation work can be conducted.

10.11. Visual Impacts

The activities will have a minimal impact on the aesthetic value of the area.

10.12. Impacts related to Health and Safety

The operation of machinery and heavy-duty vehicles both on-site and off-site may increase risks to personal health and safety. Occupational risks affect the workforce including, professionally trained, skilled and unskilled staff. Risks pertain specifically to the presence of heavy mechanised vehicles and excavation machinery which is aggravated by poor visibility as

a result of increased dust.

The air quality of the area surrounding the mine is likely to be reduced as a result of construction and continuous mining activities.

10.13. Community Perceptions and Responses

Community perceptions and concerns regarding the effects of the proposed project may in themselves constitute a social impact. If community members believe that the project will have a negative effect on their lives, regardless of whether or not this perception is justified, they are likely to be extremely resistant to the proposed development. This constitutes a source of social risk to the project, which should be addressed by allaying unjustified community fears regarding the project and instituting appropriate mitigation measures to address realistic concerns.

10.14. Community Development

Community development will be aligned with the approved SLP. It must be noted that most of the community development initiatives are positive, and hence, beneficial. It therefore also one of the main drivers to justify the needs of this project.

10.15. Final Site Map

The final site map is attached on larger scale in **Annexure 11**.

11. SUMMARY OF SPECIALIST STUDIES

The following table lists the specialist studies that were undertaken as part of this EIA process to assess the possible impacts that will be caused by the proposed activities at Vlaklaagte Block OC6. References have been included to some of the specialist recommendations and where these have been included in the EIAR.

Table 38: Summary of specialists' recommendations

Recommendation of specialist reports	Specialist recommendations included, amendments and reference where included in EIAR	Reference to the applicable section of the report where the specialist recommendations have been included
Terrestrial Ecological Habitat Integrity Assessment (Attached as Annexure 6)		
During the field investigation, five habitat units were encountered, with four been applicable to the Block OC6 area, namely the Mixed vegetation of farming and mining areas, Cultivated fields, *Eragrostis – Helichrysum* grassland and Wetland habitat units. The The Cultivated fields study unit does not have suitable habitat for any of the species that are considered threatened, or for those that are considered not threatened, but of conservation concern. The part of the Wetland Vegetation unit which forms the north eastern boundary of the site, and the *Eragrostis – Helichrysum* grassland study unit, are deemed sensitive. The rest of the study site comprises secondary grassland and farming and mining areas and is not deemed sensitive. No Red List, Orange List or protected species were recorded on the study site. The mammal study found that the proposed mining activities will affect the remaining mammals recorded from the site. However, it is argued that this is of little consequence since species richness has been seriously depleted and the *Crocidura* species are not endangered. The proposed mining on the terrestrial portion of the site will not impact much more on species richness or the depleted ecological functionality. The river- and wetland system is the main corridor for immigration of species and the integrity of the river system is non-negotiable. Hence from a mammal perspective the river and riparian zones is deemed to have a high sensitivity. The avifaunal study found that most of the Red Data avifaunal species that are likely to occur in the study area are only likely to move through the area on rare occasions due to the fragmented state and surrounding disturbed areas. Some of the habitat systems, however, offer suitable habitat for Red Data avifaunal species during optimal conditions. Most of the aquatic habitat with their buffers, as delineated by an aquatic specialist, should be regarded as highly sensitive and should be kept free from any development or any form of disturbance. Natural grassland along these wetland systems should also be regarded as sensitive to offer suitable foraging habitat for aquatic Red Data avifaunal species. Not only are these areas sensitive for Red Data avifaunal species but also for all other avifaunal species that occur or are likely to occur within the study area. The herpetological study found that the Olifants River, drainage lines and dams are sensitive ecological systems. A 100 metre buffer must be conserved next to the river. Measures will have to be taken to stop water pollution of the Olifants River, drainage lines and dams. The removal of	Recommendations of aspects that should receive adequate attention as stated in the specialist study were included in the EIAR/EMPr. No amendments were made as to what the specialist recommended.	Section 8.5 – EIAR Section 9 – EIAR Section 5 – EMPr Section 7 – EMPr

Recommendation of specialist reports	Specialist recommendations included, amendments and reference where included in EIAR	Reference to the applicable section of the report where the specialist recommendations have been included
exotic trees along the drainage lines will increase the water quality and the habitat of water-dependent herpetofauna. The Invertebrate study found that wetlands on site have habitat that is suitable for supporting breeding populations of the Marsh Sylph. Both sexes of this species of butterfly drink from flowers and the larvae feed on marsh grasses, and the High sensitivity areas comprises of grasses with ample flowering plants. Additionally, the combination of artificial water impounds with natural unchannelled valley bottom wetlands in both the High sensitivity areas, can assure the wetland areas to remain moist throughout most of the year and thereby sustaining M. meninx habitat. A 50-200m buffer has been allocated to the sensitive areas in the north and south-eastern parts of the study site. It is essential that the wetland areas and at least a 50m buffer be preserved to conserve the habitat of the *M. meninx*. It is the opinion of the ecologists that this study provides the relevant information required in order to implement IEM and to ensure that the best long-term use of the ecological resources in the study area will be made in support of the principle of sustainable development. It is recommended that, from a terrestrial ecological perspective, the proposed mining development be considered favorably provided that the recommended mitigation measures for the identified impacts are adhered to and provided that mining activities do not encroach upon the sensitive wetland habitat unit.		
Freshwater Resource Ecological Assessment (Attached as Annexure 8)		
A desktop study was conducted, in which possible watercourses were identified for on-site investigation, and relevant national and provincial databases were consulted. According to the NFEPA database (2011), only one natural wetland system is located within the northern portion of the study area, described as a floodplain. During the field assessment, two valley bottom wetlands were identified within the study area and are described below: • A channelled valley bottom (CVB) system is located within the northern portion of the study area. This wetland flows in a south-west to north-east direction and drains into the Olifants River, located outside of the study area; and • An unchannelled valley bottom (UCVB) wetland is located within the southeastern corner of the study area. This wetland seems to have historically formed part of a larger wetland system which ultimately drains into the Olifants River. Due to the recent mining activities (2012 - 2013), the downstream portion thereof (outside of the study area) has been cut off from the upstream portion. Nevertheless, the upstream portion within the study area is	Recommendations of aspects that should receive adequate attention as stated in the specialist study were included in the EIAR/EMPr. No amendments were made as to what the specialist recommended.	Section 8.7 – EIAR Section 9 – EIAR Section 5 – EMPr Section 7 – EMPr

Recommendation of specialist reports	Specialist recommendations included, amendments and reference where included in EIAR	Reference to the applicable section of the report where the specialist recommendations have been included
still hydrologically functional. Based on the findings of the freshwater resource assessment and the results of the risk assessment, it is the opinion of the ecologist that the proposed mining activities will pose a direct risk to the wetlands within the study area, specifically to the unchannelled valley bottom (UCVB) wetland of which a portion would be completely destroyed. Adherence to cogent, well-conceived and ecologically sensitive site development plans, and the mitigation measures provided in this report as well as general good construction practice, is essential if the significance of perceived impacts is to be reduced to acceptable levels on the remaining portion of the UCVB wetland (outside the study area) and on the channelled valley bottom (CVB) wetland within the study area. It is the opinion of the freshwater ecologist that the proposed activities are not fatally flawed, since the loss of a portion of the UCVB wetland could be considered a low quantum of loss, in relation to the surrounding freshwater environment and considering its Present Ecological State. Nevertheless, strict adherence to mitigation measures, as described in this report, should be enforced, in order to ensure that the ecological integrity of the remaining freshwater resources is not further compromised.		
Phase I Heritage Impact Assessment (Attached as Annexure 10)		
The Phase I heritage survey for Vlaklaagte Block OC6 revealed only one site were identified and recorded in the study area during the assessment namely: Site 1 - Graveyard Site 1 contains at least 4 graves with clear headstones and inscriptions while a further 2 graves (in the shape of depressions) could also be present on the site. The vegetation cover was very dense during the assessment, and there might therefore be more graves present. Graves always carry a High Significance Rating from a Cultural Heritage point of view and should be handled with care. As these graves are older than 60 years of age they are protected by the National Heritage Resources Act as well and should be protected in situ if possible. If the grave site and graves on it cannot be avoided by the proposed mining development then they can be exhumed and relocated after all due processed have been followed. This will include detailed social consultation to try and contact any living descendants of the deceased in order to obtain their consent for the exhumations & relocations and obtaining permits from SAHRA, local, provincial and national authorities before the exhumation and relocation work can be conducted.none of the of the types and ranges of heritage resources as outlined in Section 38 of	Recommendations of aspects that should receive adequate attention as stated in the specialist study were included in the EIAR/EMPr. No amendments were made as to what the specialist recommended.	Section 8.11 – EIAR Section 9 – EIAR Section 5 – EMPr Section 7 – EMPr

Recommendation of specialist reports	Specialist recommendations included, amendments and reference where included in EIAR	Reference to the applicable section of the report where the specialist recommendations have been included
the National Heritage Resources Act (No 25 of 1999). It should be noted that although all efforts are made to locate, identify and record all possible cultural heritage sites and features (including archaeological remains) there is always a possibility that some might have been missed as a result of grass cover and other factors. The subterranean nature of these resources (including low stone-packed or unmarked graves) should also be taken into consideration. Should any previously unknown or invisible sites, features or material be uncovered during any development actions then an expert should be contacted to investigate and provide recommendations on the way forward. If any more heritage resources of significance are exposed during the Vlaklaagte Block OC6 project, the SAHRA should be notified immediately, all development activities must be stopped and an archaeologist accredited with the Association for Southern African Professional Archaeologists (ASAPA) should be notified in order to determine appropriate mitigation measures for the discovered finds. This may include obtaining the necessary authorisation (permits) from the SAHRA to conduct the mitigation measures.		
Soil, Land Capability, Land Use and Hydropedology Assessment (Attached as Annexure 5)		
<u>Soils and land capability</u> Approximately 90.43% (71.28 ha) of the study area consists of moderately deep to deep, red and yellow brown, well to moderately well-drained, loamy sand to sandy clay loam soils, which were classed as arable land with moderate to high agricultural potential. No area were classified as grazing potential Approximately 9.57% (6.90 ha) of the study area consists of grey, imperfectly to poorly drained sandy soils situated in seepage zones, subject to seasonal and permanent wetness. These soil are dominated by the Longlands soil form of which the land capability was classed as wetland with low agricultural potential. <u>Pre-mining land use</u> Maize cover 76.49% (55.10 ha) of the study area. Grazing, which mostly consist of formerly grazed areas (prior to mining activates) covers 20.43% (14.72 ha). The remainder of the study area (10%)	Recommendations of aspects that should receive adequate attention as stated in the specialist study were included in the EIAR/EMPr. No amendments were made as to what the specialist recommended.	Section 8.4 – EIAR Section 9 – EIAR Section 5 – EMPr Section 7 – EMPr

Recommendation of specialist reports	Specialist recommendations included, amendments and reference where included in EIAR	Reference to the applicable section of the report where the specialist recommendations have been included
consist of the farmstead. Hydropedology Recharge and interflow hydropedological zones reside in the mining area. No responsive zones are present in the proposed mining area. Approximately 91% of the proposed mining site resides in a recharge. No lateral water flow pathways and shallow soil water occur within this zone and therefor mining within this zone will not reduce water quantities in nearby wetlands. Two interflow zones reside in the proposed mining area, consisting of a small section in the south as well as the north. The sandy E-horizon is the flow path of shallow, lateral moving soil water and forms the main mechanism of the wetland. Mining of the interflow zone will influence/reduce water quantities in downslope wetlands. However, the southern interflow zone is already destroyed by mining on the eastern side of the tar road. Any infrastructure or activities that disturb the flow path will impact negatively on the functionality and water quantities in the wetland and should be avoided. Impact assessment All identified impacts can be mitigated to acceptable levels.		
Geohydrological Investigation (Attached as Annexure 3)		
It is recommended that the project be authorized. The following recommendations are made: • Before mining commences an accurate determination of the extents of the underground voids should be undertaken; • Water levels in the underground voids should be monitored in close proximity to the proposed blocks; • Mitigation measures should be implemented to address the risk of groundwater inrushes due to barrier pillar failure or (partly) mining of these pillars; • Options of discharging, treating, storing and/or evaporation of the abstracted groundwater volumes should be studied to indicate the best practical way to deal with these groundwater volumes; • The actions in the groundwater monitoring plan should be adhered to;	Recommendations of aspects that should receive adequate attention as stated in the specialist study were included in the EIAR/EMPr. No amendments were made as to what the specialist recommended.	Section 8.8 – EIAR Section 9 – EIAR Section 5 – EMPr Section 7 – EMPr

Recommendation of specialist reports	Specialist recommendations included, amendments and reference where included in EIAR	Reference to the applicable section of the report where the specialist recommendations have been included
• If discard is backfilled in the opencasts, the discard must be backfilled in the deepest parts of the opencasts, below the decant level; • All mining areas should be flooded as soon as possible to restrict oxygen ingress into the backfill and lower sulphate levels in seepage; • The rate of water level recovery in the opencasts should be monitored. Stage curves should be developed which would aid in the management of closure phase; • Treatment options of decant, if needed, should be investigated for the post-closure phase; • Water quality sampling of the tributaries of the Olifants River is essential for the operational and post-closure phase; • The groundwater monitoring network should be expanded for the operational and post-closure phases at 2 Seam Pty Ltd Mine; To improve the model confidence level, the following is recommended: • Periodical, multiple water level monitoring measurements in the existing TNC underground mine; • Additional aquifer testing with multiple groundwater level monitoring in the weathered and fractured aquifers; and • Predicted and measured flows and head stages of the Olifants River in combination with interaction/connectivity testing between groundwater and surface water and the existing underground mine; • The effect of final pillar width between the existing and proposed developments on groundwater inflow into the opencasts; • The numerical model should be updated once every three years or after significant changes in mine schedules or plans by using the measured water ingress and water levels to re-calibrate and refine the impact predictive scenario. Updates to the model should be carried out more frequently if significant changes are made to the mine schedule or plan.		
Surface Water Management Plan (Attached as Annexure 2)		
The floodline analysis and preliminary designs so conducted have been done based on the planning data made available to us. The floodline delineation is based on the accuracy of the survey data that was obtained for this study and should be sufficient for basic planning purposes. Should, however, the Client require more accurate floodlines in support of detailed designs, it is recommended that these floodlines are checked and verified against more detailed survey data. The information supplied herewith is done in good faith to assist the Mine during the IWULA	Recommendations of aspects that should receive adequate attention as stated in the specialist study were included in the EIAR/EMPr. No amendments were made as to what the specialist recommended.	Section 7 - EIAR Section 8.6 – EIAR Section 5 – EMPr

Recommendation of specialist reports	Specialist recommendations included, amendments and reference where included in EIAR	Reference to the applicable section of the report where the specialist recommendations have been included
approval stage. OFC and JKC cannot be held liable for design concepts that are implemented without our involvement and final design approvals. It is WUL requirement that the design consultant who has submitted the concept designs as part of the IWUL application is also responsible for the detail design and final approval of the measures so approved by DWS.The professional team must therefore also be closely involved during the project implementation phase.		

12. PUBLIC PARTICIPATION

The Public Participation Process (PPP) is an important part of the EIA process, ensuring all project stakeholders are informed and have an opportunity to contribute to the process. The guidelines for engagement with project stakeholders and public participation during the EIA process are stipulated in Section 24 (5) and regulation 39-44 of GNR 982 of NEMA. The Public Participation Report is attached as **Annexure 13**.

12.1. Objectives of the Public Participation Process

The objectives of the Vlaklaagte Block OC6 PPP are to:

- Comply with national legislation;
- Establish and manage good relationships with key stakeholder groups;
- Encourage involvement and participation in the EIA process; and
- Obtain and utilise local knowledge.

Note that a single, consolidated stakeholder engagement process is undertaken for this project, adhering to the PPP requirements of all three acts, including the requirements from the following acts:

- the NEMA;
- the MPRDA; and
- the NWA.

A list of Interested and Affected Parties (I&APs), including landowners, lawful occupiers, and others that have registered as I&APs was compiled and updated throughout the process.

A PPP has been initiated as part of the Vlaklaagte Block OC6 development and is undertaken as per GNR 982 of NEMA.

As part of this PPP the details of the I&APs were registered and included in the database. Individuals and groups who requested to be registered as I&APs have been registered.

12.2. General Public Participation Approach

The PPP for the project has been undertaken in accordance with the NEMA Regulations and timeframes; however, the principles of the PPP are governed by the NEMA: EIR regulations. The aim of the PPP conducted throughout the entire Scoping and Environmental Impact Assessment (S&EIR) of the project was primarily to ensure that:

- Any potential stakeholders and I&APs are identified and consulted with;
- Information containing all relevant facts in respect of the application is made available to

identified stakeholders and I&APs;

- Participation is facilitated in such a manner that all potential stakeholders and I&APs are provided with a reasonable opportunity to comment on the application and identify issues to be addressed throughout the S&EIR process; and
- Comments received from stakeholders and I&APs is recorded.

The PPP activities undertaken during the S&EIR of the project are discussed in the sections below.

12.3. Stakeholder Engagement and Consultation Process

12.3.1. One-on-One Consultations

No one-on-one meetings were held up to now but if and when required meetings will be set up and conducted with relevant stakeholders.

12.3.2. Advertisements

A newspaper notice providing a brief description of the project and inviting I&APs to register on the stakeholder database was published in the Witbank News on 27 July 2018. Proof of advertisement is included **Annexure 5.**

12.3.3. On-Site Notices

On-site notices were placed at the entrance of the proposed Vlaklaagte Block OC6 Colliery as well as the R544 road (Ogies/Kriel road) on 27 July 2018. Photographs of the notices are attached as **Annexure 5**.

12.3.4. Background Information Document

The announcement of the proposed Vlaklaagte Block OC6 Colliery to these parties were conducted by distributing a Background Information Document (BID), a copy thereof is attached as **Annexure 5**. The BID was distributed to everyone listed in the current database by means of e-mails. The proof of distribution of the BID is attached as **Annexure 5.**

The identified I&APs were afforded the opportunity to gain background knowledge of the proposed project and to raise their initial concerns.

12.4. Registration of I&APs

12.4.1. Registration of I&APs of Vlaklaagte Block OC6

This is an on-going process and stakeholders are welcome to register throughout the process. The placement of site notices and advertising in the newspaper afforded the general public the opportunity to register as I&APs and to participate in the process. All landowners, lawful occupiers, municipal ward councillors and relevant organs of the state are contained in the I&AP register throughout the life of the project. However, as stipulated in the BID, other parties need to register to remain on the I&AP database.

After the conclusion of the announcement phase, the I&AP register was compiled and is attached as **Annexure 13.4**.

12.4.2. Notification of Relevant Authorities

The following government departments and non-governmental organisations (NGOs) were notified about the project during the PPP:

- DMR;
- DWS;
- MTPA;
- ELM;
- Department of Public Works, Road and Transport; and
- The Department of Agriculture, Forestry and Fisheries (DAFF).

12.5. Access and Opportunity to Comment

12.5.1. Availability of the Consultation Scoping Report

The consultation scoping report was made available for comments over a period of 30 days from 07 November 2018. It was made available via email to all I&APs in possession of an email address.

Hard copies of the consultation scoping report were issued to the relevant organs of the state including the following:

- Department of Mineral Resources;
- Department of Water and Sanitation;
- Department of Agriculture, Forestry and Fisheries;
- Mpumalanga Tourism and Parks Agency;
- Department of Public Works, Road and Transport; and
- eMalahleni Local Municipality.

Proof of inviting comments on the draft consultation scoping report are attached as **Annexure 13.7**. This annexure will also include proof that the hard copies of the consultation report were distributed to the parties indicated above.

I&APs were informed when the final scoping report was submitted and where a copy of that report can be obtained. The final scoping report was submitted to all the organs of the state as indicated above. Refer to **Annexure 13.8** for proof of submission.

12.5.2. Availability of the EIR and EMPr

The Consultation EIAR and EMPr will be made available in a similar manner as the Scoping Report and will be distributed for comments and inputs from 14 May 2019 to 12 June 2019. A

meeting will be held during this commenting period.

The notice of availability of the following will be communicated:

- Notice of availability through letters to all registered I&APs and an electronic copy will be sent to those who have the resources to receive the documents in that manner.
- Availability of hard copy reports at specified locations (similar as for the Scoping Report).
- Availability of CD's with reports at specified locations or on request.

12.5.3. Issues and Concerns Raised

Any comments received on the EIAR and EMPr were included in the Issue and Response Register (IRR). All the issues and responses made to date are included in **Table 3939**.

All issues/comments raised throughout the course of the project were (and will continue to be) recorded in an IRR (**Table 3939**) that will be updated on a regular basis and included as part of the Final EIAR. Hence, issues and concerns raised to date were noted in the IRR.

12.5.4. Public Review of the EIR and EMPr

The Consultation EIAR and EMPr will be made available in a similar manner as the Scoping Report and will be distributed for comments and inputs from 14 May 2019 to 12 June 2019. A meeting will be held during this commenting period.

Table 39: Issue and Response Register

Interested and Affected Parties (Marked with an X if consulted as required)		Date Comments Received	Issues raised	Response to issues raised
Mr. O. Mosito – South 32	X	05/11/2018 (email)	As you know we are always interested in the planned water management in the current mine workings, as well as the long-term water management plans. I take it that this information will be made available during the EIA phase. If this is not the case, then please let us know how this will be managed before and post mining phase.	You are registered as an I&AP and will be part of the consultation process going forward. The information mentioned will be shared with you.
			The added impacts to both quantity and quality as a result of proposed mining activities needs to be assessed and compared to the current baseline.	This forms part of the EIA process
			The added impacts to both quantity and quality as a result of proposed mining activities needs to be assessed and compared to the current baseline.	This forms part of the EIA process.
			A mention is made of the EMPr and an IWUL in the document, can you please share these documents with us please.	The information will be forwarded to you once the drafts have been finalised.

Interested and Affected Parties (Marked with an X if consulted as required)		Date Comments Received	Issues raised	Response to issues raised
Mr. J.J. Eksteen - MTPA	X	12 November 2017 (letter via email)	1. The sensitivity of the above farm portion was assessed according to the Mpumalange Biodiversity Sector Plan (MBSP; MTPA, 2014). This sensitivity was assessed in terms of a terrestrial and freshwater assessment. The scoping report mentions that the Mpumalanga C-Plan will be consulted during the S&EIAR process, we would like to recommend that hence forth that the MBSP be used for reference as it is the most up-to-date biodiversity plan of the province.	So noted and understood. Wording was changed in the final Scoping document. The specialist was notified of the procedures to be followed.
			2. The terrestrial assessment shows that there are no biodiversity sensitive areas within the proposed area.	Noted
			3. The freshwater assessment shows that there is an *ESA Wetland* within the proposed mining/prospecting area.	Noted.
			4. The title of the draft scoping report submitted is for "listed activities with mining right and/or sampling activities including trenching in cases of alluvial	The heading refer to the wording in the legislation and does not necessary includes all mentioned activities. There will be no alluvial diamond

Interested and Affected Parties (Marked with an X if consulted as required)		Date Comments Received	Issues raised	Response to issues raised
			diamond prospecting". However there is no mention in the scoping report of the proposed alluvial diamond prospecting, the wetland to be trenched, and the method description of the activity or any mitigation measures thereof.	prospecting but only mining of coal.
			5. The MTPA looks forward to receiving and reviewing the EIAR report once it is completed with all the specialist assessments and layout plan of all activities being applied for.	MTPA will be included in the consultation process going forward.
Winnie Mdluli	X	13 August 2018 (email)	I would like to register our company as an interested party to supply services in the project: Vlaklaagte Mining of Block OC6 as advertised on Witbank news.	Stakeholder registered. Information forwarded to client.
Radzilani Khuthadzo - DWS	X	6 February 2019 E mail - Comments scoping report	DRAFT SCOPING REPORT FOR THE PROPOSED MINING OF BLOCK OC6 VLAKLAAGTE MINE SUBMITTED FOR ENVIRONMENTAL AUTHORISATIONS IN TERMS OF THE NATIONAL ENVIRONMENTAL	

Interested and Affected Parties (Marked with an X if consulted as required)		Date Comments Received	Issues raised	Response to issues raised
			MANAGEMENT ACT, 1998 AND IN RESPECT OF LISTED ACTIVITIES THAT HAVE BEEN TRIGGERED BY APPLICATIONS IN TERMS OF THE MINERAL AND PETROLEUM REOSURCES DEVELOPMENT ACT, 2002 (MPRDA) (AS AMENDED) WITHIN NKANGALA DISTRICT MUNICIPALITY, MPUMALANGA PROVINCE. The Department acknowledges receipt of the above-mentioned report on 18 October 2018, prepared by Jack-K Consulting on behalf of 2 Seam (Pty) Ltd and the comments are as follows:	
			1. The Applicant shall conduct a preliminary legal assessment to identify all the water use activities associated with the proposed project that will require authorization by the Department of Water and Sanitation (DWS) and the applicant is hereby referred to Section 22(1) of the National Water Act, 1998 (Act 36 of 1998).	The Water Use License Application forms part of the process and the required water uses will be applied for.

Interested and Affected Parties (Marked with an X if consulted as required)		Date Comments Received	Issues raised	Response to issues raised
			2. Therefore any other water use related activities associated with this project that are not permissible as indicated on Section 22(1) of the National Water Act, 1998 (Act No. 36 of 1998(shall have to be authorised by the DWS prior to such water use activities taking place	The Water Use License Application forms part of the process and the required water uses will be applied for.
			3. **Flood-lines**: The applicant must note that no activities should occur within a 100m or within 1:100 year flood line (whichever is the greatest), unless authorised.	The Water Use License Application forms part of the process and the required water uses will be applied for.
			4. **Wetlands and Streams**: As illustrated on page 4 of the scoping report, figure 2: regional locality map, proposed mining activities is closer to the watercourse. The applicant should note that any activity that take place within 500m radius of a watercourse triggers Section 21(c) & (i) of the National Water Act, 1998 (Act No. 36 of 1998) and it should be authorised by the	The Water Use License Application forms part of the process and the required water uses will be applied for.

Interested and Affected Parties (Marked with an X if consulted as required)		Date Comments Received	Issues raised	Response to issues raised
			Department	
			5. **Pollution of underground and surface water:** It is indicated on page 4 of the scoping report that the water for dust suppression will be obtained from the current pollution control dam as well as water collected in the pit. The applicant should note that disposal of wastewater and removal of water found underground triggers section 21 (g) and (j) water uses in terms of the National Water Act, 1998 (Act No. 36 of 1998) and it should be authorised by the Department.	The Water Use License Application forms part of the process and the required water uses will be applied for.
			6. **Stormwater Management:** Stormwater management plan must be implemented to prevent pollution on run-off. The applicant must ensure that stormwater is diverted away from all the working areas and the stormwater leaving the construction areas must not be contaminated by any substance, whether that substance is a solid,	A Stormwater Management Plan was compiled and will be implemented.

Interested and Affected Parties (Marked with an X if consulted as required)		Date Comments Received	Issues raised	Response to issues raised
			liquid, vapour or any combination thereof. The soil must be stabilized in order to prevent the resulting wash downs into any water resource and where possible rehabilitation of the disturbed areas must be done concurrently with the construct ion activity.	
			7. **Sanitation:** It is not indicated on the scoping report which type of ablution will be utilized during construction and operation of the proposed mine. The Applicant shall ensure that no sanitary system is located within a horizontal distance of 100 metres from any watercourses. Therefore reasonable measures shall have to be taken to prevent the potential pollution of the ground and surface water resources due to the proposed onsite sanitation facilities.	The current French drain system will be replaced by a conservancy tank that will be emptied on a regular basis.
			8. **Storage facilities:** The Applicant shall ensure that fluids such as,	Diesel storage tanks will be bunded.

Interested and Affected Parties (Marked with an X if consulted as required)		Date Comments Received	Issues raised	Response to issues raised
			diesel and oil are stored and handled properly in a concrete or cement lined surface with berm walls to avoid any seepage into the groundwater resources and also ensure that the design of the storage area is such that any leakages or spillages can be contained.	
			9. **Waste:** The general waste generated on site shall be stored, handled and transported to a permitted waste disposal site in such a manner as not to cause any nuisance or secondary pollution. Furthermore, the hazardous waste shall be disposed of at waste disposal site permitted to handle such waste materials.	A certified contractor will be appointed to provide the required waste disposal equipment and all waste removal will be monitored and recorded.
			10. The Applicant is referred to Section 19(1) of the National Water Act, 1998 (Act No. 36 of 1998), and to report any pollution incidents originating from the proposed project to the Regional	Noted.

Interested and Affected Parties (Marked with an X if consulted as required)		Date Comments Received	Issues raised	Response to issues raised
			Office of the Department of Water and Sanitation within 24 hours.	
MC Morolo - Public Works, Roads & Transport	X	Posted letter dated 19 October 2018	ENVIRONMENTAL AUTHORIZATION FOR THE PROPOSED VLAKLAAGTE MINING RIGHTS This is with reference to your EIA, (MP) 30/5/1/2/3/2/1 (405) EM, dated 18 October 2018	
			1. We are at this stage unable to give comprehensive comments as we do not know as yet what the final route of the above will be	Noted
			2. We shall be able to give our comments after or towards the finalization of your E.I.A, which will be on all affected Provincial Roads under the jurisdiction of Mpumalanga Department of Public Works, Roads and Transport.	Noted

13. DESCRIPTION OF ANY ASSUMPTIONS, UNCERTAINTIES AND GAPS IN KNOWLEDGE

○ Adequacy of Predictive Methods Utilised

Predictive methods were used to establish the potential impact on groundwater.

Groundwater model

The numerical model for the project was constructed using GMS 10.1.3, 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.

○ Assumptions and Limitations

According to the other specialists the underlying assumptions used in their studies are sufficiently adequate.

Freshwater resource Assessment

The following assumptions and limitations are applicable to this report:

- The determination of the watercourse boundaries and the assessment thereof is confined to the watercourses within the study area. All watercourses identified within 500m of the study area were delineated in fulfilment of Regulation GN509 of the NWA using desktop methods; however, these resources were not assessed individually or in great detail;
- The watercourse delineations as presented in this report is regarded as the best estimate of the watercourse boundaries, based on the site conditions present at the time of assessment. Global Positioning System (GPS) technology is inherently inaccurate, and some inaccuracies due to the use of handheld GPS instrumentation may occur. If more accurate assessments are required, the watercourses will need to be surveyed and pegged according to surveying principles;
- The use of vegetation as an indicator of the temporary zone boundary of watercourses was limited, due to the season in which the field assessment was undertaken (July

2018), almost all of the vegetation present was in a dormancy period, with no inflorescences or flowers to aid with the identification of such species;

- Freshwater and terrestrial zones create transitional areas where an ecotone is formed as vegetation species change from terrestrial to obligate/facultative species. Within this transition zone, some variation of opinion on the watercourse boundary may occur. However, if the DWAF (2008) method is followed, all assessors should get largely similar results; and
- With ecology being dynamic and complex, certain aspects (some of which may be important) may have been overlooked. However, it is expected that the proposed development activities have been accurately assessed and considered, based on the field observations and monitoring data in terms of watercourse ecology.

Hydropedological Assessment

Hydropedological science and research is rapidly evolving and there are currently no standard methods to assess and/or model the recharge capacity of soils, as a result, the findings of this assessment are therefore a mix of qualitative and quantitative results and based on the specialist's opinion and experience with the hydrological properties of the identified soil types. Sampling by definition means that not all areas are assessed, and therefore some aspects of soil and hydropedological characteristics may have been overlooked in this assessment. However, it is the opinion of the professional study team that this assessment was carried out with sufficient sampling and in sufficient detail to enable the proponent, the Environmental Assessment Practitioner (EAP) and the regulating authorities to make an informed decision regarding the proposed activity.

The effects climate change dynamics were not considered as part this assessment; however, it is acknowledged that this might exacerbate the anticipated reduction in water inputs and the resultant hydrological function of the remaining wetlands beyond the extent of the proposed mining project.

Soil, Land Capability, Land Use and Hydropedology Assessment

The location and extent of the proposed mining extension area was obtained from Jaco-K via email in electronic kmz file format named "INSA Solid Blocks.kmz" and it is accepted that this areas will cover the final mining footprint. No information of any planned infrastructure was obtained.

Terrestrial Ecological Assessments

Flora Assessment

Sufficient information was received and sufficient rain had fallen to accomplish the survey that was done during optimum growing conditions.

Mammals an Habitat Assessment

The Galago Environmental team has sufficient experience and ample access to information sources to confidently compile lists of biota such as presented herein to support conclusions and suggested mitigation measures based on a site visit. In instances where doubt exists, a species is assumed to be a possible occupant (viz. Suncus species); -this approach renders the conclusions to be robust. In instances where the possible occurrence has significant ecological implications, an intensive survey is recommended. In view of the latter, it is highly unlikely whether an intensive survey to augment this site visit will add significantly to the data base, and the additional costs are unlikely to warrant the effort.

Even though every care is taken to ensure the accuracy of this report, environmental assessment studies are limited in scope, time and budget. Discussions and proposed mitigations are to some extent made on reasonable and informed assumptions built on bone fide information sources, as well as deductive reasoning. Deriving a 100% factual report based on field collecting and observations can only be done over several years and seasons to account for fluctuating environmental conditions and migrations. Since environmental impact studies deal with dynamic natural systems additional information may come to light at a later stage. Galago Environmental can thus not accept responsibility for conclusions and mitigation measures made in good faith based on own databases or on the information provided at the time of the directive. This report should therefore be viewed and acted upon with these limitations in mind.

Avifaunal Habitat Assessment

The Galago Environmental team has appropriate training and registration, as well as extensive practical experience and access to wide-ranging data bases to consider the derived species lists with high limits of accuracy. In this instance, the biodiversity of all alignments has to a greater or lesser extent been jeopardized, which renders the need for field surveys unnecessary. In instances where uncertainty exists regarding the presence of a species it is listed as a potential occupant, which renders the suggested mitigation measures and conclusions more robust.

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on field collecting and observations can only be done over several years and seasons to account for fluctuating environmental conditions and migrations. Since environmental impact studies deal with dynamic natural systems, additional information may come to light at a later stage. Galago Environmental can thus not accept responsibility for conclusions and mitigation measures made in good faith based on own databases or on the information provided at the time of the directive. This report should therefore be viewed and acted upon with these limitations in mind.

The site surveys were done during several hours in one day and not on a regular basis during several seasons over a period of time: thus the avifaunal biodiversity could change slightly as more species are confirmed from the various habitat systems within the study area. The time of the day and weather condition also has an effect on the number of species recorded in the study area during the site visit. The general assessment of species rests mainly on the 1987 atlas for birds of the then-Transvaal (Tarboton et al. 1987), the 1997 SABAP1 atlas data (Harrison et al. 1997) and the current data for the SABAP2 period for comparison, so any limitations in any of those studies will by implication also affect this survey and its conclusions.

The general assessment of species rests mainly on the 1997 SABAP1 atlas data (Harrison et al. 1997) for comparison with the current SABAP2 atlas, so any limitations in either of those studies will by implication also affect this survey and conclusions.

Furthermore the number of atlas cards received and the diversity of habitat systems surveyed for avifaunal species within a q.d.g.c. or pentad, or lack thereof, could also have an effect on the avifaunal diversity that could potentially occur on the study site. A totals of 86 atlas cards were received for the 2629AB q.d.g.c. over the SABAP1 project period and to date, 43 cards for the entire 2629AB q.d.g.c. over the current SABAP2 project period and 7 and 5 cards for the 2605_2920 and 2610_2920 pentads respectively (in which the study site is situated) since 1 July 2007.

Herpetofaunal Habitat Assessment

Galago Biodiversity and Aquatic Specialists are committed to the conservation of biodiversity but concomitantly recognise the need for economic development. Even though we appreciate the opportunity to learn through the processes of constructive criticism and debate, we reserve the right to form and hold our own opinions and therefore will not willingly submit to the interest of other parties or change statements to appease them.

Even though every care is taken to ensure the accuracy of this report, environmental assessment studies are limited in scope, time and budget. To some extent, conclusions are drawn and proposed mitigation measures suggested based on reasonable and informed

assumptions built on bone fide information sources, as well as deductive reasoning. Deriving a 100% factual report based on field collecting and observations can only be done over several years and seasons to account for fluctuating environmental conditions and migrations. Since environmental impact studies deal with dynamic natural systems, additional information may come to light at a later stage. Galago Biodiversity and Aquatic Specialists can therefore not accept responsibility for conclusions drawn and mitigation measures suggested in good faith based on own databases or on the information provided at the time of the directive. This report should therefore be viewed and acted upon with these limitations in mind.

Heritage Impact Assessment

It should be noted that although all efforts are made to cover a total area during any assessment and therefore to identify all possible sites or features of cultural (archaeological and/or historical) heritage origin and significance, that there is always the possibility of something being missed. This will include low stone-packed or unmarked graves. This aspect should be kept in mind when development work commences and if any sites (including graves) are identified then an expert should be called in to investigate and recommend on the best way forward.

14. REASONED OPINIONS TO WHETHER THE PROPOSED ACTIVITY SHOULD OR SHOULD NOT BE AUTHORISED

14.1. Reasons why the activity should be authorized or not

This application should be authorised based on the following:

- Coal can potentially be supplied to Eskom that generates electricity for use in South Africa;
- Temporary employment opportunities during the construction phase;
- 200 new employment opportunities will be created during the LOM;
- All aspects have been closely considered and investments have been made to have top specialists working on the development of this project;
- There will be benefits derived from taxes and royalties that can be utilised by the South African Government;
- Impacts on the bio-physical and socio-economic environments can be limited with the effective implementation of the proposed mitigation measures summarized in the EMPr;
- Water management infrastructure was designed in line with the requirements of GN

704, and if managed accordingly, a limited impact on the surface water resources can be expected; and

- A Closure Plan has been developed to provide for an acceptable post-activity land use strategy.

The objective of the proposed development should be to establish and manage a balance between the benefits created and the mitigation, management and compensation for losses. If Authorities, in reviewing the report, make an affirmative decision, continuous management, monitoring and evaluation of socio-economic and environmental impacts must be implemented to ensure the effectiveness of the mitigation measures and management strategies. Anglo must also establish continuous communication channels with the affected parties through the management plans proposed.

14.2. Conditions that must be included in the authorisation

14.2.1. Specific conditions that need to be included in the compilation and approval of the EMPR

The EMPr was compiled from a holistic view perspective of the project. Management objectives, proposed mitigation measures, and monitoring, reporting and auditing requirements have been included in the EMPr. Hence, if this project is approved, it is important that the EMPr be implemented and approved.

In addition, it is important that an Environmental Control Officer (ECO) is present at the site during the Construction Phase of the project, and that regular reporting is done accordingly. An Environmental Officer should also be actively involved throughout the lifespan of the project to ensure that the EMPr is effectively implemented to keep the impacts of this project as low as possible.

14.3. Rehabilitation Requirements

The EMPr contains management objectives, proposed mitigation measures, and monitoring, reporting and auditing requirements that is relevant to the rehabilitation requirements and the closure phase of the project. In addition, a Closure Plan was also developed that will be utilised for the project (refer to *Annexure 3* of the **EMPr**). Hence, if the activities are approved, it is important that the EMPr be implemented as approved, as well as the Closure Plan.

15. PERIOD OF WHICH THE ENVIRONMENTAL AUTHORISATION IS REQUIRED

The Environmental Authorisation is required for the period equal to the operational period of the mine (+/- 9 years), as well as an additional 3-5 years for decommissioning and closure purposes.

16. FINANCIAL PROVISION

Refer to *Section 6* in the **EMPr** for details related to the financial provision of the Vlaklaagte mine Block OC6 project.

17. OTHER INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

17.1. Compliance with the provisions of sections 24(4)(a) and (b) read with section 24 (3) (a) and (7) of NEMA

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

Refer to **Section 8.13**.

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

Refer to **Section 8.11.**

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

This report adheres to the requirements stipulated in the NEMA and the recently published EIA Regulations 2014. The NEMA Appendix 2 guidelines were used as framework.

18. 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. ☒

Jaco-K Consulting (Pty) Ltd
Company

_____
Date

_____
Signature of EAP