Environmental and Engineering Consultants

ENVIRONMENTAL MANAGEMENT ASSISTANCE (PTY) LTD

CLIMATE CHANGE IMPACT ASSESSMENT - BASELINE

BCR COAL (PTY) LTD – VLAKFONTEIN OPENCAST MINE

AUGUST 2022

Rayten Project Number: SCI-EMA-222714

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REVISION AND APPROVAL PAGE

Revision Number	**2.0**		
Rayten Project Number	**SCI-EMA-222714**		
Report Title	**ENVIRONMENTAL MANAGEMENT ASSISTANCE (PTY) LTD** **CLIMATE CHANGE IMPACT ASSESSMENT - BASELINE** **BCR Coal (PTY) LTD – Vlakfontein Opencast Mine**		
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Report Submission Summary		
Report Revision Number	1.0	29 July 2022
Report Revision Number	2.0	05 August 2022

DISCLAIMER

Information contained in this report was based on the last information received from Environmental Management Assistance and BCR Coal (Pty) Ltd during July 2022. Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by Rayten Engineering (Pty) Ltd for incomplete or inaccurate data supplied by others. We are aware of the fact that there might have been changes since this report was submitted, however this report and its findings is based on the last information received from the client during July 2022. To the best of our knowledge the assumptions and findings are correct at the time of submission of the specialist report. Should any of the assumptions or findings prove to be incorrect subsequent to submission of the report we as the specialist cannot be held accountable. Note that although every effort has been made by Rayten Engineering (Pty) Ltd to obtain the correct information and to carry out an appropriate, independent, impartial and competent study, Rayten Engineering (Pty) Ltd cannot be held liable for any incident which directly or indirectly relates to the work in this document and which may have an effect on the client or on any other third party.

CONFIDENTIALITY

DECLARATION

PROJECT TITLE

BCR Coal (Pty) Ltd – Vlakfontein Opencast Mine, climate change impact assessment baseline report.

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Name of Registration Body: South African Council for Natural Scientific Professions

Professional Registration No: 1251081 (Claire Taylor)

Declaration of accuracy of information provided:

Climate change impact assessment baseline report:

I, Claire Taylor, declare that – general declaration

I am independent of the applicant;
I have the necessary expertise to conduct the assessments required for the report; and
I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
I will disclose to the applicant and the relevant authorities all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application.
The information provided in this climate change impact assessment baseline report is, to the best of my knowledge, in all respects factually true and correct. I am aware that the supply of false or misleading information to an authority is a criminal offence in terms of section 51(1)(g) of the NEM:AQA (No.39 of 2004).

Signature of the specialist:

Rayten Engineering Solutions (Pty) Ltd

Name of company (if applicable):

Date: 16 August 2022

EXECUTIVE SUMMARY

Rayten Engineering Solutions (Pty) Ltd (hereafter referred to as “Rayten”) was appointed by Environmental Management Assistance (Pty) Ltd to compile a climate change impact assessment (CCIA) baseline report for the proposed BCR Coal (Pty) Ltd – Vlakfontein Opencast Mine (hereafter referred to as “Vlakfontein Opencast Mine” or “the activity”), located on portion (Ptn.) 2, Ptn 11 and Ptn 21 of farm Vlakfontein 108 IT, Ptn 1, 7, 14, and 12 of farm Welgelegen 107 107 IT, Msukaligwa Municipality, Mpumalanga Province, South Africa. BCR Coal has applied for a mining right in terms of the Mineral and Petroleum Resources Development Act, 2002 (No. 28 of 2002), as amended.

As part of the mining right application, a scoping and environmental impact assessment process must be undertaken. A climate impact assessment was identified as a requirement in the screening report for inclusion the environmental impact assessment (EIA) report. This baseline climate change impact report has been compiled as part of the scoping process for the EIA.

The terms of reference and scope of work for this CCIA baseline report are to describe the existing status of the biophysical environmental, in terms of climate, that will be affected by the mining activity, as well as to provide a list and description of potential impacts identified on the biophysical environment in terms of climate. Greenhouse gases (GHGs) the proposed mine could emit include carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). However, a GHG emissions inventory and carbon footprint of the mining activity was not undertaken for the purpose of this baseline report. Additionally, the effects that climate change could have on the project will also be assessed in the full assessment phase.

The main conclusions based on the information obtained during the Baseline Assessment can be summarised as follows:

There are proposed mining operations to be undertaken at the site. The following activities are expected to be key sources of GHG emissions at the mine:

- Blasting (fugitive emissions resulting from the combustion of a complete explosives mix)
- Truck and mining equipment emissions from combustion of fuels
- Other combustion processes (e.g., gas, diesel & oil combustion)
- Transportation of the ore to the wash plant
- Septic/chemical ablution facilities for containing sewage
- Electricity consumption from the workshop, administrative office, weighbridge, and additional lighting of stockpile areas (supplied by the generator)
- Construction of required infrastructure onsite

Other possible indirect GHG emission sources, include, but are not limited to:

- Employee commute and business travel
- Transportation of the pump the septic tank/ablution facilities and waste treatment offsite.
- Transportation of general and hazardous waste offsite

Additionally, the clearing of land during the construction and operational phase will result in the loss of a carbon sequestration source. Furthermore, when terrestrial carbon sinks are cleared, stored carbon is released into the atmosphere. Thus, the clearing of land will not only result in a potential loss of a carbon sequestration source, but also the release of stored carbon dioxide.

The life of mine does indicate that the land will be rehabilitated and the void filled, however, the carbon sequestration capacity will take time get back to its full capacity preclearance.

A full impact assessment is required in the EIA phase in order to gain an undertraining of the potential impacts of the proposed activity on the climate.

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LIST OF ABBREVIATIONS

CCIA	Climate Change Impact Assessment
CH_4	Methane
CO_2	Carbon dioxide
DEA	Department of Environmental Affairs (now the DFFE)
DFFE	Department of Forestry, Fisheries and the Environment
EIA	Environmental Impact Assessment
Gg	Gigagrams
GHG	Greenhouse Gas
IPCC	Intergovernmental Panel on Climate Change
LoM	Life of Mine
MW	Megawatt
N_2O	Nitrous oxide
NAEIS	National Atmospheric Emissions Inventory System
NEM:AQA	National Environmental Management: Air Quality Act
PGMs	Platinum Group Metals
ROM	Run-of-Mine
SWDS	Solid Waste Disposal Sites
UNFCCC	United Nations Framework Convention on Climate Change

TERMINOLOGY

Climate Change	Changes in regional climate characteristics, including temperature, humidity, rainfall, wind, and severe weather events, which also have economic and social dimensions.
Greenhouse Gas	Greenhouse gases are gases that absorb and emit radiant energy within the thermal infrared range, thus, causing the greenhouse gas effect, where the earth's atmosphere traps solar radiation.
Upstream Emissions	Refers to the emissions originating from the suppliers to the organisation
Downstream Emissions	Refers to the emissions originating from the organisation's customers

1. INTRODUCTION

Rayten Engineering Solutions (Pty) Ltd (hereafter referred to as "Rayten") was appointed by Environmental Management Assistance (Pty) Ltd (EMA) to compile a CCIA baseline report for the proposed BCR Coal (Pty) Ltd – Vlakfontein Opencast Mine (hereafter referred to as "Vlakfontein Opencast Mine"), located on Portion (Ptn.) 2, Ptn 11 and Ptn 21 of farm Vlakfontein 108 IT, Ptn 1, 7, 14, and 12 of farm Welgelegen 107 107 IT, Msukaligwa Municipality, Mpumalanga Province, South Africa (refer to Figure 1.1). BCR Coal has applied for a mining right in terms of the Mineral and Petroleum Resources Development Act, 2002 (No. 28 of 2002), as amended. As part of the mining right application, a scoping and environmental impact assessment process must be undertaken. A climate impact assessment was identified as a requirement in the screening report for inclusion the environmental impact assessment (EIA) report. This baseline climate change impact report has been compiled as part of the scoping process for the EIA.

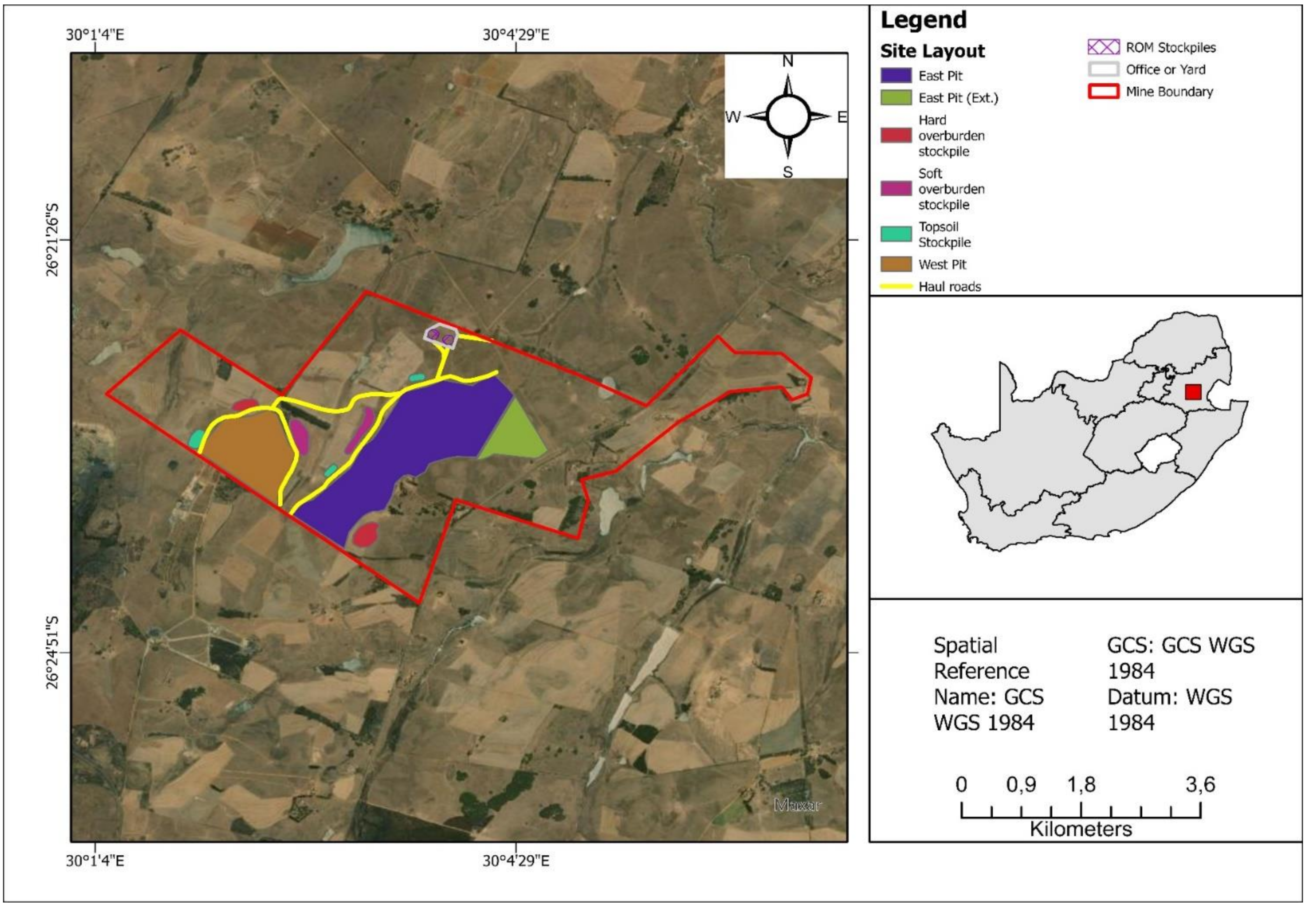


Figure 1.1: Site locality of Vlakfontein Opencast Mine

The main objective of the CCIA baseline report is to provide the baseline of the current conditions at the location prior to the proposed mining activity to inform the scoping report. It aims to provide a background understanding of the potential contribution of the project towards climate change, through the emission of greenhouse gases (GHGs). GHGs the proposed mine could emit include carbon dioxide (CO_2), methane (CH_4) and nitrous Oxide (N_2O). Additionally, the effects that climate change could have on the project will also be assessed in the EIA phase.

The terms of reference and scope of work for this CCIA baseline report are to describe the existing status of the biophysical environmental, in terms of climate, that will be affected by the mining activity, as well as to provide a list and description of potential impacts identified on the biophysical environment in terms of climate.

A GHG emissions inventory and carbon footprint of the mining activity has not been undertaken yet, as this will form part of the EIA phase. With the mining being undertaken by means of an open cast mining method, the following activities, which are expected to result in direct GHG emissions, will be undertaken:

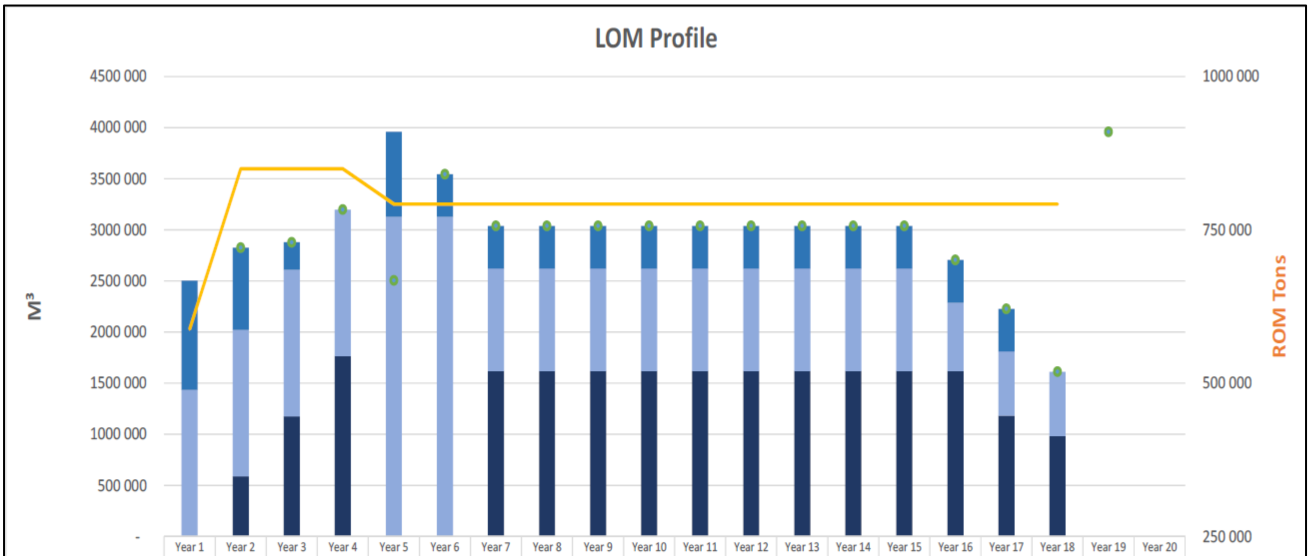
- Construction of support facilities and infrastructure
- Blasting to break down the hard overburden
- Blasting of the ore
- Transport of the ore to various stockpiles as well as to the wash plant
- Waste management
- Septic tank/ablution facilities for sewage waste
- Clearing of land to access the ore
- Combustion of fuels in mine vehicles, machinery and generators, etc.

Indirect GHG emissions will result from the use of grid obtained electricity, heat or steam consumed onsite. Other indirect GHG emissions may occur, such as from employee commute and business travel, and the transportation of goods and services to and from the mine, when not controlled by the mining company itself.

Therefore, assessment of impacts from the mining activity should not only focus on direct GHG emissions, but also on upstream and downstream emissions through the supply chain. MM5 meteorological data for the project area for the period 01 January 2019 – 31 December 2021 was used to determine the prevailing meteorological conditions at the site.

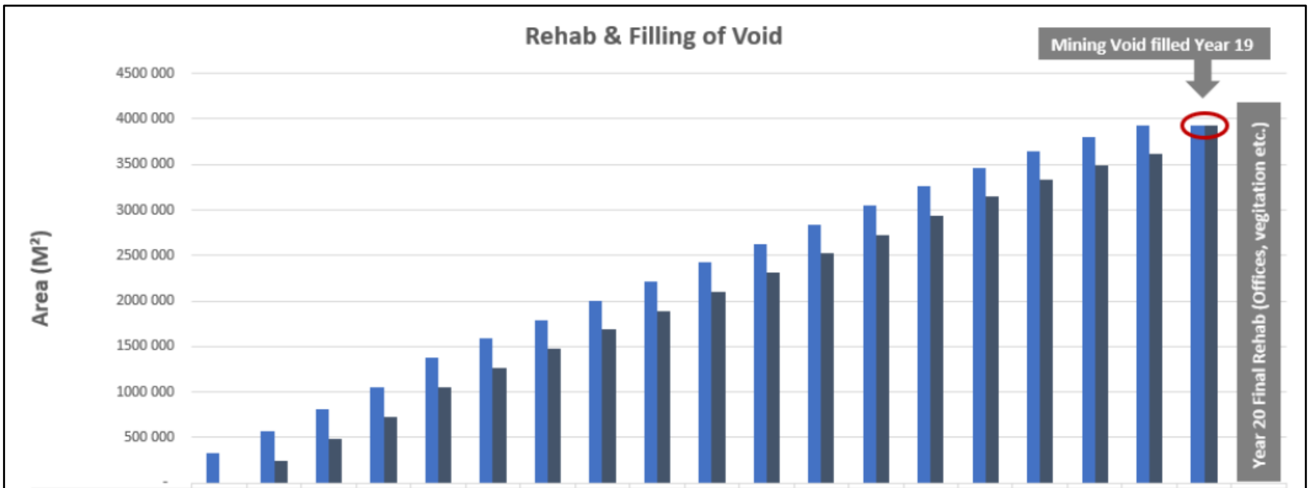
2. BRIEF PROJECT DESCRIPTION

BCR Coal and EMAssistanse have provided the information for the proposed mine activities. Mining operations at the proposed Vlakfontein mining site will be undertaken by means of an open cast mining method. The mine is expected to have a life of mine (LoM) of 18 years. The first 4 months will be utilised to establish the mine site. Topsoil will be removed, and soft and hard overburden stripping will take place to open the ore resource. The first ore is expected to be mined in year one, but due to the mine needing to be established, less ore is expected in year one. The mined ore will be stockpiled to have sufficient stock to supply the preferred wash plant. The supply of the mine will be at a constant rate of 65 861 tonnes of ore per month. Refer to Figure 2.1 for the project and for the mine's expected production schedule over the LoM. Underground mining may be considered at a later stage; however, a feasibility study would need to be undertaken for this. The entire mining operation will be outsourced to a mining contractor.



	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Topsoil (M^3)	1070 862	803 147	267 716		830 778	415 389	415 389	415 389	415 389	415 389	415 389	415 389	415 389	415 389	415 389	415 389	415 389			
Soft Overburden (M^3)	1433 582	1433 582	1433 582	1433 582	3127 742	3127 742	1003 755	1003 755	1003 755	1003 755	1003 755	1003 755	1003 755	1003 755	1003 755	670 580	628 933	628 933		
Hard Overburden (M^3)	-	588 136	1176 272	1764 408			1618 942	1618 942	1618 942	1618 942	1618 942	1618 942	1618 942	1618 942	1618 942	1618 942	1182 399	982 399		
Rehab Void		2824 865	2877 570	3197 991	2504 444	3543 131	3038 086	3038 086	3038 086	3038 086	3038 086	3038 086	3038 086	3038 086	3038 086	2704 912	2226 722	1611 333	3958 520	
Coal (T)	588 207	849 632	849 632	849 632	792 056	792 056	792 056	792 056	792 056	792 056	792 056	792 056	792 056	792 056	792 056	792 056	792 056	792 056		

Figure 2.1: Vlakfontein Opencast Mine LoM of 18 years



Prog Disturbed Area	335 72	576 34	816 96	1057 5	1375 6	1584 6	1793 6	2002 6	2211 7	2420 7	2629 7	2838 7	3047 7	3256 8	3465 8	3646 9	3808 1	3929 2	3929 2
Prog Filled Void Area	-	240 61	481 23	721 85	1057 5	1266 6	1475 6	1684 6	1893 6	2102 6	2311 7	2520 7	2729 7	2938 7	3147 7	3328 9	3490 0	3611 2	3929 2

Figure 2.2: Vlakfontein Opencast Mine Rehab and Filling of Void schedule

Due to the size of the Vlakfontein project, the mine will only produce and sell ore to the consumer, the bulk of which will go to Eskom. Different grades of coal (quality dependent) will be sent to different consumers. A processing plant will not be constructed on site, however, there may be a possibility of having a mobile crusher on-site at a later stage.

2.1 Basic overview of the mining method

The surface sub-outcrop of the Vlakfontein project is planned to be mined using an advancing open pit mining method which allows for concurrent filling of the pit. The pit will be used to develop portals which will allow the remainder of the ore to be exploited using underground mining methods, if desired.

The open pit planned applies a conventional open cast truck and shovel mining philosophy including the following steps:

- Removal of topsoil and storing it at a designated position
- Removal of the overburden.
- Drilling and blasting will be required to break the hard overburden.
- The waste will be dumped in the pit behind the advancing face where possible with the remainder placed at the waste dump, separate from the topsoil.
- Drilling and blasting of the Coal Seams.
- Loading and hauling of the ore for stockpiling at the Run-of-Mine (ROM) pad and for transport to the preferred Washing Plant.

A portion of the waste will be used in the construction of haul roads. Topsoil will be placed on top of backfill for the purpose of rehabilitation. The ore will be stockpiled on a ROM pad and transported to the Washing Plant by trucks. The open pit mining philosophy is based on a contractor-operated operation. A production shift cycle operating 9 hours a day, 6 days a week will be adopted.

Open pit mining operation will commence after the site establishment is completed. Initially, the removal of overburden will take place for a period of 4 months before any mining of ore is done. The first ore will be mined in month 5, and ore and waste mining will take place concurrently onwards. The pit will be mined from the north-east to south-west direction, with backfilling of the mined-out areas taking place behind as the pit advances.

A map indicating the mining area and basic site layout is given in Figure 2.3.

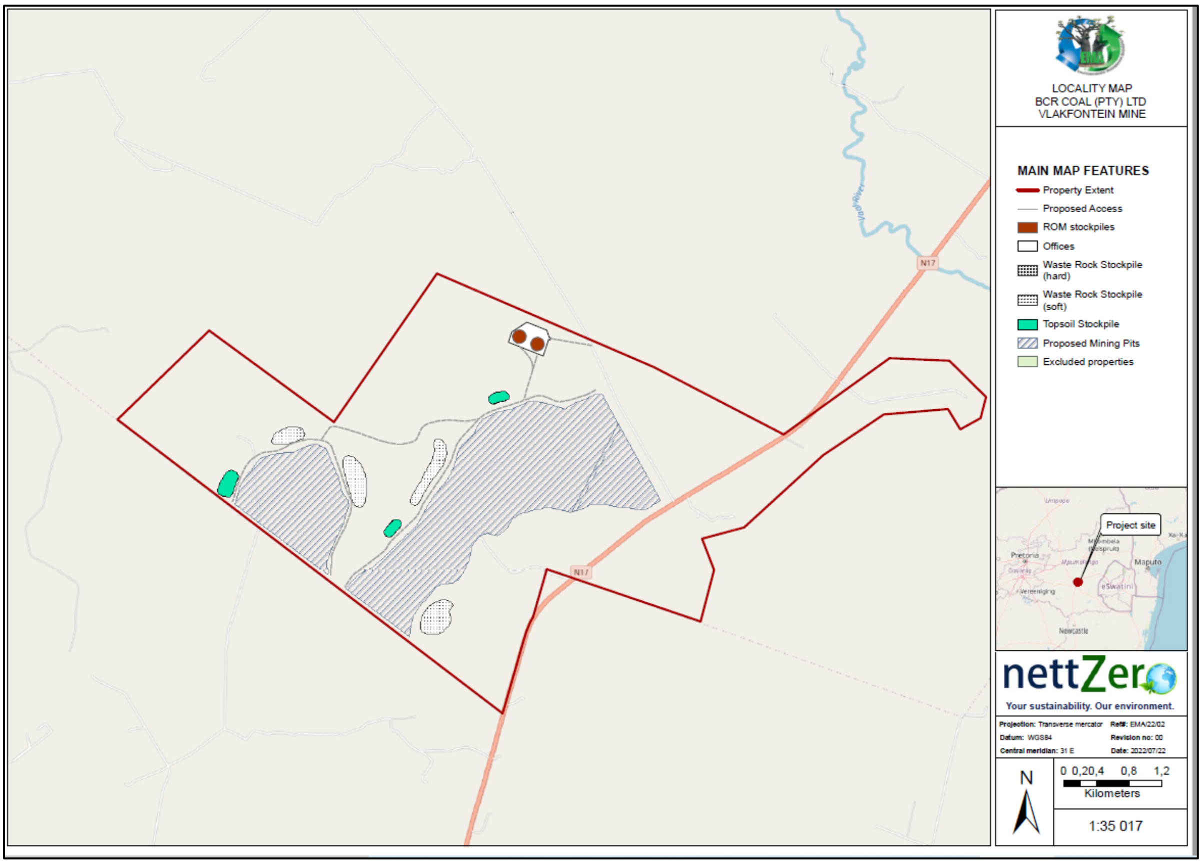


Figure 2.3: Vlakfontein Opencast mine layout

2.2 Infrastructure and mining equipment

Infrastructure will be constructed, including: a workshop, administration office, and a weighbridge. Electricity produced by the generators will be used at these sites, while lighting will also be required at the stockpile area. The number of vehicles expected to be used onsite to undertake the mining activity are as follows:

- 2 x CAT Bulldozer
- 3 X Bell Hydraulic Excavators
- 12 X Bell B40 Articulated 6X6 Dump trucks
- 1 X CAT 140 Motor Grader
- 1 X 10 000-liter Water Bowser
- 1 x 4 000-liter Diesel Bowser
- 2 X Mobile Percussion Drill Rig
- 4 X Service Truck
- Support equipment (transport / material handling – Diesel)
- Contractor (beneficiation / crushing)

The above-mentioned vehicles / mining equipment will be owned and controlled by the mining contractor.

3. LEGISLATION AND REGULATIONS

3.1 Climate Change - The National Climate Change Bill [B9-2022]

South Africa is at an advanced stage with formulating its national policy on mitigating the effects of climate change. The National Climate Change Bill [B9-2022] (the “Bill”) was formally introduced by the department of Fisheries, Forestry and Environment (DFFE) to parliament on the 18th of February 2022.The first draft of the bill was released for public comment on the 08 June 2018 and have been up for public consideration for more than three years.

If the Bill is legislated, it will provide the first legal framework in South Africa in response to the impacts of climate change. It comes at an important time, as South Africa is beginning to experience several weather events a lot more frequently. The main purpose of the Bill is to develop an effective climate change response, with a long-term transition to a low-carbon and climate resilient economy and society for South Africa as a whole.

Finally, the Bill recognizes the urgent threat that climate change poses on South Africa, as well as presents and emphasizes the need for an effective, progressive and gradual response.

3.2 National Environmental Management: Air Quality Act, Act No. 39 of 2004

Air quality in South Africa is governed by the National Environmental Management: Air Quality Act (NEM:AQA) (No.39 of 2004); and as amended the NEM:AQA (No. 20 of 2014). The NEM:AQA makes provision for reasonable measures in order to protect the environment, prevent pollution and ecological degradation and secure ecological sustainable development. The NEM:AQA also provides national norms and standards for regulating air quality monitoring, management and control specific air quality measures and matters. As per the NEM:AQA, GHG means the gaseous constituents of the atmosphere, both natural and anthropogenic that absorb and re-emit infrared radiation.

On 14 March 2014, the following six greenhouse gases were declared as priority air pollutants in South Africa:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous Oxide (N_2O)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)
- Sulphur hexafluoride (SF_6)

National GHG Emission Reporting Regulations (Government Gazette No. 40762 of 3 April 2017), were published by the DEA (now the DFFE). A person identified as a Category A data provider in terms Annexure 1 of these regulations, must register their facilities on the South African Greenhouse Gas Reporting System (SAGERS) and must submit a GHG emissions inventory and activity data in the required format given under Annexure 3 on an annual basis. A summary of GHG emitting activities required to report is given under section 4. The NEM:AQA and the National GHG Emission Reporting Regulations, establish the legislative framework for the national GHG reporting system in South Africa.

National Pollution Prevention Plan Regulations (Gazette No. 40996) were published on 21 July 2017 by the DEA. A pollution prevention plan will be required should the development do the following:

a) Undertake any of the following activities identified in Annexure A of the National GHG Emission Reporting Regulations (Government Gazette No. 40762 of 3 April 2017), which involves the direct emission of GHG more than 0.1 Megatonnes (Mt) annually measured as carbon dioxide equivalents ($CO_{2\text{-}eq}$); or
b) Undertake any of the following activities identified in Annexure A of the National Pollution Prevention Plan Regulations (Gazette No. 40996 of 21 July 2017) as a primary activity, which involves the direct emission of GHG more than 0.1 Megatonnes (Mt) annually measured as carbon dioxide equivalents ($CO_{2\text{-}eq}$);

<u>Annexure A activities in terms of the National Pollution Prevention Plan Regulations include:</u>

- Coal mining
- Production and /or refining of crude oil
- Production and/or processing of natural gas
- Production of liquid fuels from coal or gas
- Cement production
- Glass production
- Ammonia production
- Nitric acid production
- Carbon black production
- Iron & steel production
- Ferro-alloys production
- Aluminium production
- Polymers production
- Pulp and paper production
- Electricity production

Mining and Quarrying falls under category 1A2i in terms of Annexure 1 of the National GHG emission reporting regulations (Government Gazette No. 40762 of 3 April 2017). All facilities conducting this activity are required to register and report on their GHG emissions by the 31 March of every year if they trigger the required reporting thresholds (if they have stationary fuel combustion installations with a combined net heat input greater than 10MW).

Furthermore, controlled emitters (such as mines and quarries) have to report on the national atmospheric emissions inventory system (NAEIS) by 31 March every year. Mines or activities required to report as per the local municipality bylaws. If the proposed mine goes ahead, it is required by law to complete and submit annual reports on the system.

3.3 Carbon Tax Act, Act No. 15 of 2019

The Carbon Tax Act No. 15 of 2019 was promulgated on 23 May 2019 and is implemented using a phased approach, allowing emitters time to transition to cleaner and more efficient technologies resulting in lower GHG emissions. Phase One is effective from 1 June 2019 to 31 December 2022.

Any person, company or entity who undertakes an activity (above a certain threshold) and is responsible for the release of GHG emissions is required to report on their emissions to the Department of Forestry, Fisheries and the Environment, (DFFE) by the 31 March each year and pay tax on those emissions by July each year.

The tax rate is R120 per tonnes of $CO_{2\text{-eq}}$ (carbon dioxide equivalent) emitted by the generation facility or entity for the relevant reporting period. The carbon tax rate will increase by CPI + 2% during the first phase and thereafter by CPI. However, there are tax-free allowances that apply that can make the overall effective tax rate much lower between R6 and R48 per tonnes of $CO_{2\text{-eq}}$ emitted. Tax free allowances are capped at 95% and include:

- A basic tax-free allowance of 60% during Phase One (until December 2022).
- An additional tax-free allowance of 10% for process emissions.
- An additional tax-free allowance of 10% for fugitive emissions.
- An additional tax-free allowance of up to a maximum of 10% for trade exposed sectors.
- An additional tax-free performance allowance of up to 5% based on performance against intensity benchmarks.
- An additional tax-free allowance of 5% for companies who participate in the carbon budget system.
- An additional tax-free carbon offset allowance of 5% or 10% (depending on the sector).

Carbon offsets can be used to reduce tax liability up to 5% or 10% depending on the sector. On 29 November 2019, the South African National Treasury published the Regulations for Carbon Offsets. The Regulation outlines the suitability of offset projects and the procedure which is required to be followed in claiming the offset allowance.

3.4 South African GHG Reporting Legislative Requirements

A person identified as a Category A data provider in terms Annexure 1 of the National GHG Emission Reporting Regulations (Government Gazette No. 40762 of 3 April 2017 and Government Gazette No. 43712 of 11 September 2020), is required to report on their GHG emissions annually, by the 31 March of the following year. In terms of these regulations, GHG information must be calculated and reported in line with the 2006 IPCC guidelines methodology and using the South African technical guidelines. This is required to assist South Africa in reporting emissions on a national level to the United National Framework Convention on Climate Change (UNFCCC).

3.4.1 2006 IPCC Guidelines

The IPCC guidelines categorise GHG emission sources into four main sectors, each including several subsectors. The main four sectors include:

- Energy
- Industrial processes and Product Use (IPPU)
- Agriculture, Forestry, and other Land Use (AFOLU), and
- Waste.

A summary of emission sources per sector are given below (Table 3.4.1). The IPCC identifies these activities a key emission sources that have a significant influence on a country's total GHG inventory.

A company will report on their emissions, to which the company has operational control over, associated with the different activities identified across the four main sectors. Emissions must be reported for operations that take place within the boundary of South Africa.

The IPCC guidelines use a tiered approach in calculating GHG emissions for different activities. There are three tier levels, tier 1 to tier 3. Tier 3 has a higher level of detail and accuracy associated with it and often includes physical measurements of emissions, whereas tier 1 is simpler and makes use of default emission factors where country specific or project specific data is not available. The IPCC recommends a tier 2 or 3 level approach if data is available, to increase the accuracy of the inventory. In terms of the national GHG reporting regulations, data providers are required to calculate emissions using a tier 2 or tier 3 approach. Transitional arrangements are in place for certain IPCC categories until the end of 2022, whereby facilities may report under Tier 1. However, from the 2022 reporting year onwards, transitional arrangements will fall away.

Table 3.4.1: Summary of GHG emitting activities.

IPCC SECTOR	GHG EMISSION SOURCE	SUB-SECTOR ACTIVITIES
ENERGY	Fuel combustion (both stationary and mobile)	Energy Industries: • Electricity and heat production • Petroleum Activity (refineries) Manufacturing Industries and Construction: • Metals • Chemicals • Pulp, paper & paint • Food processing, beverages & tobacco • Non-Metallic Minerals • Machinery • Wood products • Textile & leather Transport Sector: • Civil aviation • Road transportation

		• Railways • Water-borne navigation Other Sectors: • Commercial/Institutional • Residential • Agricultural/Forestry/Fishing
	Fugitive emissions from fuels	• Solid fuels • Surface and underground coal mining & handling • Uncontrolled combustion & burning coal dumps • Storage of coal and wastes • Solid fuel transportation • Leakage of natural gas and the emissions of methane during coal mining and flaring during oil/gas extraction and refining. • Oil & natural gas production • Processing of solid fuels
	CO_2 transport, injection ad geological storage	• CO_2 capture • CO_2 transport by pipeline & ship • Intermediate storage facilities on CO_2 transport routes • CO_2 injection • Geological storage of CO_2
IPPU	Industrial processes and other product use	Mineral Production: • Cement production • Lime production • Glass production Other process uses of carbonates • Ceramics • Soda ash • Non-metallurgical magnesia production Chemical Production: • Ammonia production • Nitric acid production • Adipic acid production • Caprolactam, glyoxal and glyoxylic acid production • Carbide production • Titanium dioxide production • Soda ash production • Petrochemical & carbon black production • Fluorochemical production Metal Industry: • Iron production • Steel production • Ferroalloys production • Aluminum production • Magnesium production • Lead production • Zinc production Non-energy products from Fuels and Solvent Use Other product manufacture and use
AFOLU	Agriculture, Forestry, and other land use	Livestock: • Enteric fermentation • Manure management Land: • Forest land • Cropland

		• Grassland • Wetlands • Settlements • Other land use Aggregate sources and non-CO_2 emissions on land: • Biomass burning • Liming • Urea application • Direct N_2O emission from managed soils • Indirect N_2O emission from managed soils • Indirect N_2O emission from manure management
WASTE	Waste Management	• Solid waste disposal • Wastewater treatment and discharge • Industrial waste disposal • Waste incineration • Waste pyrolysis

3.4.2 Identified Potential GHG Emitting Activities for the Mine

In terms of GHG emitting activities, Vlakfontein Opencast Mine would trigger the following activities in terms of Annexure 1 of the National GHG Emission Reporting Regulations (Government Gazette No. 40762 of 3 April 2017), if the applicable reporting thresholds are exceeded:

Applicable activities:

- Sector: Energy
  - 1A2i – Fuel Combustion Activities, Mining and Quarrying (if exceeding the 10MW reporting threshold)

Table 3.4.2: Identified GHG emitting activities in terms of Annexure 1 of the national GHG reporting regulations (Government Gazette No. 40762 of 3 April 2017).

Associated Emissions by Listed Activity					
Listed Activity	**Primary IPCC Code**	**Description**	**Secondary IPCC Code**	**Description**	**Associated Activity Emissions**
1	1A	*ENERGY, Fuel Combustion Activities*	1A2i	*Mining and Quarrying*	• Emissions from the mining operation and processing plants.

Despite the above, and the related reporting thresholds, when reporting on Climate Change impacts, all emissions should be calculated, so as to obtain a holistic overview of the company's GHG emissions, and overall contribution to climate change.

BCR Coal will own the Vlakfontein Opencast Mine, however the mining work itself will be outsourced to an external contractor. BCR Coal will have full financial and operational control over the mining activities and are therefore responsible for reporting to the national inventory, should it be required.

4. BASELINE – CLIMATE CHANGE

4.1 South African Context

South Africa's climate change response is part of a broader global effort to mitigate and manage the effects of global warming, embedded within the United Nations Framework Convention on Climate Change (UNFCCC), and associated international mechanisms (Department of Environmental Affairs (DEA), 2018). On the international front it is in the interest of developing countries to maintain the spirit of the Paris Agreement, for its ultimate test lies in the elements contained under article 2 of the Agreement. This speaks to the enhanced collective efforts to limit the increase in global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels (DEA, 2018).

South Africa is at an advanced stage with formulating its national policy on mitigating the effects of climate change. The National Climate Change Bill is expected to be passed in the near future (with it currently being in Draft phase).

According to South Africa's 3rd Climate Change Report (DEA, 2018), South Africa has warmed considerably in the last 80 years. Some parts of South Africa have "warmed at twice the global rate of warming". South Africa is expected to experience extreme warming of between 4-6°C over the next six decades.

Changes in rainfall intensity, magnitude and seasonality, as well as extreme weather events and sea level rises are expected. The impacts of climate change on water resources will be particularly challenging. "Different human settlement types and locations have varying vulnerabilities and capacities and will experience the hazards associated with the present and future climate changes to an unequal extent, with informal settlements and their populations being the most exposed" (DEA, 2018). South Africa is most likely to experience climate change impacts primarily affecting water resources (DWA, 2013). South Africa is classified as a water-stressed country, with less than 9% of annual rainfall ending up in the rivers, and only 5% filling groundwater aquifers (DEA, 2018). Impacts on water are due to changes in rainfall and evaporation rates, which themselves are influenced by wind speed and air temperatures. With a drier future climate scenario, it is expected that there will be reduced surface water availability.

The greatest warming has been observed in the west over the Western and Northern Cape, and in the north-eastern provinces of Limpopo and Mpumalanga, extending southwards to the coastal areas of Kwa-Zulu Natal. Moreover, increases have not been observed only in the annual and seasonal averages of minimum and maximum temperature, but also in their extremes. According to South Africa's 3rd Climate Change Report (DEA, 2018), "the Western and Northern Cape, Gauteng, Limpopo, and eastern Kwa-Zulu Natal, in particular, have experienced warming at a rate that is more than twice the global rate of warming".

Drier conditions also have adverse effects on people, with changing wind patterns leading to increased dust generation, resulting in respiratory problems.

4.2 Greenhouse gases in South Africa

GHG aerosols and trace gases impact climate through their effect on the radiative balance of the earth. Aerosol particles have a direct effect by scattering and absorbing solar radiation and an indirect effect by acting as cloud condensation nuclei. Atmospheric aerosol particles range from dust and smoke to mists, smog and haze particles. Trace gases such as greenhouse gases absorb and emit infrared radiation which raises the temperature of the earth's surface causing the enhanced greenhouse effect. Common greenhouses gases include carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride. Of these, carbon dioxide and methane are the major contributors to climate change.

South Africa has already signed and/or ratified several international conventions and agreements for climate change including the:

- Vienna Convention for the Protection of the Ozone Layer in 1990
- Montreal Protocol on Substances that Deplete the Ozone Layer in 1992
- United Nations Framework Convention on Climate Change (UNFCCC) in August 1997
- Kyoto Protocol in July 2002
- Stockholm Convention on Persistent Organic Pollutants in 2002
- Paris Agreement on Climate Change in April 2016

On a National level, South Africa currently has a number of laws relating to the protection and management of the environment. The overarching legislation is contained within the provisions of the National Environmental Management Act of 1998. Climate change is referred to explicitly in the White Paper on Integrated Pollution and Waste Management of 2000 and referenced in the White Paper on a National Water Policy for South Africa, 1997. It is also specifically addressed in the Government's imminent National Water Resource Strategy. The following can be expected on the mine:

4.1.1. Fuel combustion activities – Energy industries

South Africa's primary energy consumption is ranked 16th in the world. This energy intensity is high primarily due to the largescale, energy-intensive primary minerals beneficiation industries and mining industries (DEA, 2016). Additionally, the energy sector is heavily reliant on fossil fuels to generate this electricity. GHGs emitted as a result of the combustion of these fossil fuels are CO_2, CH_4, N_2O and H_2O. The industrial sector, which includes mining, is South Africa's largest consumer of energy. South Africa's energy demand shows that industry/manufacturing sectors consume the highest percentage of electricity (45%), followed by mining (20%).

Total GHG emissions in 2015 attributable to the energy sector were estimated at 429 907 Gg CO_2e. Of this, 400 948 Gg CO_2e were due to fuel combustion activities, equivalent to 93.2% of the energy emissions. Refer to Table 4.2.1 which shows the emissions per GHG from the energy sector in South Africa.

Table 4.2.1: South Africa's energy sector emissions in 2015 (DEA, 2016, pg 68)

Greenhouse gas source and sink categories	CO_2	CH_4	N_2O	Total
	Gg CO_2e			
1.ENERGY	**423 182**	**4 110**	**2 615**	**429 907**
1.A Fuel combustion activities	397 862	472	2 615	400 948
1.B Fugitive emissions from fuels	25 320	3 639	0	28 959
1.C Carbon dioxide transport and storage	NE	NE	NE	NE

However, it should be noted that, according to DEA (2018), “energy efficiency has been the largest contributor to climate change mitigation in the country, accounting for approximately 82% of GHG emission reductions since 2010”.

4.1.2. Fuel combustion activities – Manufacturing industries and construction

Mining and Quarrying (with IPCC code 1A2i), falling under the Energy sector, reports under ‘Manufacturing Industries and Construction’ (IPCC code 1A2). The manufacturing industries and construction sector in South Africa produced an estimated 36 870 Gg CO_2e GHG emissions in 2015, equivalent to 8.6% of the emissions from the energy sector. A breakdown was not provided for each category reporting under “Manufacturing Industries and Construction”, therefore the percentage contribution of Mining and Quarrying towards these GHG emissions was not available.

The largest category of fuel consumed in 2015 in South Africa was sub-bituminous coal (77% of total fuel consumed) (DEA, 2016). The second highest fuel consumed was natural gas (15.72% of total fuel consumption in the manufacturing industries and construction category) in 2015.

4.1.3. Fuel combustion activities – Transport

In terms of the National Greenhouse Gas Emission Reporting Regulations (NGERs) (DEA, 2016), Road Transportation (IPCC sub-category 1A3b) is excluded from reporting. This means that companies are not expected to report their GHG emissions associated with their vehicle use and on-site mobile equipment. However, it is nonetheless useful to calculate these GHG emissions so as to understand the fuel consumption and its contribution towards climate change.

Road transport was responsible for the largest fuel consumed in the transport sector.

4.1.4. Waste

Among the sectors that contribute to the increasing quantities of GHGs into the atmosphere is the waste sector (DEA, 2016). The waste sector comprises 3 sources: Solid waste disposal, incineration and open burning of waste, and wastewater treatment and discharge. South Africa’s Waste sector produces mainly CH_4 (95.6%), with smaller amounts of N_2O (4.2%) and CO_2 (0.2%). In 2015 the Waste sector produced 19 533 Gg CO_2e (3.6% of South Africa’s gross GHG emissions). The largest source category is the Solid waste disposal which contributed 80.7% (15 756 Gg CO_2e) towards the total sector emissions.

Waste sector emissions have increased by 80.2% from the 10 838 Gg CO_2e in 2000. In South Africa the expected growth in the provision of sanitation services, particularly with respect to collecting and managing solid waste streams in managed landfills, is likely to result in an increase in emissions of more than 5% annually. Emissions from Solid waste disposal more than doubled between 2000 (7 814 Gg CO_2e) and 2015 (15 756 Gg CO_2e), while emissions from incineration and open burning of waste and wastewater treatment and discharge both increased by 24.9% over this period. Incineration of waste generates GHG emissions of CO_2, CH_4 and N_2O. Incineration can be in the form of open burning or incineration in a combustion chamber.

Wastewater treatment contributes to anthropogenic emissions, mainly CH_4 and N_2O. The generation of CH_4 is due to anaerobic degradation of organic matter in wastewater from domestic, commercial, and industrial sources. Wastewater can be treated on site (mostly industrial sources) or treated in septic systems and centralised systems (mostly for urban domestic sources) or disposed of untreated (mostly in rural and peri-urban settlements). Most domestic wastewater CH_4 emissions are generated from centralised aerobic systems that are not well managed, or from anaerobic systems (anaerobic lagoons and facultative lagoons), or from anaerobic digesters where the captured biogas is not flared or completely combusted. Wastewater treatment and discharge were estimated to produce 3 427 Gg CO_2e in 2015, of which 78.2% (2 678 Gg CO_2e) was from CH_4.

4.3 Mpumalanga Context

Mpumalanga Province is expected to experience higher minimum, average and maximum temperatures over the next few decades. These temperature changes would be accompanied by increasing incidence and intensity of drought, possibly even in regions where total rainfall increases (such as along the Mpumalanga escarpment). Total annual rainfall is expected to increase by between 85 and 303 mm per year, with distinct increases along the escarpment (MSDF, 2018).

Water demand in Mpumalanga has increased due to rapid industrialisation, mining, urbanization and population growth, and it is stated that the province is unlikely to meet the water availability due to the climate change impact on the province.

Impact studies in terms of water should be able to indicate whether the area can handle additional rainfall (additional volumes of water in the river system) or whether, for example, the area where the mine will be located is low-lying and may become flooded. It would need to be assessed whether, at a worst-case scenario, how much rainfall the river system can handle, and at what point this would adversely affect the mine, such as from the river bursting its banks, the pit being flooded, river crossings becoming damaged, roads being washed away, etc. The ground quality in terms of drainage may also need to be looked at, such as whether the soil is able to drain properly and not become waterlogged.

It must be noted that water demand in Mpumalanga has increased rapidly, and it has been stated that the province is unlikely to meet the water availability requirements. This may then result in water restrictions, which could adversely affect the mine.

Finally, there are predictions by the Mpumalanga Spatial Development Framework. In terms of temperature in the area (2019-2021 met data obtained), it’s more or less the same over the 3 years. Average temperatures don’t seem to have changed much over the last 3 years. However, looking at meteorological data over 3 years only discusses the weather, and not the climate itself. Higher temperatures over the next few decades could be over the next 30 years or more, with no indication of how many degrees higher they expect it to be. Increased temperatures may lead to more evaporation from water sources (both those feeding the borehole, as well as evaporation from the pollution control dams, etc, which will then lead to a need to utilise more water). These temperature changes could be accompanied by increasing incidence and intensity of drought, possibly even in regions where total rainfall increases (such as along the Mpumalanga escarpment). Increased temperatures may also lead to more frequent heat waves as well, potentially adversely affected employees.

5. BASELINE – METEOROLOGY OF PROPOSED SITE

5.1 Meteorological overview for the site

MM5 modelled meteorological data was used for the project area. MM5 meteorological data was obtained from Lakes Environmental for the period January 2019 to December 2021. The meteorological data is representative of recent prevailing weather conditions that will likely be experienced at the project site.

5.1.1. Temperature and Relative Humidity

Mpumalanga province generally experiences a sub-tropical climate characterised by hot summers and mild to cool winters, shifting to cold and frosty conditions in the Highveld regions. World Climate Data presented in the province's Vulnerability Assessment Report shows that the current mean annual temperatures are highest in the north-west and northeast regions of the province, while mean annual precipitation tends to increase towards the eastern regions of the province. The province is characterised by summer rainfall and thunderstorms, except the escarpment area which receives fair levels of precipitation throughout the year.

Monthly average temperatures and relative humidity profiles at the project site for the period January 2019 to December 2021 are presented in Figure 5.1. Average monthly temperatures range from 7.7 – 19.0 ºC (Table 5.1.1). Highest temperatures are observed during the spring, summer and autumns months (September to April) and minimum temperatures are observed during the late autumn and winter months (May – August). Relative humidity fluctuates throughout the year, with the highest being in April (late summer) and lowest being in November. Relative humidity is also low between May – July (end of Autumn through to Winter).

Table 5.1.1: Hourly Minimum, Maximum and Monthly Average Temperatures for January 2019 - December 2021.

	TEMPERATURE 2019 - 2021 (avg, min, max)											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Average	19,0	18,5	17,2	14,3	11,0	8,0	7,7	10,7	13,1	15,9	18,7	18,9
Minimum	7,0	8,0	7,6	3,4	-0,4	-1,2	-2,8	-1,6	1,6	2,4	9,0	7,0
Maximum	29,1	27,1	27,1	25,2	20,4	18,1	17,8	21,2	24,0	27,8	30,0	29,6

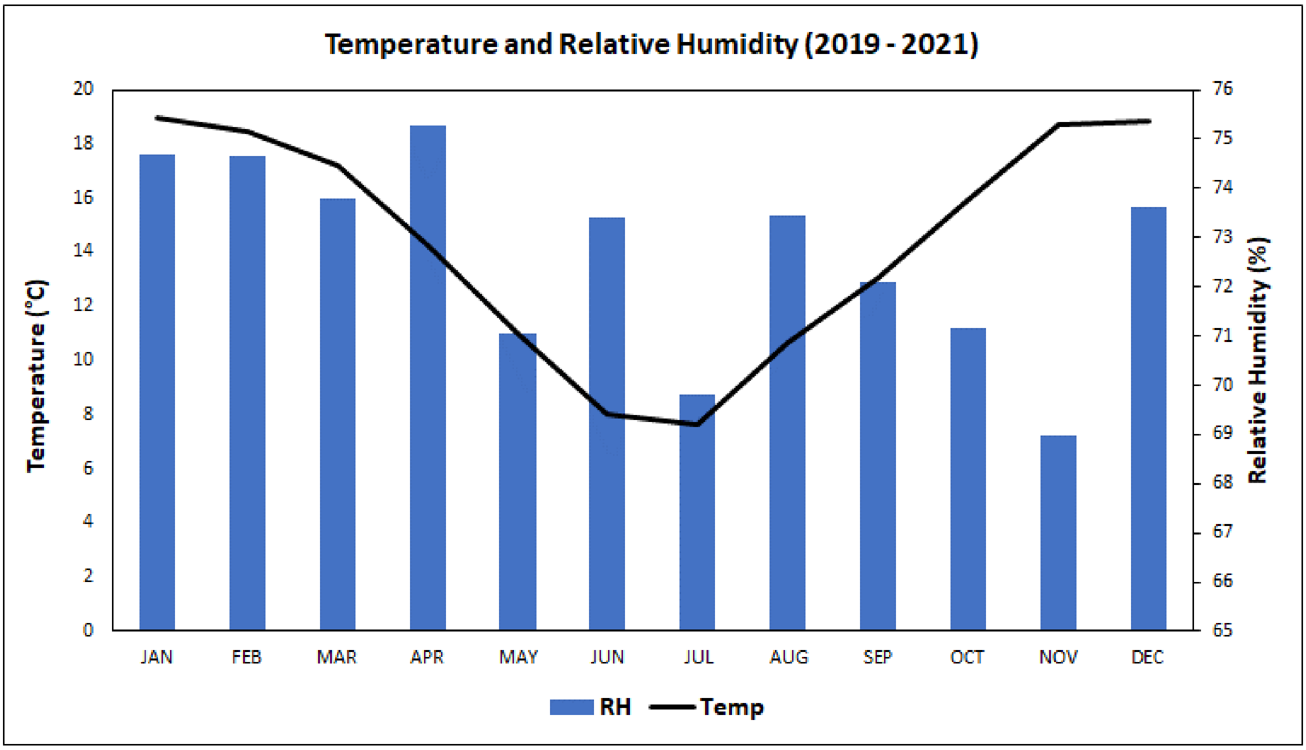


Figure 5.1: Monthly Average Temperature and Relative Humidity (for the past three years) profiles for the project site for January 2019 - December 2021.

5.1.2. Precipitation

The region experiences a summer-rainfall area separated by the escarpment into two climatic zones, namely, (a) the Highveld, which is characterised by cold frosty winters and moderate summers, and the (b) Lowveld which is characterised by mild winters and subtropical climate (MSDF, 2018). During winter the Highveld and Escarpment sometimes experience snow. The annual rainfall occurs mainly during summer in the form of heavy thunderstorms.

Monthly total rainfall at the project site for the period January 2019 to December 2021 is presented in Figure 5.2. The area receives most of its rainfall during the spring, summer and early autumn seasons during the months September - March. Little to no rainfall is observed during the late autumn and winter seasons from April to August (Table 5.1.2).

Table 5.1.2: Total Monthly Rainfall for January 2019 - December 2021.

	TOTAL RAINFALL in mm 2019 - 2021 (SUM OF)											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2019	166,4	146,1	62,2	65,8	5,8	0,0	0,0	0,0	20,6	43,9	133,9	317,8
2020	267,7	101,9	90,4	34,5	0,8	0,0	0,0	4,3	40,4	74,7	194,6	220,0
2021	210,6	273,3	62,0	18,8	3,0	2,5	0,0	8,6	71,4	45,7	102,4	177,5
Average Rainfall	**214,88**	**173,74**	**71,54**	**39,71**	**3,22**	**0,85**	**0,00**	**4,32**	**44,11**	**54,78**	**143,59**	**238,42**

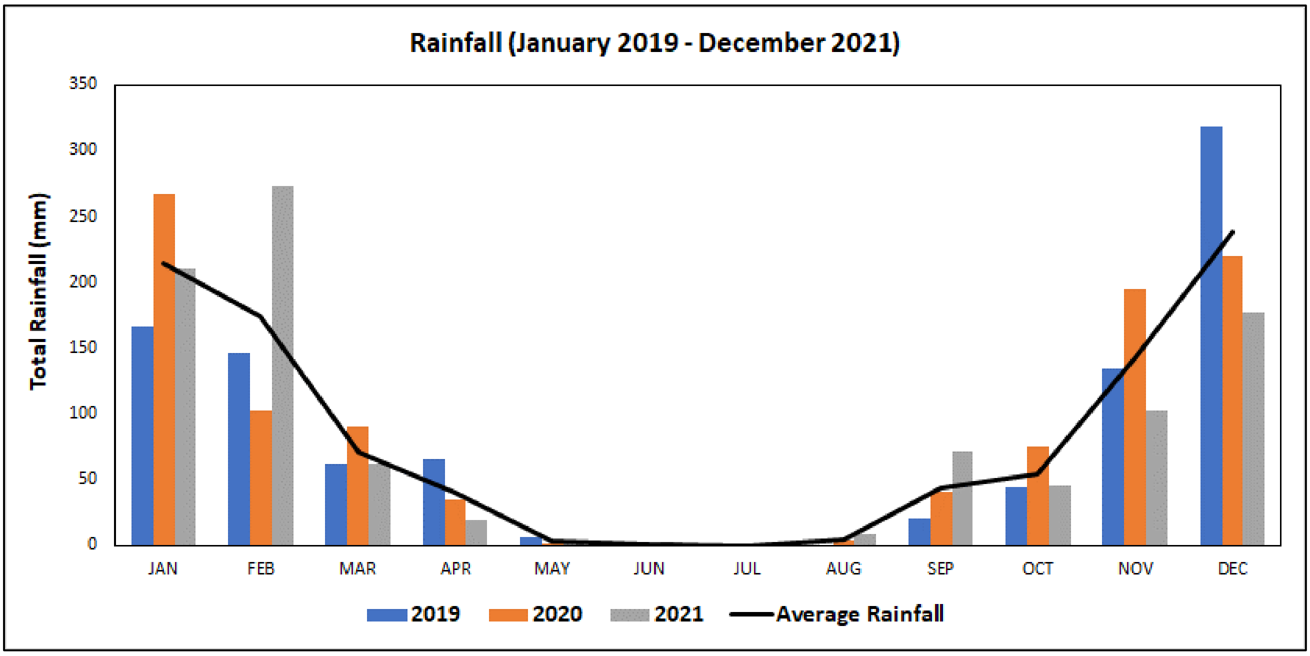


Figure 5.2: Total Monthly and Average Rainfall (mm) for the project site for the period January 2019 - December 2021.

6. ANTICIPATED IMPACTS OF THE PROJECT ON CLIMATE CHANGE

There are proposed mining operations to be undertaken at the site and surrounding the site. The following activities are expected to be key sources of GHG emissions at the mine:

- Blasting (fugitive emissions resulting from the combustion of a complete explosives mix)
- Truck and mining equipment emissions from combustion of fuels
- Other combustion processes (e.g., gas, diesel & oil combustion)
- Transportation of the ore to the wash plant
- Septic/chemical ablution facilities for containing sewage
- Electricity consumption from the workshop, administrative office, weighbridge, and additional lighting of stockpile areas (supplied by the generator)
- Construction of required infrastructure onsite

Other possible indirect GHG emission sources, include, but are not limited to:

- Employee commute and business travel
- Transportation of the pump the septic tank/ablution facilities and waste treatment offsite.
- Transportation of general and hazardous waste offsite

At this stage, GHG calculations will not be undertaken, however a general overview of potential contribution of certain activities towards climate change are discussed below, which will be calculated in the impact phase. It is recommended that GHG calculations to estimate the proposed carbon footprint of the mine be undertaken. This will assist in establishing the extent of the proposed mine's contribution towards climate change.

5.3.1 Blasting

BCR Coal expects to use explosives to break through the hard overburden, as well as blasting of the coal seams. Explosives will not be used on topsoil and soft overburden. Waste volumes including topsoil, soft and hard overburden over the 18-year LoM is expected to be 52 792 258 m^3, of which 85% will be overburden. To determine the potential contribution of this blasting (in terms of GHG emissions) to climate change, one would need to calculate the GHG emissions thereof. Information on the type of explosives used, the mass of the fossil fuel (if applicable) in the explosives, and the carbon content of the fossil fuel may be required.

5.3.2 Diesel consumption

Diesel consumption is expected to be 180 000 litres per month. This equates to 38 880 000 litres over the 18-year LoM. 2.5% of the diesel used will be for the generators to generate electricity, while 7.5% will be used for mobile transport. The remaining 90% will be for the mining operations. Based on the use of a diesel combustion generator, GHG emissions can be expected over the duration of the LoM.

5.3.3 Liquefied Petroleum Gas (LP Gas) consumption

It is expected that 180 kg of LP Gas (used on a rental basis from a service provider) will be consumed by the mine per month, which equates to 46 656 kg (47 tonnes) over the 18-year LoM.
GHG emissions can be expected from the use of LP Gas.

5.3.4 Electricity consumption

The mine will have 2 stationary generators (with 1 being a back-up generator). The mine expects to consume about 4 500 litres of diesel per month in these generators, which it is assumed will be used to electrify the infrastructure (workshop, administration office, weighbridge, and additional lighting of the stockpile area). GHG emissions thereof will be included under diesel consumption.

In future grid electricity may be used. Information has not been provided on whether the mine will make use of grid (Eskom) electricity on-site during future operations. The current mine works plan indicates that electricity will be generated from the two stationary generators.

5.3.5 Construction of infrastructure onsite

Infrastructure expected to be constructed onsite include a workshop, administration office, security and access control area, onsite change houses / ablution facilities, contractor yard, surface water management areas (such as stormwater diversion berms and trenches, pollution control dams), storage areas, etc. It has not been established whether the buildings to be constructed will be permanent structures, or if they will be temporary, such as in the form of moveable storage containers for the workshop and offices. The physical construction of buildings will generate more GHG emissions that the placement of temporary structures that can be used elsewhere after closure of the mine.

However, the footprint in terms of infrastructure is relatively small compared to other mines. If a processing plant were constructed onsite, this would have resulted in a greater GHG emissions profile. Larger mines may have processing plants, concentrator plants, smelters, etc., all onsite, and owned, which would result in a substantially larger GHG emission profile.

It should however be noted that, although the ore will be processed by a wash plant not owned and managed by BCR Coal, the mine is in part responsible for the GHG emissions generated by the wash plant, due to the role they play in feeding the wash plant with the raw materials needed to undertake their own processes.

5.3.6 Sewage treatment

A sewage treatment plant is not planned on being installed, however there will be a septic tank. This septic tank sewage waste will be pumped out by a designated service provider every 3 months. The sewage will then be treated offsite. Information has not been provided on the amount of sewage that will be contained in the septic tank. Tanks thanks contain sewage emit CH_4, and additional information would be required to calculate the GHG emissions thereof. That being said, the emissions from the septic tank are expected to be low. The tank will not be at full capacity throughout the 3-month periods between being emptied, and the tank itself will only service the 7 employees from BCR Coal and 89 employees from the mining contractor, and any service providers that may visit the mine.

5.3.7 Waste

The mine will undertake temporary handling and storage of general and hazardous waste on-site. Hazardous waste may include oils, chemical waste, lubricants, fuels, explosives, raw material stockpiles, etc. General non-hazardous waste may include office waste, food waste, scrap metal, plastics and wood waste.

It is assumed that this will either be collected by an external contractor or transported by the mine to a landfill site capable of handling hazardous waste. To estimate GHG emissions from waste generated by the mine, the waste would need to be categorised into the appropriate waste streams, after which the required IPCC waste stream model will be applied to calculate the GHG emissions.

CH_4 emissions from waste stored temporarily onsite are not expected to generate any significant GHG emissions. CH_4 is generated as a result of degradation of organic material under anaerobic conditions, therefore it is only the total mass of decomposing material currently in the solid waste disposal site (SWDS) that matters, and not what (and how much) waste was deposited in that year. CH_4 emissions can however be calculated once the projected amount of waste (waste composition) to be deposited annually at the SWDS is known.

These GHG emissions are also considered to be other indirect GHG emissions as, although generated by the mine, they will be managed by another organisation.

5.3.8 Other indirect GHG emissions

The impact of other indirect GHG emissions cannot be assessed at this stage, however, will have an impact.

A contractor yard will be constructed onsite, however, the staff and sub-contractors won't be staying on site which would have significantly reduced the majority of employee commute. In terms of transportation of the ore from the mine site, it is assumed that transportation thereof will be undertaken by the mining contractor, and that the GHG emissions thereof have been accounted for under diesel consumption emissions. The ore will be transported to either market or the plant depending on the grade. The distance to market and the plant have not yet been identified, but distance should be considered, as reducing the distance travelled will reduce fuel consumption, and subsequently GHG emissions.

The general and hazardous waste generated by the mine, as discussed above, will be ultimately managed by another organization (presumable the waste disposal site selected), and the GHG emissions are therefore also considered to be other indirect GHG emissions.

5.3.9 Other impacts on climate change

During the construction and operational phases, it is expected that some clearing of land may be required in terms of removing vegetation. This will result in the loss of carbon sink capacity due to vegetation not being available to convert the CO_2 emitted to oxygen. The LoM does indicate that the land will be rehabilitated, therefore, there will be a period of time where the carbon sink is lost. However, once the land has been rehabilitated, the vegetation will sequestrate carbon. Current Google Earth images show the land as partially barren, however at the proposed pit location there are numerous trees and bushes that would most likely be cleared away.

7. ANTICIPATED IMPACTS OF CLIMATE CHANGE ON THE PROJECT

The impacts of climate change are already being seen in South Africa and are projected to intensify over the coming decades. These impacts vary across the country but are projected to include changes to long-term temperature and rainfall patterns (MSDF, 2018). An increase in extreme weather events including floods and droughts is also projected. Climate change is more than simply an increase in global temperatures; it encompasses changes in regional climate characteristics, including temperature, humidity, rainfall, wind and severe weather events, which also have economic and social dimensions.

Climate change poses significant threats to the basic provisions of life including water, the environment, health, and food production. Assuming moderate to high increases in greenhouse gas concentrations such as carbon dioxide, regional modelling scenarios indicate that the in north-eastern South Africa (which includes Mpumalanga) there have already been notable shifts in climate with significant increases in average temperatures (MSDF, 2018). This is further illustrated by stating that for the period 1995-2006, 11 of the 12 years ranked among the 12 warmest years on record since 1850. Observed trends include more frequent heat waves, and colder days and nights becoming less frequent. The following climate change impacts can be anticipated to affect the mine (MSDF, 2018):

- Higher minimum, average and maximum temperatures over the next few decades Increased extreme weather events such as drought and floods
- Increased total annual rainfall by between 85 and 303 mm per year
- Increased water demand in Mpumalanga due to rapid industrialisation, mining, urbanization, and population growth will result in the province being unlikely to meet its water demand capacity

Impact studies in terms of water should be able to indicate whether the area can handle additional rainfall (additional volumes of water in the river system) or whether, for example, the area where the mine will be located is low-lying and may become flooded. It would need to be assessed whether, at a worst-case scenario, how much rainfall the river system can handle, and at what point this would adversely affect the mine, such as from the river bursting its banks, the pit being flooded, river crossings becoming damaged, roads being washed away, etc. The ground quality in terms of drainage may also need to be looked at, such as whether the soil is able to drain properly and not become waterlogged.

In terms of rainfall there is a strong possibility of additional rainfall being experienced in the area over the foreseeable future, especially over the escarpment of Mpumalanga. To what degree the mine site will experience this is unknown. However, it is recommended that an investigation be undertaken into the capacity of the river system and its ability to handle additional volumes of water, as well as on the location of the mine site compared to the river (in terms of drainage as well as flooding). An additional concern may be that if the borehole is at a certain point where, if the water level drops due to lack of rainfall, they may not be able to access any of this water and may need to dig another well/borehole (for example at a lower point in the river system).

It must be noted that water demand in Mpumalanga has increased rapidly, and it has been stated that the province is unlikely to meet the water availability requirements. This may then result in water restrictions, which could adversely affect the mine.

The impacts of climate change pose serious risks for the mining sector. “The mining sector is extremely energy-intensive and one of the major emitters of greenhouse gases. Total CO_2 emissions vary across the industry, largely depending upon the type of resource mined as well as the design and nature of the mining process. It is widely recognised that available mining deposits are increasingly deeper and of declining ore grade. This will lead to growing demands for water as well as greater mine waste, thereby raising energy consumption, and increasing the industry’s climate footprint” (Ruttinger, 2016). Some of the world’s largest mining operations currently operate in remote, climate sensitive regions. The industry is not relocatable should natural environmental conditions become unsupportive for varying reasons. The mining sector requires a number of suitable natural conditions including, but not limited to, a habitable climate, access to water resources and supporting infrastructure to extract resources and process them for future domestic and/or international use.

Changing climatic conditions will have both direct (operational and performance-based) and indirect (securing of supplies and rising energy costs) impacts on the mining sector. These include but are not limited to water-related impacts (droughts, floods, storms, etc); heat-related impacts (bush fires and heat strokes); and sea level rise.

As discussed by Ruttinger (2016), key climatic impacts on various stakeholders across the resources sector, can include, but are not limited to:

- Increased demand for water conservation during droughts
- Increased demand for emergency services during flood events
- Reduced asset operating life
- Health and Safety risks for workforce
- Inability to meet performance targets resulting in impacts on share prices
- Increased demand for changing infrastructure design standards

- Increase in costs of water
- Disrupted access routes, leading to forced mine closures
- Potential employment loss due to lack of safe access to sites
- Conflicts with other water users in the region over water availability
- Force Majeure, sometimes also leading to disputes around delivery obligations
- Supply chain breakdowns

Mining operations typically use large volumes of water to mine and process minerals. Vlakfontein Opencast Mine will however not be processing any of the ore. The mine expects to consume 650 kl/month of borehole water per month, and 473 litres per day (9933 L/month) of potable water, for use at the offices. It can therefore be assumed that water will not be used in the open cast pit. The representative of the mine has also confirmed that they will only obtain water from a borehole, and none of it will be recycled or reused. There will also not be any wastewater treatment undertaken onsite. With the mine not processing its own ore, its dependence on water is substantially reduced, thereby minimising the impact of climate change on water resources, and on the mine itself. The ore will be transported to a wash plant which will however use more water to process the ore. If there are water shortages, this will impact the wash plant's ability to process the mine's ore, which will then negatively impact the mine's ability to sell its ore. If the wash plant is unable to take ore to process due to water shortages, the mine may need to stockpile the ore until such time as the situation improves, or it will have to transport its ore further distances for processing in locations not experiencing water shortages. This will however have an effect on diesel combustion, thereby increasing the mine's GHG emissions from mobile combustion sources.

Dust suppression is an important mitigation measure for mines. Excessive dust combined with windy conditions can have far reaching impacts, particularly on local communities and biodiversity. Rising temperatures and warmer, drier conditions in summer can exacerbate dust emissions. Therefore, dust control measures are especially important in hot, dry conditions. In most mines, dust suppression involves spraying water to suppress the dust. Vlakfontein Opencast Mine will make use of a water bowser for dust suppression of roads and waste dumps and screening areas. Should water shortages occur, or if the borehole dries up, the mine will not be able to access water easily for dust suppression, and other general water requirements. It is assumed that the borehole will be fed by the Vaal River. Threats to the river system are largely attributed to the surrounding agricultural land uses which have impacted on the local aquatic ecosystems, as well as the increase in mining operations within the larger area. The river itself runs adjacent to the open cast pit (refer to Figure 7.1).

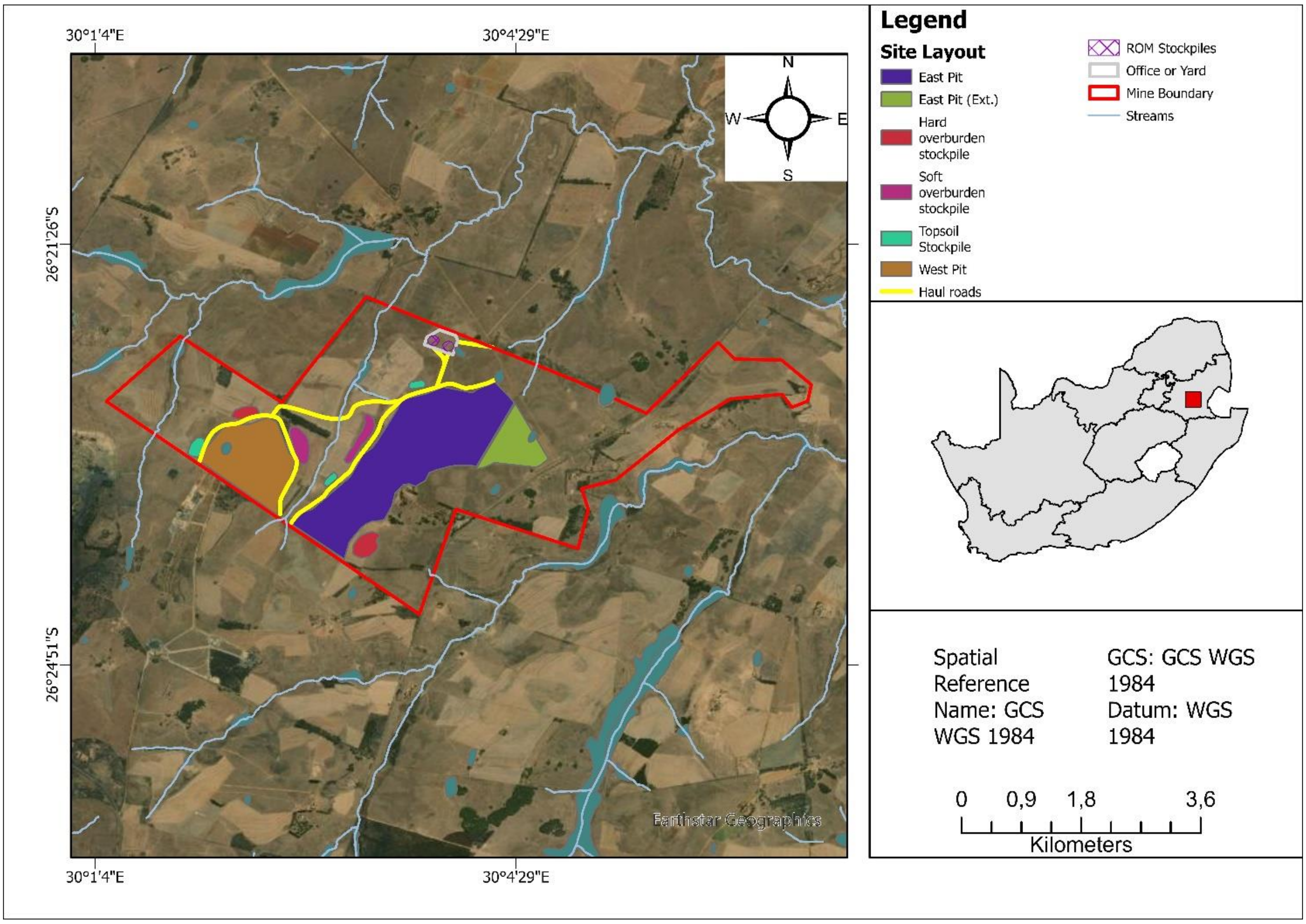


Figure 7.1: Site layout within the river system

The potential impact of climate change remains uncertain, and it is not possible to predict specific trends of the possible impacts it may have on the area. However, it can be anticipated that seasonal variations and fluctuations in water availability may increase. The variations between wet and dry periods may also become more pronounced and severe.

Flooding associated with high rainfall events has the potential to result in unplanned discharges from water storage dams at the operations. Infrastructure at Vlakfontein Opencast Mine such as buildings, storm water controls, water dams, wastewater collection and treatment systems, tailings and waste disposal ponds, transportation infrastructure such as river crossings and roads can all be easily affected by extreme conditions caused by changes in weather patterns.

Therefore, based on the above, adverse impacts that may occur could be increased temperatures resulting in heat waves, drought resulting in drying up of water resources (despite additional rainfall expected), and possible flooding in the area (depending on the site location versus the adjacent river). Therefore, the mine needs to take these impacts into consideration, and possibly consider what mitigation measures they could put in place to reduce these potential impacts.

8. PLAN OF STUDY FOR THE EIA

A preliminary CCIA has been undertaken as part of the scoping phase of the EIA. This was based on information provided by the client, as well as a desktop study, to identify potential issues that are likely to be of importance during the EIA, and to eliminate those that are of little or no concern.

It is recommended that, for the EIA phase of the project, that an in-depth GHG calculation (as per tier 1) project be undertaken to obtain a clear understanding of the proposed impact of the project on climate change (during construction, operation and closure), in terms of its GHG emissions. This will assist in confirming the preliminary risks identified (in terms of the mine's potential contribution towards climate change) and will look at minimum values as well as maximum worst case scenario figures, to gain a holistic view of potential emissions.

9. ASSUMPTIONS, LIMITATIONS AND EXCLUSIONS

The key assumptions, limitations and exclusions of the study are given below:

Assumptions/Limitations

- Data/information provided by the client was assumed to be accurate and complete at the time of submission of this report;
- Material throughputs were based on information provided by the client. The Mine Work Programme was provided with data for the life of mine.
- It is assumed that water will not be used at the pit, as it was indicated borehole water will only be used for dust suppression and at the offices.
- It was assumed that grid electricity would not be utilised. It was indicated that there will be 2 generators, and these will be used for the electricity requirements.
- It was assumed that the mining contractor will deliver the ore to the preferred wash plant for processing;
- It was assumed that a service provider would collect all hazardous waste and general waste from the mine for safe disposal elsewhere;
- The study is limited by the amount of detailed information that could be provided at the time of compilation of the report.
- Climate is changing, and what is occurring at the site location now is not necessarily what will be happening 5 or 10 years later. Research is continuously being undertaken to establish the potential spatial relationship between mining and climate change.

Exclusions

GHG calculations and a detailed CCIA report have not been compiled. This baseline report has been compiled as a desktop study only, and it is recommended that a full climate change impact assessment be undertaken at a later stage to fully assess the potential impact of the project on climate change. This would require a thorough calculation of all potential GHG emissions for the life of the mine.

10. SUMMARY AND CONCLUSIONS

10.1 Summary of Desktop Verification

The main conclusions based on the information obtained during the baseline assessment can be summarised as follows:

Vlakfontein Opencast Mine is expected to have a relatively small footprint in terms of infrastructure, with a few offices, workshop, contractor yard, etc to be constructed. The mining will be completely outsourced to a mining contractor. The mining contractor owns the mining machinery and equipment. The mine will not have a processing plant. Ore will be stored until there are sufficient stockpiles to send to the preferred wash plant for processing, however the mine will set up a mobile crusher and screening facility.

Mines in general of large consumers of electricity, fossil fuels and water. The water to be utilised will be obtained from a borehole. It will be used for dust suppression and water at the offices. It is therefore assumed that water will not be used at the pit, thus water requirements may be considered to be lower. Water usage should remain relatively stable (no expected sudden increases required, unless drier temperatures and more frequent stronger winds require more frequent dust suppression to be undertaken).

It was indicated that diesel generators will be used for electricity, and an assumption was therefore made that grid electricity will not be used. Diesel usage will however be predominantly for use in mining vehicles and machinery. Fossil fuel use is thus expected to have a relatively low impact, compared to other mines that have conveyor belts, smelters, processing plants, etc. Additionally, depending on the distance to the preferred wash plant that will be used to process the ore, fuel consumption can be reduced if the wash plant is close to the mine, as less diesel for transportation of the ore to the plant will be required.

Climate change itself can have various impacts on mines. With Vlakfontein Opencast Mine relying on water extraction from a borehole, there is a risk of the water drying up. Research has shown that the Mpumalanga Province has had water shortages, an increase in average temperatures, and varying weather and rainfall patterns. Increased temperatures can result in faster evaporation rates, which may impact the mine in terms of their water storage capacity (in their water supply dams, mine residue facility return water dams, and pollution control dams). Increased rainfall can also impact the mine in terms of flooding of the pit resulting in downtime, as well as damage to river crossings and infrastructure, etc. increased wind speeds and evaporation rates may also result in increased dust flareups, resulting in the requirement of increased dust suppression. Not only will this require additional water requirements, but the dust itself will have adverse impacts on the employees and any surrounding communicates in the area.

The clearing of land during the construction and operational phase will result in the loss of a carbon sequestration source. Current Google Earth images show the land as partially barren, however at the proposed pit location there are numerous trees and bushes that would most likely be cleared away. When terrestrial carbon sinks are cleared, stored carbon is released into the atmosphere. Thus, the clearing of land will not only result in a potential loss of a carbon sequestration source, but also the release of stored carbon dioxide.

The LoM does indicate that the land will be rehabilitated and the void filled, however, the carbon sequestration capacity will take time get back to its full capacity preclearance.

10.2 Reasoned opinion regarding the acceptability of the proposed activity

An impact verification statement cannot be determined from the baseline study, as this requires the quantification of GHG emissions and the activity's contribution to the carbon budget of South Africa.

Site sensitivity and desktop verification is not applicable for CCIAs, as these have not been developed for the South African screening tool. Furthermore, climate change is spatially homogeneous, therefore, emissions that result from the mining activity will affect the climate regardless of where the mine is sited. Thus, ratings for the screening tool and verified sensitivity cannot be provided in this baseline assessment report. Climate change impacts associated with the proposed project can only be determined through an emissions inventory and GHG calculations.

SCREENING TOOL SENSITIVITY	VERIFIED SENSITIVITY	OUTCOME STATEMENT/PLAN OF STUDY	RELEVANT SECTION MOTIVATING VERIFICATION
CLIMATE CHANGE IMPACT ASSESSMENT			
N/A	N/A	GHG Calculations and predictions for the EIA phase of the project to determine potential climate change impacts associated with proposed project	N/A

Overall, the mine is expected to have an impact on climate change, in terms of GHG emissions, the degree of which will be assessed in the CCIA report, based on the information provided, and assumptions based on researched information only.

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