Environmental and Engineering Consultants

BCR COAL (PTY) LTD – PROPOSED VLAKFONTEIN COAL MINE

BASELINE AIR QUALITY & PLAN OF STUDY REPORT

August 2022

Rayten Project Number: SCI-EMA-222713

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EXECUTIVE SUMMARY

Rayten Engineering Solutions (Pty) Ltd was appointed by Environmental Management Assistance (Pty) Ltd (hereafter referred to as “EMA”) to compile an Air Quality Impact Assessment (AQIA) baseline report for the proposed operation of BCR Coal (Pty) Ltd - Vlakfontein Coal Mine (hereafter referred to as “Vlakfontein Coal Mine”), located within the Msukaligwa Local Municipality, Mpumalanga Province.

As part of the mining right application, a scoping and environmental impact assessment (EIA) process must be undertaken. An AQIA was identified as a requirement in the screening report for inclusion in the EIA report. This baseline AQIA report has been compiled specifically as a supporting document to inform the Scoping Phase. The main objective of the AQIA baseline assessment is to determine the following:

- the prevailing meteorological conditions at the site;
- baseline concentrations of key air pollutants of concern;
- identify existing sources of emissions; and
- identify key sensitive receptors surrounding the project site.

MM5 meteorological data for the project area for the period 01 January 2019 – 31 December 2021 was used. Baseline air quality at the proposed Vlakfontein Coal Mine was evaluated using available monitoring data for PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO, and O_3 from a permanent ambient air quality monitoring station, i.e. at the Ermelo Station (-26.493348°S; 29.968054°E), located approximately 13km south-west of the proposed mine. The ambient air quality monitoring data covers the period 01 January 2016 – 31 December 2021, with moderate to high data capture (>50%) observed for all of the criteria air pollutants, i.e. PM_{10} (50.7%), $PM_{2.5}$ (50.4%), SO_2 (86.8%), NO_2 (52.7%), CO (74.0%), and O_3 (87.4%). Dustfall data could not be provided in this AQIA baseline report as there are no available dustfall networks operated near the project site, that could be determined.

The main conclusions based on the information obtained during the Baseline Assessment are as follows:

The proposed mine is located on Portions 2, 11 and 21 of the farm Vlakfontein 108 IT, Portions 1, 7, 14, and 12 of the farm Welgelegen 107 IT, , 14.5km north-east of Ermelo, within Msukaligwa Local Municipality and Gert Sibande District Municipality, Mpumalanga Province. The project area falls within the Nationally Declared Highveld Air Quality Priority Area. The land use immediately surrounding the proposed Vlakfontein Coal Mine consists mostly of grassland and cultivated land, with few areas consisting of mines and quarries, built-up areas, waterbodies, wetlands and forested land. The larger area surrounding the proposed mine is classified as rural in nature. Few existing key sources of airborne emissions surrounding the project site have been identified as follows:

- Agricultural activity (temporary crops) and potential biomass burning ((surrounding areas);
- Planted forest (surrounding areas);
- Solid fuel combustion in nearby townships/informal settlements (south-west and north-west quadrants); and
- Vehicle dust entrainment on unpaved roads (surrounding areas).

Based on the prevailing wind fields for the period January 2019 to December 2021, emissions from activities at the proposed Vlakfontein Mine will likely be transported towards the south-westerly, east-south-easterly and west-north-westerly wind directions. Moderate to fast wind speeds observed during all the time periods, may result in effective dispersion and dilution of emissions from the proposed mine operations; however, higher winds speeds can also facilitate fugitive dust emissions from open exposed areas such as stockpiles and opencast areas. Removal of particulates via wet depositional processes would be evident during the warmer (wet) seasons (spring – early autumn) thus lower ambient concentrations of dust could be expected during these seasons. Over the remainder of the year higher ambient concentrations of particulates could be expected.

There is seasonal variation in winds at the proposed Vlakfontein Coal Mine. Prevailing winds in summer originate from the north-eastern quadrant, similar to prevailing winds observed in spring. However, additional north-westerly winds are observed in spring. During the autumn season, north-easterly and west-northwesterly winds prevail, while the winter season is characterised by high frequency west-northwesterly and east-southeasterly winds. Additional less frequent north-westerly/south-westerly and east-southeasterly/north-northeasterly winds are observed in winter and autumn, respectively. Wind speeds were generally high during all seasons, which could subsequently facilitate dust emissions from stockpiles, onsite and offsite activities associated with the proposed mine.

Based on the baseline air quality data for the period 01 January 2016 to 31 December 2021, several exceedances of the PM_{10} (75 µg/m^3) and $PM_{2.5}$ (40 µg/m^3) daily standards were observed over the monitoring period (i.e. 427 and 215 exceedances for PM_{10} and $PM_{2.5}$, respectively), while exceedances of the applicable annual standards (40 µg/m^3 and 20 µg/m^3 for PM_{10} and $PM_{2.5}$, respectively) were observed between 2017 - 2018 and 2020 - 2021. For the gaseous pollutants, exceedances were observed in SO_2 hourly and daily concentrations and NO_2 hourly concentrations, for which four exceedances of the daily standard of 48 ppb were recorded for SO_2, while seven and five exceedances of the hourly standards of 134 ppb and 106 ppb recorded for SO_2 and NO_2, respectively. Additionally, 92 exceedances of the 8-hourly standard of O_3 were recorded. Annual SO_2 and NO_2 concentrations, as well as hourly and 8-hourly CO concentrations comply with applicable NAAQS. Higher concentrations for all criteria air pollutants were observed between April and October, as well as during summer (between January and February), for O_3.

Dustfall, PM_{10} and $PM_{2.5}$ are key pollutants of concern associated with the open pit mining operations at the proposed Vlakfontein Coal Mine and will likely be emitted from the following key sources:

Dust and Particulate Emissions:

- Drilling and blasting at the opencast pit (to break the hard overburden and coal seams);
- Bulldozing (moving material and shaping stockpiles);
- Materials handling operations (truck loading/offloading operations);
- Transportation/hauling of Run-of-Mine (ROM) ore and overburden material (trucks);
- Material storage: Stockpiling;
- Crushing and screening;
- Excavators (stripping ore and overburden and loading trucks);
- Wind erosion from exposed areas (i.e. the open cast pit, exposed surfaces, and material stockpile areas); and

- Vehicle dust entrainment on unpaved roads.

Reasoned Opinion Regarding the Acceptability of the proposed Project

The anticipated impact of activities at the proposed Vlakfontein Coal Mine will be quantitatively assessed through dispersion modelling and presented in the final Level 2 AQIAr. The level of assessment (i.e. Level 2) required has been determined in accordance with the National Environmental Management: Air Quality Act (Act No. 39 of 2004) (NEM:AQA) and Dispersion Modelling Regulations (Government Gazette No. 37804 of 11 July 2014). It is expected that emissions from activities at the proposed mine will most likely result in air quality impacts in terms of dustfall, PM_{10} and $PM_{2.5}$. However, as the impact assessment has not yet been conducted (this will be done after the dispersion modelling exercise), no fatal flaws and red flags that could impact on the feasibility of the Mine could be determined in this baseline assessment report. Furthermore, a reasoned opinion regarding the acceptability of the project cannot be provided at this stage. These factors will be determined in the final AQIAr.

Summary of Desktop Verification Outcome

According to the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and Environmental Impact Regulations, 2014 (as amended) (EIA Regs), site sensitivity and desktop verification must be undertaken to inform the Scoping Phase and EIA process for any proposed development, where applicable. However, site sensitivity and desktop verification are not applicable for AQIAs, as these have not been developed for the South African screening tool. Furthermore, air emissions that result from the proposed mining activity will affect air quality regardless of where the mine is sited. Thus, ratings for the screening tool and verified sensitivities cannot be provided in this baseline assessment report. Air quality impacts associated with the proposed project can only be determined through dispersion modelling. As such, Rayten recommends that dispersion modelling be conducted as part of the EIA phase of the proposed project.

SCREENING TOOL SENSITIVITY	VERIFIED SENSITIVITY	OUTCOME STATEMENT/PLAN OF STUDY	RELEVANT SECTION MOTIVATING VERIFICATION
AIR QUALITY IMPACT ASSESSMENT			
N/A	N/A	Dispersion modelling is recommended for the EIA phase of the project to determine potential air quality impacts associated with proposed project	N/A

TABLE OF CONTENTS

1. INTRODUCTION ... 1
1.1. Project Details ... 1
1.2. Brief Project Description ... 2
1.3. Terms of Reference ... 4
1.4. Outline of Report ... 4
2. SITE CHARACTERISTICS ... 4
2.1. Site Location ... 4
2.1.1. Highveld Priority Area Air Quality Management Plan ... 4
2.2. Surrounding Land Use ... 7
2.3. Topography ... 7
2.4. Sensitive Receptors ... 7
3. LEGISLATION ... 13
3.1. National Environmental Management Air Quality Act (NEM:AQA No 39 of 2004) ... 13
3.2. Listed Activities and Minimum Emission Standards ... 13
3.3. Ambient Air Quality Standards ... 14
3.4. Dust Deposition Standards ... 15
3.5. Greenhouse Gas (GHG) Emissions ... 16
3.6. Carbon Tax Act ... 17
3.7. Human Health Effects (Dustfall and Particulates) ... 17
3.7.1. Dustfall ... 17
3.7.2. Particulates (PM_{10} & $PM_{2.5}$) ... 18
4. BASELINE ASSESSMENT ... 18
4.1. Meteorological Overview ... 18
4.1.1. Local Wind Field ... 20
4.1.2. Temperature and Relative Humidity ... 24
4.1.3. Precipitation ... 25
4.2. Baseline Air Quality Concentrations ... 26
4.2.1. PM_{10} concentrations ... 28
4.2.2. $PM_{2.5}$ concentrations ... 30
4.2.3. SO_2 concentrations ... 32
4.2.4. NO_2 concentrations ... 34
4.2.5. CO concentrations ... 36
4.2.6. O_3 concentrations ... 38
4.3. Surrounding Sources of Air Pollution ... 40
4.3.1. Agricultural Activity and Potential Biomass Burning ... 42
4.3.2. Forestry Activities/Plantations ... 43
4.3.3. Domestic Fuel Combustion Activities ... 43
4.3.4. Vehicle Dust Entrainment on Unpaved Roads ... 43
5. BASELINE AIR QUALITY IMPACT ASSESSMENT ... 43

5.1. Plan of Study for EIA Phase ... 44
5.2. Model Overview ... 45
5.2.1. AERMOD View ... 45
5.2.2. Model Requirements ... 46
6. SUMMARY AND CONCLUSIONS ... 47
6.1. Assumptions and Gaps in Knowledge ... 49
6.2. Reasoned Opinion Regarding the Acceptability of the Proposed Activity ... 49
7. REFERENCES ... 51
8. DECLARATIONS ... 52

LIST OF FIGURES

Figure 1-1: Proposed Vlakfontein Coal Mine Preliminary Layout Plan. 3

Figure 2-1: Air Quality Priority Areas. 7

Figure 2-2: Highveld Priority Area (DEA, 2011). 7

Figure 2-3: Site locality for the proposed Vlakfontein Coal Mine. 9

Figure 2-4: Land use surrounding the proposed Vlakfontein Coal Mine. 10

Figure 2-5: Elevation surrounding the proposed Vlakfontein Coal Mine. 11

Figure 2-6: Sensitive receptors within 20km of the proposed Vlakfontein Coal Mine. 12

Figure 4-1: Period Wind Rose Plots for the proposed Vlakfontein Coal Mine for the period January 2019 - December 2021. 21

Figure 4-2: Morning (AM) (00:00 - 12:00) and Evening (PM) (12:00 - 23:00) Period Wind Rose Plots for proposed Vlakfontein Coal Mine for the Period January 2019 - December 2021. 22

Figure 4-3: Seasonal Variation of Winds for the proposed Vlakfontein Coal Mine for the Period January 2019 - December 2021. 23

Figure 4-4: Monthly Average Temperature and Relative Humidity profiles for the proposed Vlakfontein Coal Mine for January 2019 - December 2021. 25

Figure 4-5: Total Monthly and Average Rainfall (mm) for the proposed Vlakfontein Coal Mine for the period January 2019 - December 2021. 26

Figure 4-6: Locality of Ermelo AQMS (yellow pin) in relation to the proposed Vlakfontein Mine (black outline). A 20km radius from the proposed mine is represented by the red solid line. 27

Figure 4-7: Hourly PM_{10} concentrations at the Ermelo AQMS for the period January 2016 – December 2021. 29

Figure 4-8: Daily PM_{10} concentrations at the Ermelo AQMS for the period January 2016 – December 2021. 29

Figure 4-9: Monthly PM_{10} concentrations at the Ermelo AQMS for the period January 2016 – December 2021. 29

Figure 4-10: Diurnal PM_{10} concentrations at the Ermelo AQMS for the period January 2016 – December 2021. 29

Figure 4-11: Hourly $PM_{2.5}$ concentrations at the Ermelo AQMS for the period January 2016 – December 2021. 31

Figure 4-12: Daily $PM_{2.5}$ concentrations at the Ermelo AQMS for the period January 2016 – December 2021. 31

Figure 4-13: Monthly $PM_{2.5}$ concentrations at the Ermelo AQMS for the period January 2016 – December 2021. 31

Figure 4-14: Diurnal $PM_{2.5}$ concentrations at the Ermelo AQMS for the period January 2016 – December 2021. 31

Figure 4-15: Hourly SO_2 concentrations at the Ermelo AQMS for the period January 2016 – December 2021. 33

Figure 4-16: Daily SO_2 concentrations at the Ermelo AQMS for the period January 2016 – December 2021. 33
Figure 4-17: Monthly SO_2 concentrations at the Ermelo AQMS for the period January 2016 – December 2021. 33
Figure 4-18: Diurnal SO_2 concentrations at the Ermelo AQMS for the period January 2016 – December 2021. 33
Figure 4-19: Hourly NO_2 concentrations at the Ermelo AQMS for the period January 2016 – December 2021. 35
Figure 4-20: Daily NO_2 concentrations at the Ermelo AQMS for the period January 2016 – December 2021. 35
Figure 4-21: Monthly NO_2 concentrations at the Ermelo AQMS for the period January 2016 – December 2021. 35
Figure 4-22:Diurnal NO_2 concentrations at the Ermelo AQMS for the period January 2016 – December 2021. 35
Figure 4-23: Hourly CO concentrations at the Ermelo AQMS for the period January 2016 – December 2021. 37
Figure 4-24: 8-Hour CO concentrations at the Ermelo AQMS for the period January 2016 – December 2021. 37
Figure 4-25: Daily CO concentrations at the Ermelo AQMS for the period January 2016 – December 2021. 37
Figure 4-26: Monthly CO concentrations at the Ermelo AQMS for the period January 2016 – December 2021. 37
Figure 4-27: Diurnal CO concentrations at the Ermelo AQMS for the period January 2016 – December 2021. 38
Figure 4-28: Hourly O_3 concentrations at the Ermelo AQMS for the period January 2016 – December 2021. 39
Figure 4-29: 8-Hour O_3 concentrations at the Ermelo AQMS for the period January 2016 – December 2021. 39
Figure 4-30: Daily O_3 concentrations at the Ermelo AQMS for the period January 2016 – December 2021. 39
Figure 4-31: Monthly O_3 concentrations at the Ermelo AQMS for the period January 2016 – December 2021. 39
Figure 4-32: Diurnal O_3 concentrations at the Ermelo AQMS for the period January 2016 – December 2021. 40
Figure 4-33: Identified surrounding emission sources within 10km of the proposed Vlakfontein Coal Mine.......... 41
Figure 4-34: Identified surrounding emission sources within 20km of the proposed Vlakfontein Coal Mine.......... 42

LIST OF TABLES

Table 2-1: HPA Air Quality Hot Spot Areas (DEA, 2011;20). 6

Table 3-1: National Ambient Air Quality Standards for Criteria Pollutants. 14

Table 3-2: South African National Dust Control Regulations. 15

Table 4-1: Meteorological Data Details. 19

Table 4-2: Hourly Minimum, Maximum and Monthly Average Temperatures for January 2019 - December 2021. 24

Table 4-3: Total Monthly Rainfall for January 2019 - December 2021. 25

Table 4-4: Data Capture (Ermelo AQMS). 26

Table 4-5: Annual Average Concentrations for PM_{10} 28

Table 4-6: Annual Average Concentrations for $PM_{2.5}$. 30

Table 4-7: Annual Average Concentrations for SO_2 32

Table 4-8: Annual Average Concentrations for NO_2 34

Table 5-1: Key Variables to be used in the modelling study. 46

LIST OF ABBREVIATIONS

AEL	Atmospheric Emissions License
AQIA	Air Quality Impact Assessment
AQIAr	Air Quality Impact Assessment Report
CH_4	Methane
CoE	City of Ekurhuleni
CO	Carbon Monoxide
CO_2	Carbon Dioxide
$CO_{2\text{-eq}}$	Carbon dioxide equivalent
DEA	Department of Environmental Affairs (now known as the Department of Forestry, Fisheries and the Environment)
DFFE	Department of Forestry, Fisheries and the Environment
DR	Discrete Receptor
EIA	Environmental Impact Assessment
GHG	Greenhouse gas
GMT	Greenwich Meridian Time
HFC	Hydrofluorocarbons
NAEIS	National Atmospheric Emissions Inventory System
NAAQS	National Ambient Air Quality Standards
NEMA	National Environmental Management Act
NEM:AQA	National Environmental Management Air Quality Act
NPI	National Pollutant Inventory
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
N_2O	Nitrous Oxide
Mtpa	Million tonnes per annum
O_3	Ozone
PBL	Planetary Boundary Layer
PFC	Perfluorocarbons
PM_{10}	Particulate Matter, aerodynamic diameter equal to or size less than 10µm
$PM_{2.5}$	Particulate Matter, aerodynamic diameter size equal to or less than 2.5µm
PRIME	Plume Rise Model Enhancements
ROM	Run of Mine
SAAQIS	South African Air Quality Information System
SAGERS	South African Greenhouse Gas Emissions Reporting System
SF_6	Sulphur hexafluoride
SO_2	Sulphur Dioxide
USEPA	United States Environmental Protection Agency

TERMINOLOGY

"Ambient air quality" means the degree to which air is suitable or clean enough for humans or the environment.

"Criteria air pollutants" means common pollutants with a potential to harm human health or the environment.

"Emission" means any emission or entrainment process emanating from a point, non-point or mobile source that results in air pollution**.**

"Emissions inventory" means an accounting, by source, of the amount of air pollutants discharged into the atmosphere during a specified period.

"Dispersion modelling" means the mathematical simulation of how air pollutants disperse in the ambient atmosphere.

"Fatal flaw" means a major defect or deficiency in a project proposal that should result in environmental authorisation being refused.

"Greenhouse gas" means gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and re-emit infrared radiation, and includes carbon dioxide, methane and nitrous oxide.

"Priority area" means any area declared as such in terms of section 18 of NEM:AQA (Act 39 of 2004) due to the existence of any situation which may cause a significant negative impact on air quality in the area, including the likelihood of ambient air quality standards being exceeded, and the area requiring specific air quality management action to rectify the situation.

1. INTRODUCTION

Rayten Engineering Solutions (Pty) Ltd (hereafter referred to as "Rayten") was appointed by EMA to compile an Air Quality Impact Assessment (AQIA) baseline report for the proposed operation of BCR Coal (Pty) Ltd - Vlakfontein Coal Mine (hereafter referred to as "Vlakfontein Coal Mine"), located within the Msukaligwa Local Municipality, Mpumalanga Province.

As part of the mining right application, a scoping and environmental impact assessment (EIA) process must be undertaken. An AQIA was identified as a requirement in the screening report for inclusion in the EIA report. This baseline AQIA report has been compiled specifically as a supporting document to inform the Scoping Phase.

The baseline air quality assessment was undertaken through a review of meteorological monitoring data, available air quality monitoring data, air quality legislation and the identification of nearby sensitive receptors and existing emission sources surrounding the project site. The main objective of the baseline air quality assessment was to determine the prevailing meteorological conditions at the site, establish baseline concentrations of key air pollutants of concern, identify existing sources of emissions, and identify key sensitive receptors surrounding the project site.

A description of the expected emissions from the proposed mining activities will be presented in the form of a detailed emissions inventory as part of the AQIA. The potential impact of emissions from the mining activities associated with the proposed mine on air quality will be evaluated through the compilation of an emissions inventory and subsequent dispersion modelling simulations using AERMOD. Comparison of predicted concentrations for criteria air pollutants will be made with the South African Ambient Air Quality Standards and the South African National Dust Control Regulations, 2013 where applicable.

This baseline assessment report has been compiled in a manner that complies with the regulations prescribing the format of a Plan of Study Report (Government Gazette No. 37804 of 11 July 2014). The final AQIA report will be compiled in a manner that complies with the regulations prescribing the format of the Atmospheric Impact Report (Government Gazette No. 36904 of 11 October), as amended (General Notice 284 in Government Notice 38633 of 02 April 2015), as well as the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and Environmental Impact Assessment Regulations, 2014 (as amended) (EIA Regs) - Requirements for Specialist Reports (Appendix 6), where applicable.

1.1. Project Details

Applicant	BCR Coal (Pty) Ltd
Mine	Proposed Vlakfontein Coal Mine
Co-ordinates	26.370375°S 28.491806°E
Municipality and Province	Msukaligwa Local Municipality, Mpumalanga Province.
AEL number	Not required
Mining Right	Currently in the process of applying for one through an Environmental Impact Assessment (EIA) process

Designated Air Quality Priority Area	Highveld Priority Area The designated air quality priority area was also highlighted in the screening report.
Modelling contractor	Rayten Engineering Solutions (Pty) Ltd *Gertrude Mafusire (MPhil.)* *Snr Air Quality Specialist* *5 years working experience* *0117920880* *info@rayten.co.za*

1.2. Brief Project Description

Mining at the proposed Vlakfontein Coal Mine will be by means of conventional truck and shovel operations and will initially be by opencast only, with an expected life-of-mine of 18 years. The surface sub-outcrop of the coal seams 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. Ore (Run-of Mine: ROM) will be loaded onto trucks at the pit area using excavators and transported via trucks on an unpaved haul route to the ROM pad (for stockpiling) and to the preferred Washing plant for further processing. Several stockpile areas will be established and used for storage of different type of material, mainly ROM ore, topsoil and overburden (softs and hards).

The focus of this study is to quantify emissions of dustfall, PM_{10} and $PM_{2.5}$ associated with operational activities at the proposed Vlakfontein Coal Mine, which include:

- Drilling and blasting at the opencast pit (to break the hard overburden and coal seams);
- Bulldozing (moving material and shaping stockpiles);
- Materials handling operations (truck loading/offloading operations);
- Transportation/hauling of Run-of-Mine (ROM) ore and overburden material (trucks);
- Material storage: Stockpiling;
- Crushing and screening;
- Excavators (stripping ore and overburden and loading trucks);
- Wind erosion from exposed areas (i.e. the open cast pit, exposed surfaces, and material stockpile areas); and
- Vehicle dust entrainment on unpaved roads.

A preliminary site layout diagram is given in Figure 1-1. This was considered as the preferred layout plan for the proposed Vlakfontein Coal Mine and will be used in this Baseline Air Quality Assessment.

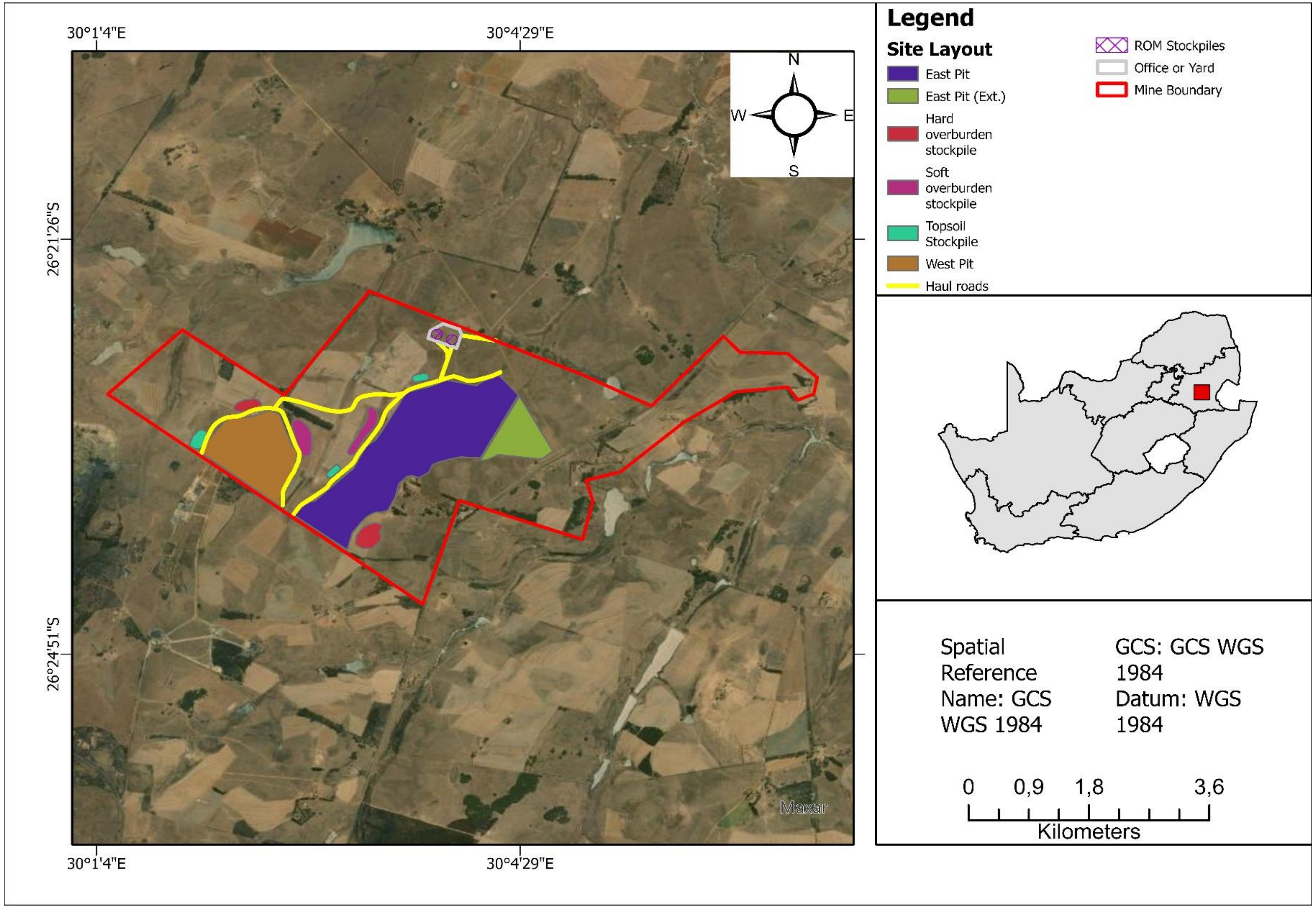

Figure 1-1: Proposed Vlakfontein Coal Mine Preliminary Layout Plan.

1.3. Terms of Reference

The scope of work for the Baseline Air Quality Assessment for the proposed Vlakfontein Coal Mine is as follows:

- A review of the study site and activities;
- An overview of the prevailing meteorological conditions in the area, which influence the dilution and dispersion of pollutants in the atmosphere;
- The identification of existing sources of emissions;
- The identification of key air pollutants of concern that may be emitted from proposed mining activities (dustfall, PM_{10} and $PM_{2.5}$);
- Characterisation of the ambient air quality within the area using available air quality monitoring data;
- A review of the current South African legislative and regulatory requirements for air quality; and
- The identification of sensitive receptors, such as local communities, surrounding the study area.

1.4. Outline of Report

An overview of the site location including surrounding receptors is given in **Section 2**. National Ambient Air Quality Standards, dust control regulations and associated health impacts for the relevant criteria pollutants are discussed in **Section 3**. The local meteorological conditions, baseline air pollutants concentrations and potential emissions associated with the proposed operation are provided in **Section 4**. Potential emissions associated with proposed operations are outlined in **Section 5**, with the report summary presented in **Section 6**.

2. SITE CHARACTERISTICS

2.1. Site Location

The proposed mine is located on Portions 2, 11 and 21 of the farm Vlakfontein 108 IT, Portions 1, 7, 14, and 12 of the farm Welgelegen 107 IT, 14.5km north-east of Ermelo, within Msukaligwa Local Municipality and Gert Sibande District Municipality, Mpumalanga Province (26.493348°S; 29.968054°E) (Figure 2-3). The project area falls within the Nationally Declared Highveld Air Quality Priority Area (HPA).

2.1.1. Highveld Priority Area Air Quality Management Plan

The HPA was declared a priority area by the Minister of Environmental Affairs and Tourism on 23 November 2007 under the National Environmental Management Air Quality Act (Act No. 39 of 2004) (NEM:AQA) (Government Gazette, No. 30518 of 23 November 2007). A Priority Area is usually associated with elevated ambient concentrations of criteria air pollutants such as PM_{10}, $PM_{2.5}$, SO_2 and NO_x. Generally, a high number of emitters (industrial and non-industrial) are also concentrated in these areas. In order to meet the requirements of the NEM: AQA, an Air Quality Management Plan (AQMP) was compiled for the HPA and provides a management tool that can be used and implemented by departments and industry to ensure effective air quality management within the area.

The primary aim of the AQMP is to provide a framework including short to long term strategies and programs that can be used to work towards achieving and maintaining compliance with the National Ambient Air Quality Standards within the HPA. In the HPA, industrial emitters were identified as the most significant contributor of emissions accounting for 89% of PM_{10}, 90% of NO_x and 99% of SO_2. Industrial emitters within the HPA include (DEA, 2011):

- Power generation;
- Coal mining;
- Primary & secondary metallurgical operations;
- Brick manufacturers;
- Petrochemical industry;
- Ekurhuleni industrial sources (excluding the above); and
- Mpumalanga industrial sources (excluding the above).

An assessment of ambient air quality monitoring data within the HPA, allowed for the following areas to be identified as areas of concern. These areas are associated with high frequency exceedances of the PM_{10} and SO_2 ambient standards. The air quality monitoring data for the HPA also shows seasonal trends. Higher frequency of exceedances of the standards are observed during the winter season where the dispersion potential of ground level pollutants (e.g. vehicle exhaust emissions) are largely reduced due to the strengthening of surface inversions (DEA, 2011).

- Witbank;
- Middelburg;
- Secunda;
- Ermelo;
- Standerton;
- Balfour; and
- Komati.

A comprehensive emissions inventory was compiled for the HPA. A combination of ambient air quality monitoring and dispersion modelling results identified nine areas within the HPA as hotspot areas, where ambient concentrations of PM_{10}, SO_2 and NO_2 frequently exceed and/or were predicted to exceed the ambient standards (Table 2-1). Residential areas associated with a high level of domestic fuel burning (wood and coal) were identified to experience high concentrations of particulates and CO.

Table 2-1: HPA Air Quality Hot Spot Areas (DEA, 2011;20).

Hot Spot	PM_{10}	SO_2	NO_2
Emalahleni	✓	✓	
Kriel		✓	
Steve Tshwete	✓	✓	✓
Ermelo	✓	✓	
Secunda	✓	✓	✓
Ekurhuleni	✓	✓	
Lekwa	✓	✓	
Balfour	✓		
Delmas		✓	

In order to achieve compliance with the National Ambient Air Quality Standards for criteria pollutants within the HPA, the AQMP for the HPA developed seven goals which are given below (DEA, 2011):

1. ***Goal 1:*** *By 2015, organisational capacity in government is optimised to efficiently and effectively maintain, monitor and enforce compliance with ambient air quality standards.*
2. ***Goal 2:*** *By 2020, industrial emissions are equitably reduced to achieve compliance with ambient air quality standards and dustfall limit values.*
3. ***Goal 3:*** *By 2020, air quality in all low-income settlements is in full compliance with ambient air quality standards.*
4. ***Goal 4:*** *By 2020, all vehicles comply with the requirements of the National Vehicle Emission Strategy.*
5. ***Goal 5:*** *By 2020, a measurable increase in awareness and knowledge of air quality exists.*
6. ***Goal 6:*** *By 2020, biomass burning, and agricultural emissions will be 30% less than current.*
7. ***Goal 7:*** *By 2020, emissions from waste management are 40% less than current.*

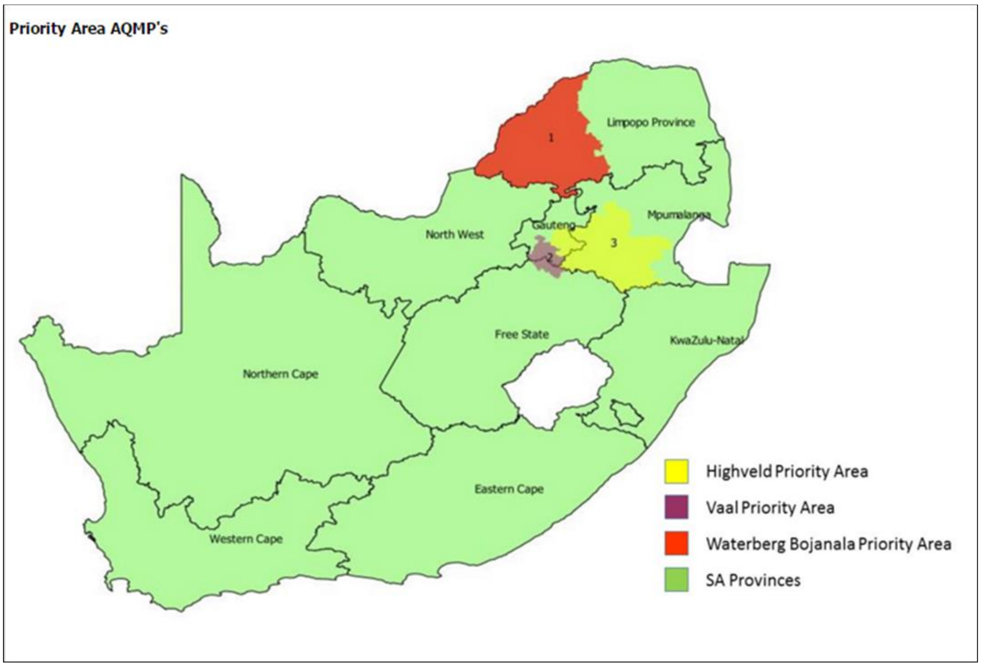

Figure 2-1: Air Quality Priority Areas.

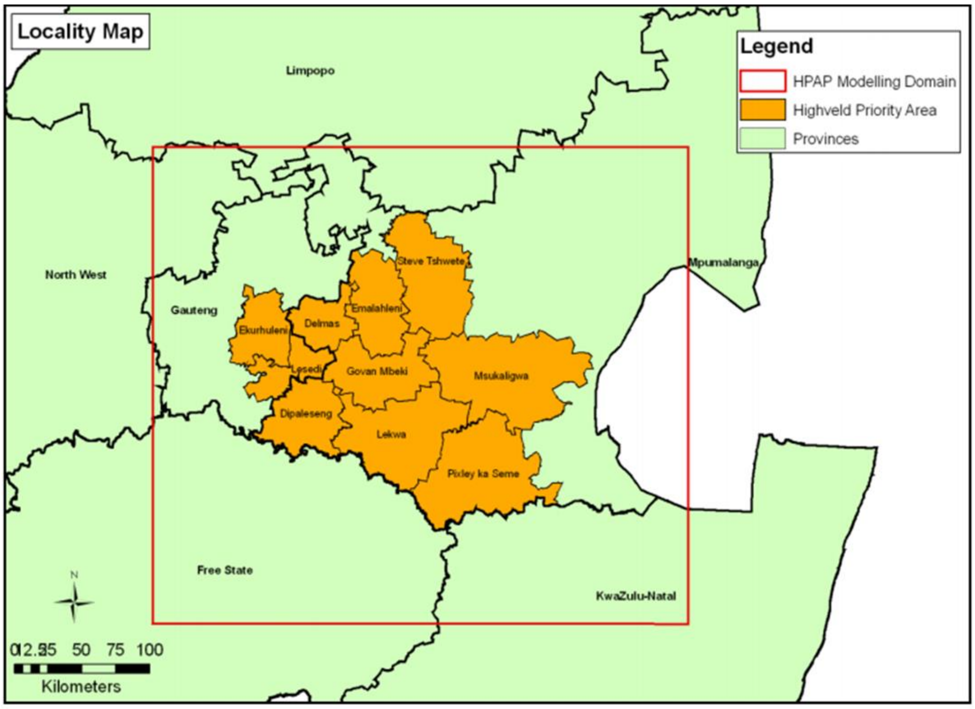

Figure 2-2: Highveld Priority Area (DEA, 2011).

2.2. Surrounding Land Use

The land use immediately surrounding the proposed Vlakfontein Coal Mine consists predominantly of grassland and cultivated land, with few areas consisting of mines and quarries and built-up areas waterbodies, wetlands, and forested land (Figure 2-4). The larger area surrounding the proposed mine is classified as rural in nature.

2.3. Topography

The topography surrounding the proposed Vlakfontein Coal Mine is shown in Figure 2-5. Surrounding elevations range from 1 614 – 1 840m above sea level. The project site is situated approximately 1 700 – 1 750 m above sea level; with increasing elevation mainly towards the north-west and south-west (Figure 2-5).

2.4. Sensitive Receptors

A sensitive receptor is defined as a person or place where involuntary exposure to air pollutants released by the site's activities could occur. Identified sensitive receptors, which are located within a 20km radius of the proposed mine are given in Figure 2-6. Receptors were identified through a desktop study.

These points are located at the centre of residentials areas, or near schools, hospitals and old age homes, in order to determine the maximum concentrations that could be expected near sensitive receptors. Discrete points are not plotted for each individual sensitive receptor but are used to represent a group of sensitive receptors located near to each other (e.g. several Schools). Maximum predicted incremental concentrations will be provided for the identified discrete receptors in the final AQIA report once dispersion modelling has been conducted.

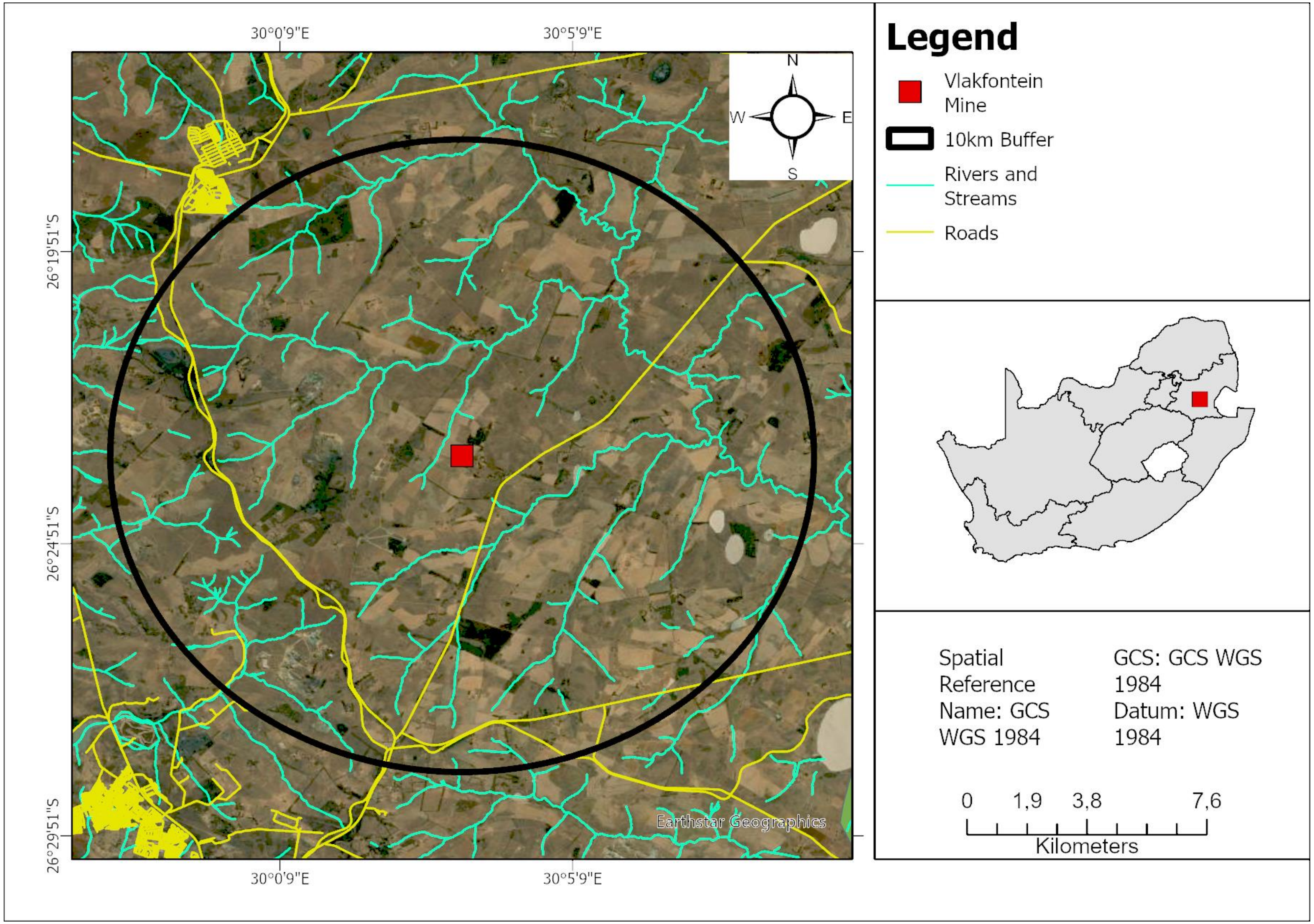

Figure 2-3: Site locality for the proposed Vlakfontein Coal Mine.

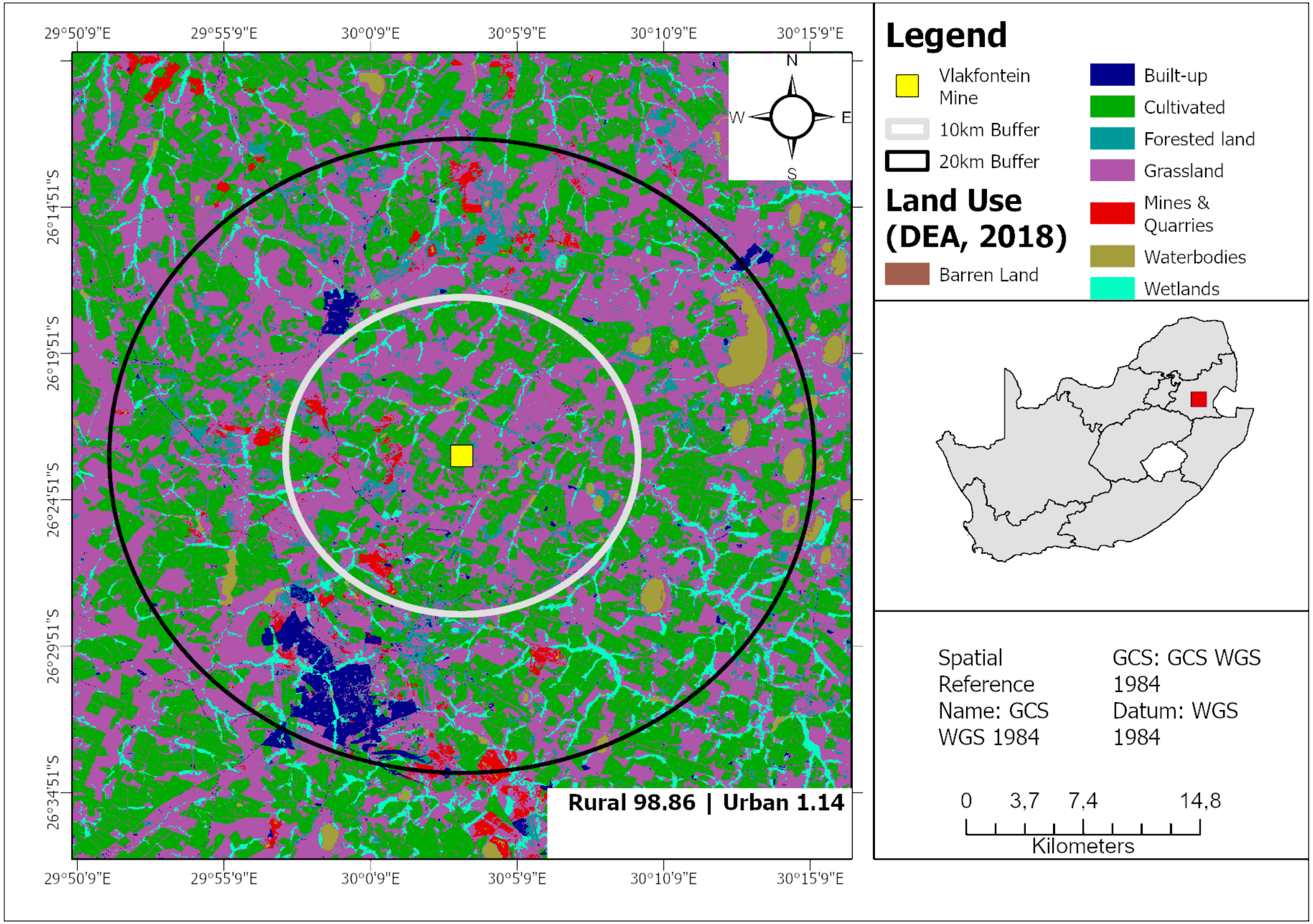

Figure 2-4: Land use surrounding the proposed Vlakfontein Coal Mine.

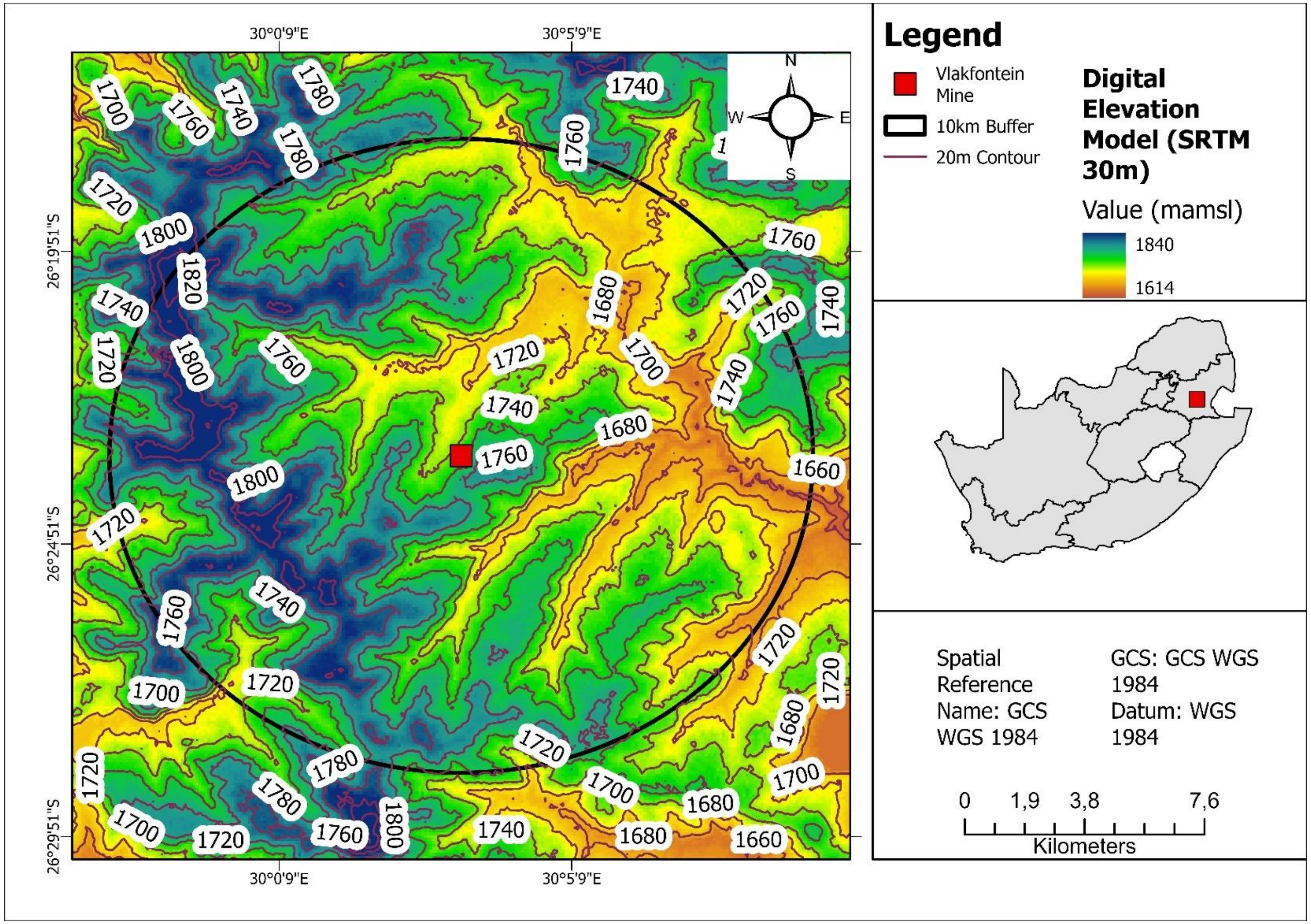

Figure 2-5: Elevation surrounding the proposed Vlakfontein Coal Mine.

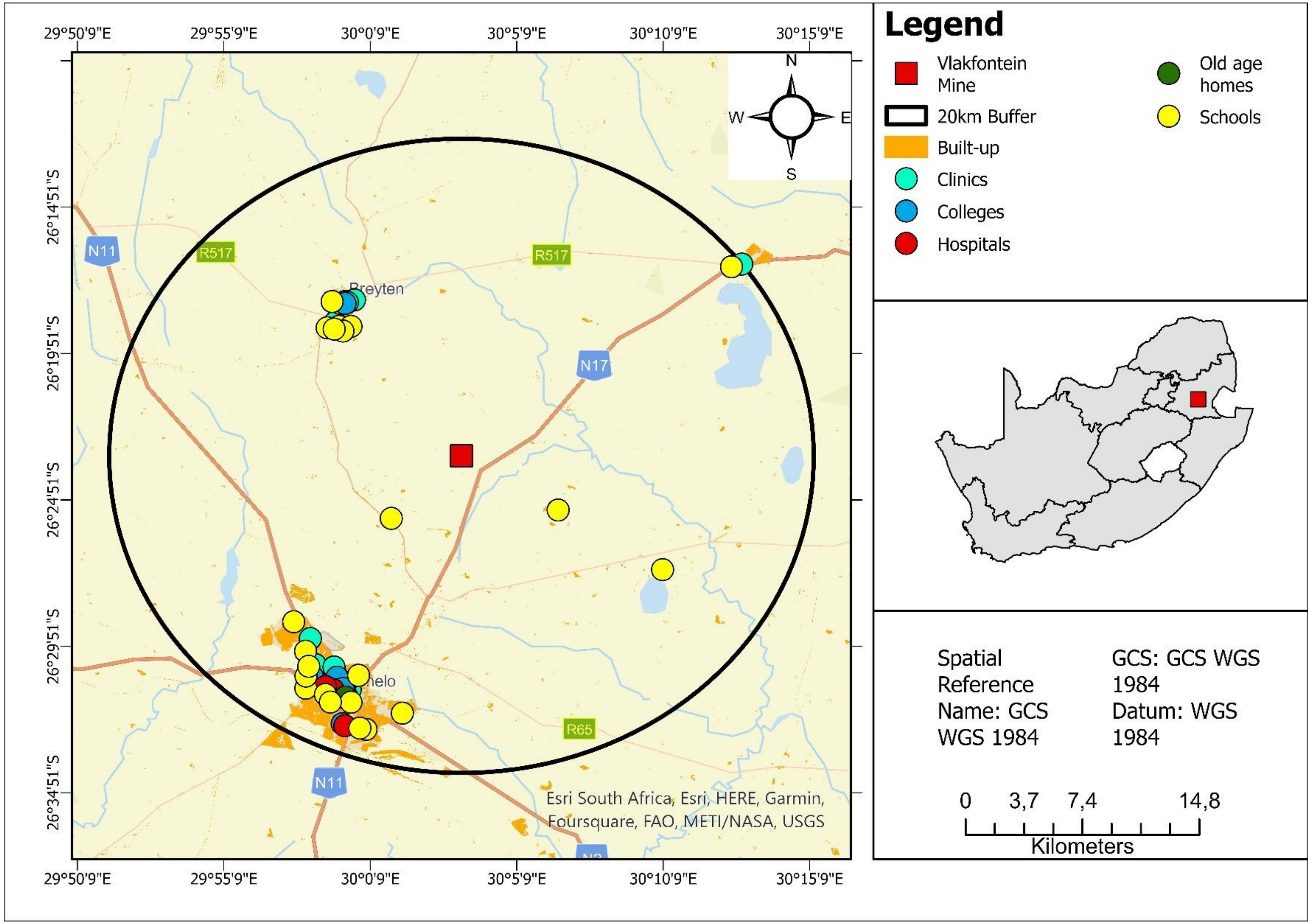

Figure 2-6: Sensitive receptors within 20km of the proposed Vlakfontein Coal Mine.

3. LEGISLATION

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

The NEM: AQA, has shifted the approach of air quality management from source-based control to receptor-based control. The main objectives of the Act are to;

- protect the environment by providing reasonable measures for—
    i. the protection and enhancement of the quality of air in the Republic;
    ii. the prevention of air pollution and ecological degradation; and
    iii. securing ecologically sustainable development while promoting justifiable economic and social development; and
- generally, to give effect to section 24(b) of the Constitution in order to enhance the quality of ambient air for the sake of securing an environment that is not harmful to the health and wellbeing of people.

The Act makes provisions for the setting and formulation of National Ambient Air Quality Standards for "substances or mixtures of substances which present a threat to health, well-being or the environment". More stringent standards can be established at the provincial and local levels.

The control and management of emissions in the NEM: AQA relates to the listing of activities that are sources of emissions and the issuing of Atmospheric Emission Licences (AEL). Listed activities are defined as activities which "result in atmospheric emissions and are regarded as having a significant detrimental effect on the environment, including human health". Listed activities have been identified by the Minister of the Department of Environmental Affairs (DEA) (now known as the Department of Forestry, Fisheries and the Environment (DFFE)) and atmospheric emission standards have been established for each of these activities. These listed activities now require an AEL to operate. The issuing of AELs for listed activities is the responsibility of the Metropolitan and District Municipalities, except for those associated within mining operations.

In addition, the Minister may declare any substance contributing to air pollution as a priority pollutant. Any industries or industrial sectors that emit these priority pollutants will be required to implement a Pollution Prevention Plan. Municipalities are required to "designate an air quality officer to be responsible for co-ordinating matters pertaining to air quality management in the Municipality". The appointed Air Quality Officer is responsible for the issuing of AELs.

3.2. Listed Activities and Minimum Emission Standards

The NEM: AQA requires all persons undertaking listed activities in terms of Section 21 of the Act to obtain an AEL. The listed activities and associated minimum emission standards were issued by the DEA on 31 March 2010 (Government Gazette No. 33064 of 31 March 2010) and were amended in:

- 2013 (Government Gazette No. 37054 of 22 November 2013);
- 2015 (Government Gazette No. 38863 of 12 June 2015);
- 2018 (Government Gazette No.41650 of 25 May 2018; Government Gazette No.42013 of 31 October 2018);

- 2019 (Government Gazette No.42472 of 22 May 2019); and
- 2020 (Government Gazette No. 43174 of 27 March 2020).

The proposed Vlakfontein Coal Mine will not trigger any of the S21 listed activities based on their proposed operations.

South Africa launched an online National reporting system, referred to as the National Atmospheric Emissions Inventory System (NAEIS). The NEM:AQA requires all emission source groups identified in terms of the National Atmospheric Emission Reporting Regulations (Government Gazette No. 38633 of 02 April 2015), to register and report emissions on the NAEIS. Mines are classified as Group C emitters and thus are required to report annually and comply with the National Atmospheric Emission Reporting Regulations.

Once operational, the proposed Vlakfontein Coal Mine must register on the NAEIS and report on their fugitive dust emissions annually before the 31 March each year.

3.3. Ambient Air Quality Standards

National Ambient Air Quality Standards (NAAQS), including permitted frequencies of exceedance and compliance timeframes, were issued by the Minister of Water and Environmental Affairs on 24 December 2009 (Table 3-1). National standards for $PM_{2.5}$ were established by the Minister of Water and Environmental Affairs on 29 June 2012.

Table 3-1: National Ambient Air Quality Standards for Criteria Pollutants.

POLLUTANT	AVERAGING PERIOD	CONCENTRATION ($\mu g/m^3$)	FREQUENCY OF EXCEEDANCE (3)
Sulphur dioxide (SO_2)	10 minutes	500 (191)	526
	1 hour	350 (134)	88
	24 hours	125 (48)	4
	1 year	50 (19)	0
Nitrogen dioxide (NO_2)	1 hour	200 (106)	88
	1 year	40 (21)	0
Particulate Matter (PM_{10})	24 hours	75	4
	1 year	40	0
Particulate Matter ($PM_{2.5}$)	24 hours	40(1) 25(2)	0
	1 year	20(1) 15(2)	0
Ozone (O_3)	8 hours (running)	120 (61)	11
Benzene (C_6H_6)	1 year	5 (1.6)	0
Lead (Pb)	1 year	0.5	0
Carbon monoxide (CO)	1 hour	30 000 (26 000)	88
	8 hours (calculated on 1 hourly averages)	10 000 (8 700)	11

Notes:

*Values indicated in blue are expressed in part per billion (ppb)

(1) Compliance required by 1 January 2016 – 31 December 2029.

(2) Compliance required by 1 January 2030.

(3) Frequency of exceedance refers to the number of times an exceedance is allowed within a calendar year.

3.4. Dust Deposition Standards

The DEA (now known as the DFFE) issued National Dust Control Regulations promulgated in Government Notice R517 of 2018, which came into effect on 1 November 2019 (Table 3-2). The purpose of the regulations is to prescribe general measures for the control of dust in all areas. The regulations prohibit activities which give rise to dust in such quantities and concentrations that the dustfall at the boundary or beyond the boundary of the premises where it originates exceeds:

a) 600 mg/m^2/day averaged over 30 days in residential areas measured using reference method ASTM D1739.
b) 1 200 mg/m^2/day averaged over 30 days in non-residential areas measured using reference method ASTM D1739.

Table 3-2: South African National Dust Control Regulations.

RESTRICTION AREAS	DUST-FALL RATE (D) (1)	REQUENCY OF EXCEEDANCE
Residential Areas	D < 600 mg/m^2/day	Two within a year, no two sequential months (2)
Non-residential areas	600 < D < 1200 mg/m^2/day	Two within a year, no two sequential months (2)

Notes:

(1) Averaged over 1 month (30±2-day average) (mg/m^2/day)

(2) Per dustfall monitoring site.

Any person who has exceeded the dustfall standard must, within three months after submission of a dustfall monitoring report, develop and submit a dust management plan to the air quality officer for approval. The dust management plan must:

a) Identify all possible sources of dust within the affected site;
b) Detail the best practicable measures to be undertaken to mitigate dust emissions;
c) Develop an implementation schedule;
d) Identify the line management responsible for implementation;
e) Incorporate the dustfall monitoring plan;
f) Establish a register for recording all complaints received by the person regarding dustfall, and for recording follow up actions and responses to the complainants.

The dust management plan must be implemented within a month of the date of approval. An implementation progress report must be submitted to the air quality officer at agreed time intervals.

3.5. Greenhouse Gas (GHG) Emissions

On 14 March 2014, the DEA (now known as the DFFE) (Government Gazette No. 37421 of 14 March 2014) declared the following six GHGs 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), as amended (General Notice 994 in Government Notice 43712 of 11 September 2020), were published by the DEA (now known as the DFFE). A person identified as a Category A data provider in terms of Annexure 1 of these regulations, must register their facilities using the online South African Greenhouse Gas Emissions Reporting System (SAGERS) and must submit a GHG emissions inventory, activity data and report in the required format given under Annexure 3 of these regulations on an annual basis. All data must be provided annually, by the 31 March of the following year. 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, as amended (General Notice 994 in Government Notice 43712 of 11 September 2020)), 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
- Carbon black production
- Iron & steel production
- Ferro-alloys production
- Aluminium production
- Polymers production
- Pulp and paper production

- Production of liquid fuels from coal or gas
- Cement production
- Glass production
- Ammonia production
- Electricity production
- Nitric acid production

Should the proposed Vlakfontein Coal Mine trigger any of the activities in terms of Annexure A, they will need to quantify and report on their GHG emissions by the 31 March of each year.

Mining falls under category 1A2i (i.e. Mining and Quarrying) in terms of Annexure 1 of the National GHG emission reporting regulations (Government Gazette No. 40762 of 3 April 2017), as amended (General Notice 994 in Government Notice 43712 of 11 September 2020). All facilities conducting this activity (i.e. Mining and Quarrying) are required to register and report on their GHG emissions by the 31 March of every year if they trigger the required reporting thresholds (i.e. if they have stationary fuel combustion installations with a combined net heat input greater than 10MW).

3.6. Carbon Tax Act

The Carbon Tax Act No. 15 of 2019 was promulgated on the 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 DFFE by the 31 March each year and pay tax on those emissions by July each year.

The tax rate is R120 per tonne 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 tonne 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 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%.

3.7. Human Health Effects (Dustfall and Particulates)

3.7.1. Dustfall

Dustfall are particles with an aerodynamic diameter greater than 20 µm that have been entrained into the air by a physical process such as wind, movement of vehicles, stack emissions or from fugitive dust. These particles are generally too heavy to remain in suspension in the air for any period and fall out of the air over a relatively short distance depending on a combination of various factors such as particle size, density, temperature (of the air and particle), emission velocity or method, ambient wind speed and humidity. These particles are therefore commonly known as "dustfall". Particulates in this range are generally classified as a nuisance dust and can cause physical damage to property and physical irritation to plants, animals and humans.

3.7.2. Particulates (PM_{10} & $PM_{2.5}$)

Particles can be classified by their aerodynamic properties into coarse particles, PM_{10} (particulate matter with an aerodynamic diameter equal to or less than 10 µm) and fine particles, $PM_{2.5}$ (particulate matter with an aerodynamic diameter equal to or less than 2.5 µm). The fine particles mostly contain secondary formed aerosols such as sulphates and nitrates, combustion particles and re-condensed organic and metal vapours. The coarse particles mostly contain earth crust materials and fugitive dust from roads and industries (Harrison and van Grieken, 1998) (Fenger, 2002).

In terms of health impacts, particulate air pollution is associated with effects on the respiratory system (WHO, 2000). When looking at human health particle size is an important factor to consider because it controls where in the respiratory system a given particle will be deposited. Fine particles are thought to be more damaging to human health than coarse particles as larger particles do not penetrate deep into the lungs compared to smaller particles. Larger particles are deposited into the extra thoracic part of the respiratory tract while smaller particles are deposited into smaller airways that lead to the respiratory bronchioles (WHO, 2000).

Recent studies suggest that short-term exposure to particulate matter leads to adverse health effects, even at low concentrations of exposure (below 100 µg/m^3). Morbidity effects associated with short-term exposure to particulates include increases in lower respiratory symptoms, medication use and small reductions in lung function. Long-term exposure to low concentrations (~10 µg/m^3) of particulates is associated with mortality and other chronic effects such as increased rates of bronchitis and reduced lung function (WHO, 2000). Those most at risk include the elderly, individuals with pre-existing heart or lung disease, asthmatics and children.

4. BASELINE ASSESSMENT

4.1. Meteorological Overview

Meteorological processes will determine the dispersion and dilution potential of pollutants emitted into the atmosphere. The vertical dispersion of pollution is governed by the stability of the atmosphere as well as the depth of the surface mixing layer. Horizontal dispersion of pollution is defined by dominant wind fields. Therefore, meteorological parameters including temperature, precipitation, wind speed and wind direction are of significance as they will influence the degree to which pollution will accumulate or disperse in the atmosphere.

As per the Code of Practice for Air Dispersion Modelling in Air Quality Management in South Africa (DEA, 2014), representativeness of the meteorological data is influenced by the following four factors:

- Proximity of the meteorological site to the area being modelled;
- Complexity of the terrain;
- Exposure of the meteorological measurement site; and
- Period of data collection.

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. MM5 is a PSU/NCAR meso-scale model used to predict meso-scale and regional-scale atmospheric circulation. The model provides integrated model meteorological data, which can be used in a wide range of applications. This model is often used to create weather forecasts and climate projections. Details of the meteorological data obtained are summarised in Table 4-1 below.

The South African dispersion modelling regulations requires a minimum of 3-years of meteorological data for input into the dispersion model. The meteorological overview given below is with reference to the data used for input into the model. The meteorological data is representative of recent prevailing weather conditions that will likely be experienced at the project site.

Table 4-1: Meteorological Data Details.

Meteorological Data Details	
Met Data Information	**Description**
Met data type	MM5 AERMET-Ready (Surface & Upper Air Data)
Datum	WGS 84
Closest Town	Ermelo - South Africa
Co-ordinates of centre of met grid:	
Latitude	26.383180°S
Longitude	30.050841°E
Time zone	UTC +2 hours
Period of record	January 2019 - December 2021
Met Station Parameters	**Description**
Anemometer height	13 m
Station base elevation	1718 m
Upper air adjustment	-2 hours
Grid Cell Information	
Cell centre	26.383180°S, 30.050841° E
Cell dimension	12km * 12km
Surface Met Data	**Description**
File format	SAMSON file
Output interval	Hourly
Upper Air Data	**Description**
Format	TD-6201- Fixed Length
Reported in	GMT

Output interval	00Z and 12Z
Models used to process met data	
Model used to process data for wind roses	WR Plot
Model used to process data for AERMOD	AERMET

4.1.1. Local Wind Field

Figure 4-1 below provides the period wind rose plot for the proposed Vlakfontein Coal Mine for the period January 2019 to December 2021. The predominant wind directions for the period are observed from the north-northeast (9.2% of the time), north-east (8.28% of the time) and west-northwest/east-south-east (8.28% of the time). Wind speeds for the three-year period are generally moderate to fast with calm conditions, defined as wind speeds less than 1 m/s, observed for 8.34% of the time (Figure 4-1).

The morning (AM) and evening (PM) period wind rose plots for the period January 2019 to December 2021 are given in Figure 4-2 below and show significant diurnal variation in the wind field data. During the morning (AM) period, high frequency winds are observed from the north-west, north-northeast and north; as opposed to the evening (PM) period, where winds are predominantly observed from the north-east, east-southeast and west-northwest (Figure 4-2). Greater variation in winds is observed during the evening period.

Seasonal variation in winds at the proposed Vlakfontein Coal Mine is shown in Figure 4-3 below. Prevailing winds in summer originate from the north-eastern quadrant, similar to prevailing winds observed in spring. However, additional north-westerly winds are observed in spring. During the autumn season, north-easterly and west-northwesterly winds prevail, while the winter season is characterised by high frequency west-northwesterly and east-southeasterly winds. Additional less frequent north-westerly/south-westerly and east-south-easterly/north-northeasterly winds are observed in winter and autumn, respectively. Wind speeds were generally high during all seasons, which could subsequently facilitate dust emissions from stockpiles, onsite and offsite activities.

Based on the prevailing wind fields for the period January 2019 to December 2021, emissions from activities at the proposed Vlakfontein Mine will likely be transported towards the south-westerly, east-southeasterly and west-northwesterly wind directions. Moderate to fast wind speeds observed during all the time periods, may result in effective dispersion and dilution of emissions from the proposed mine operations; however, higher winds speeds can also facilitate fugitive dust emissions from open exposed areas such as stockpiles and opencast areas.

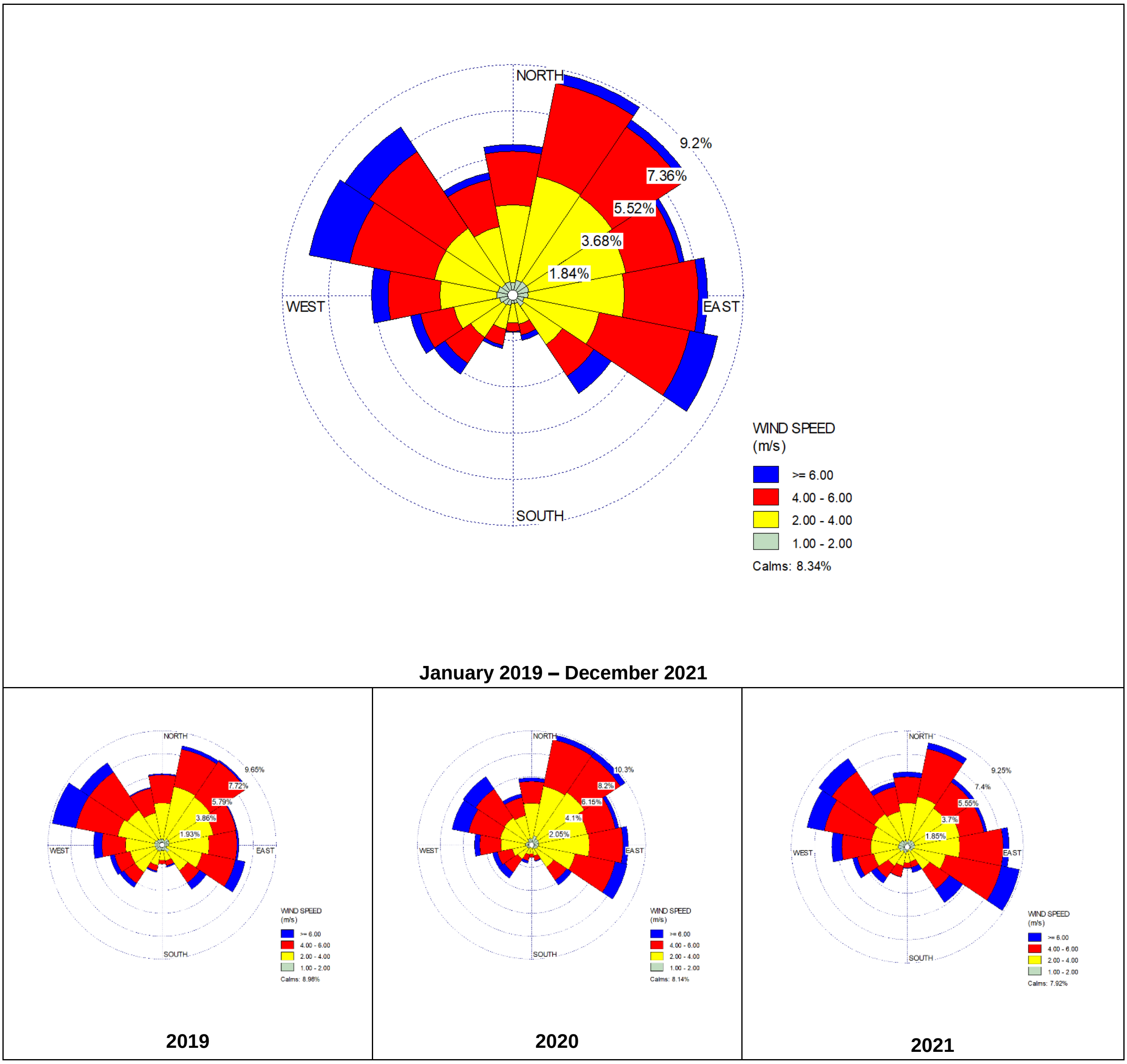

Figure 4-1: Period Wind Rose Plots for the proposed Vlakfontein Coal Mine for the period January 2019 - December 2021.

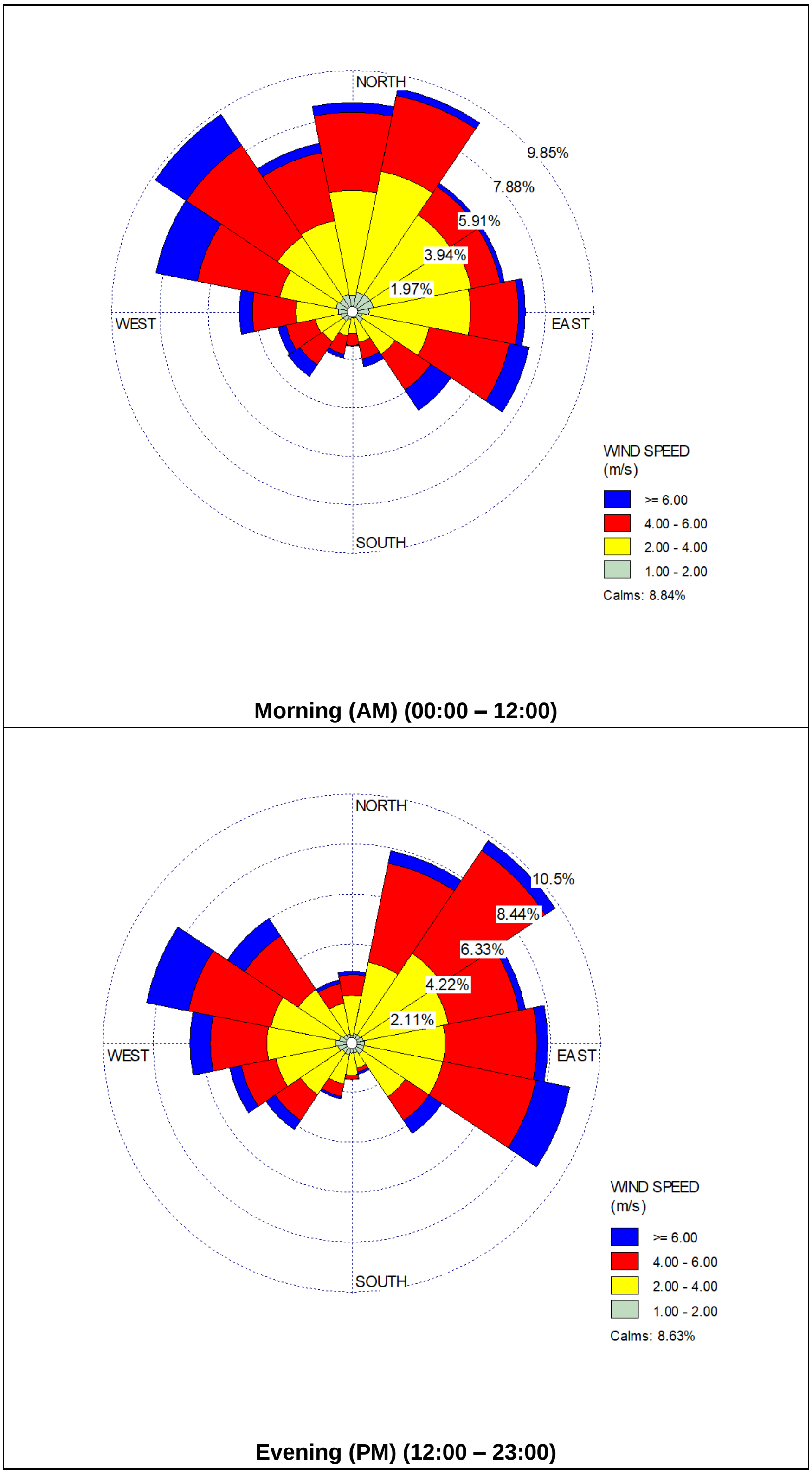

Figure 4-2: Morning (AM) (00:00 - 12:00) and Evening (PM) (12:00 - 23:00) Period Wind Rose Plots for proposed Vlakfontein Coal Mine for the Period January 2019 - December 2021.

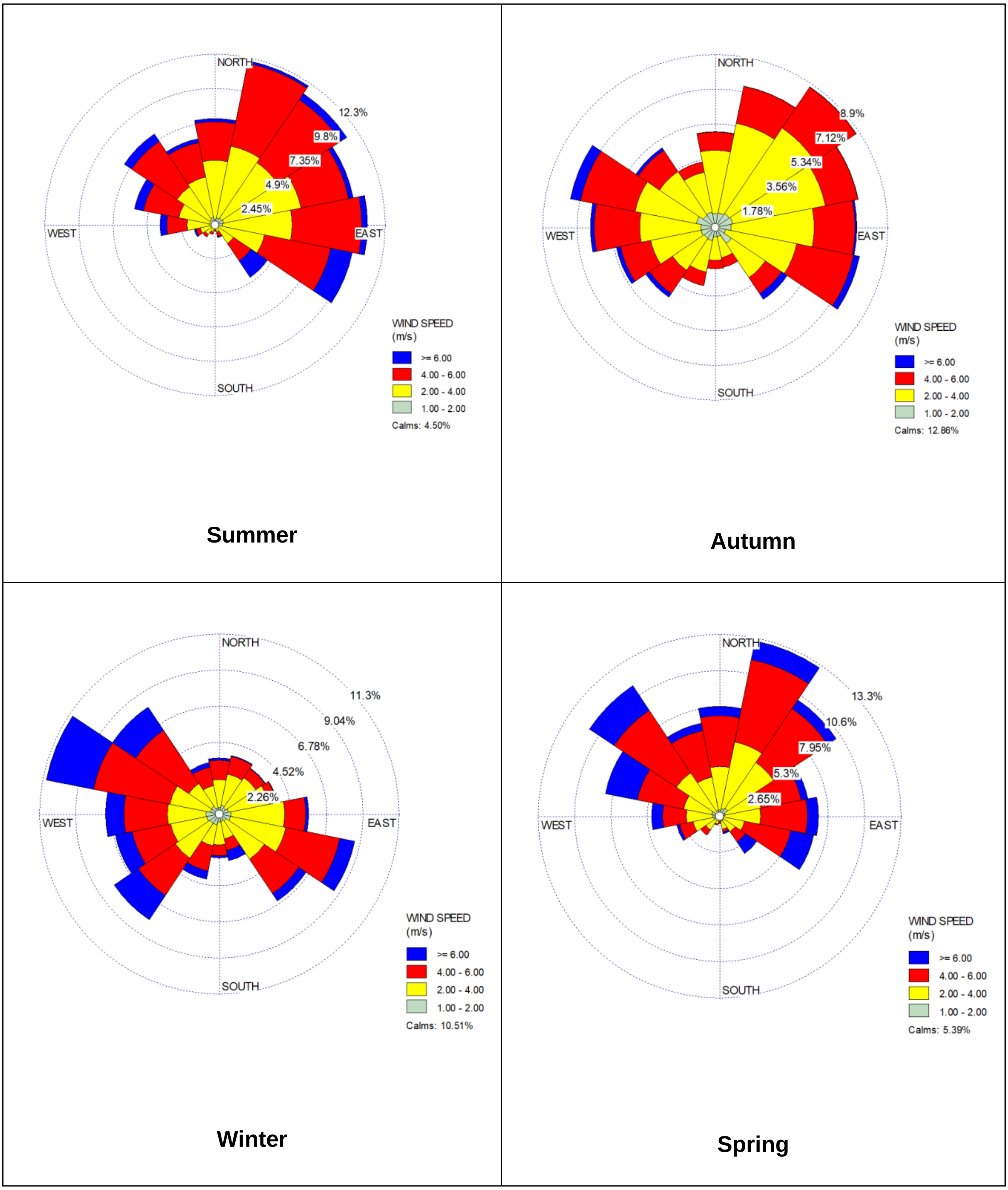

Figure 4-3: Seasonal Variation of Winds for the proposed Vlakfontein Coal Mine for the Period January 2019 - December 2021.

4.1.2. Temperature and Relative Humidity

Temperature affects the formation, action and interactions of pollutants in various ways. Temperature provides an indication of the rate of development and dissipation of the mixing layer, which is largely controlled by surface inversions. Surface temperature inversions play a major role in air quality, especially during the winter months when these inversions are the strongest. Higher ambient temperatures will facilitate the dispersion of air pollutants which can result in lower ambient concentrations.

Chemical reaction rates also tend to increase with temperature and the warmer the air, the more water it can hold and therefore the higher the humidity. When relative humidity exceeds 70%, light scattering by suspended particles begins to increase, as a function of increased water uptake by the particles. This results in decreased visibility due to the resultant haze. Many pollutants may also dissolve in water to form acids.

The Mpumalanga Province generally experiences a varied climate with warm summers and cold winters. Monthly average temperatures and relative humidity profiles at the project site for the period January 2019 to December 2021 are presented in Figure 4-4 below. Average monthly temperatures range from 7.67 – 18.98 ºC (Table 4-2). Highest temperatures are observed during the early-spring to early-autumn months (September– March), while minimum temperatures are observed during the mid-autumn to late-winter months (April – August). Relative humidity is higher from December to April, June and August, and lower but consistent for the remainder of the year.

Table 4-2: Hourly Minimum, Maximum and Monthly Average Temperatures for January 2019 - December 2021.

MINIMUM, MAXIMUM AND MONTHLY AVERAGE TEMPERATURES (ºC)												
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Min	7.0	8.0	7.6	3.4	-0.4	-1.2	-2.8	-1.6	1.6	2.4	9.0	7.0
Max	29.1	27.1	27.1	25.2	20.4	18.1	17.8	21.2	24.0	27.8	30.0	29.6
Avg	19.0	18.5	17.2	14.3	11.0	8.0	7.7	10.7	13.1	15.9	18.7	18.9

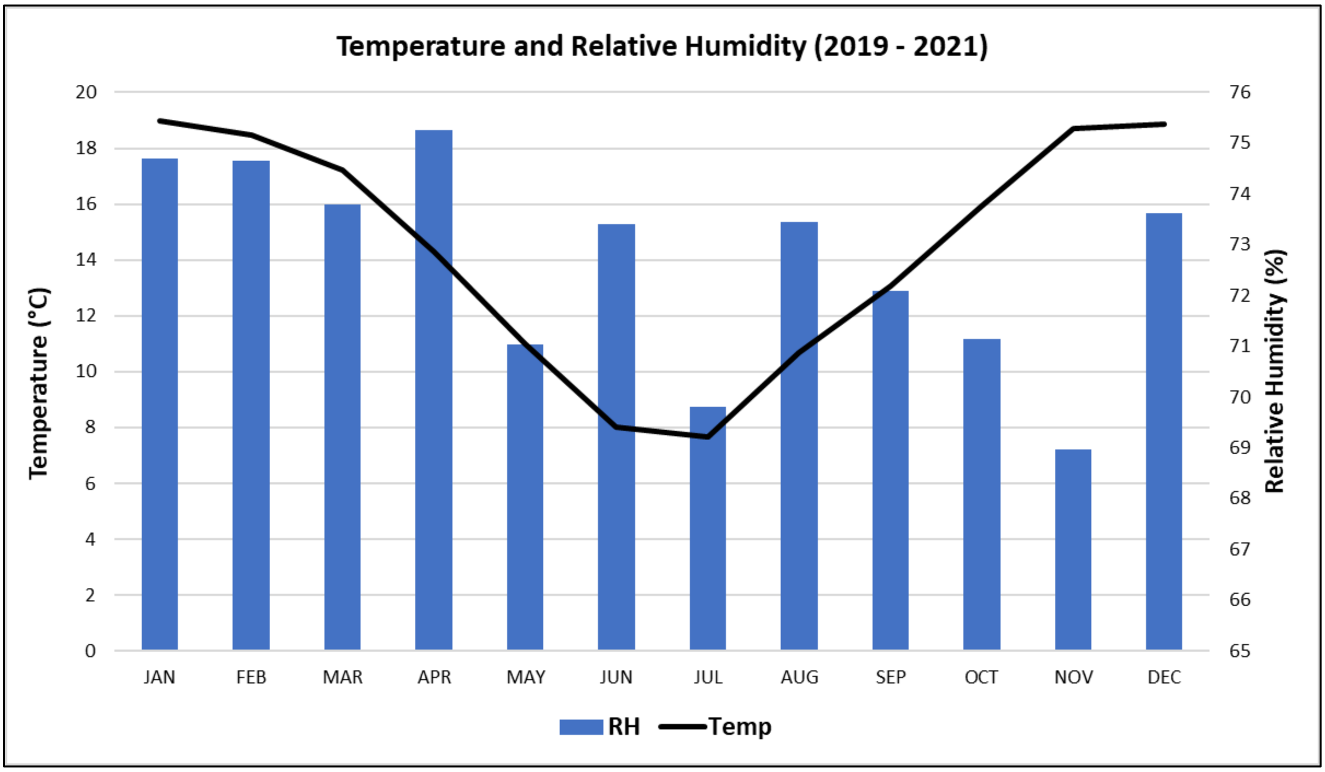

Figure 4-4: Monthly Average Temperature and Relative Humidity profiles for the proposed Vlakfontein Coal Mine for January 2019 - December 2021.

4.1.3. Precipitation

Precipitation has an overall dilution effect and cleanses the air by washing out particles suspended in the atmosphere. Monthly total rainfall at the project site for the period January 2019 to December 2021 is presented in Figure 4-5. The area receives most of its rainfall during the spring, summer and early-autumn months (September – April), with little to no rainfall observed during the late-autumn and winter months (May – August) (Table 4-3). Removal of particulates via wet depositional processes would be evident during the warmer (wet) seasons thus lower ambient concentrations of dust could be expected during these seasons. Over the remainder of the year higher ambient concentrations of particulates could be expected.

Table 4-3: Total Monthly Rainfall for January 2019 - December 2021.

TOTAL MONTHLY RAINFALL (mm)													
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
2019	166	146	62	66	6	0	0	0	21	44	134	318	962
2020	268	102	90	35	1	0	0	4	40	75	195	220	1029
2021	211	273	62	19	3	3	0	8	71	46	102	178	976

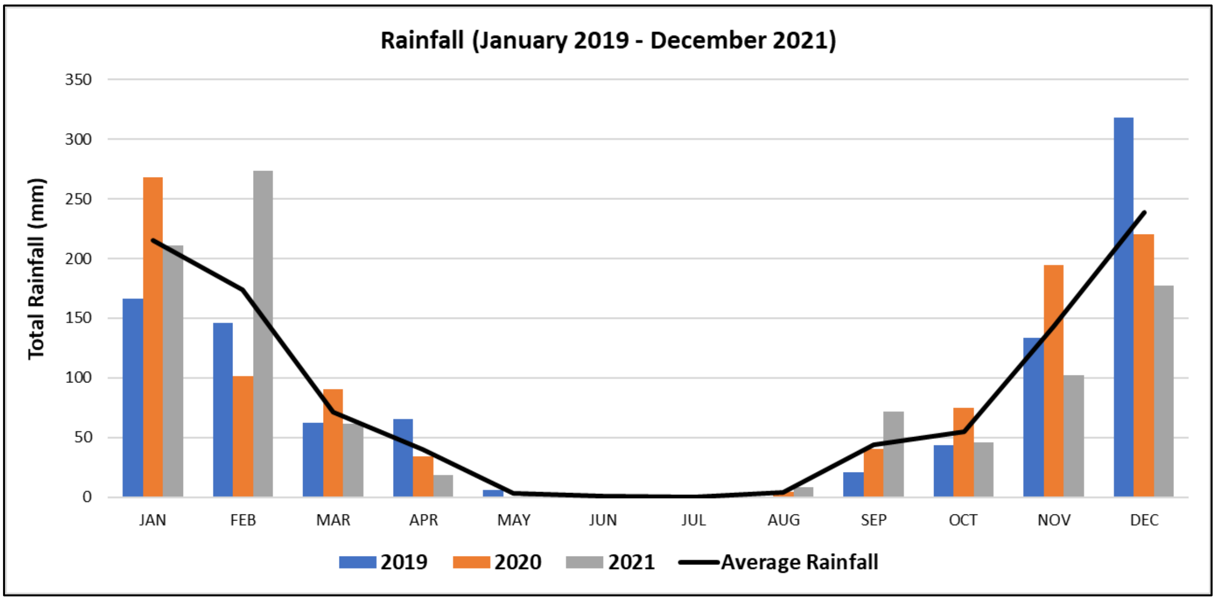

Figure 4-5: Total Monthly and Average Rainfall (mm) for the proposed Vlakfontein Coal Mine for the period January 2019 - December 2021.

4.2. Baseline Air Quality Concentrations

The existing air quality situation was evaluated using available monitoring data for PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO and O_3 from a permanent ambient air quality monitoring station (AQMS), at the Ermelo Station (-26.493348°S; 29.968054°E), located approximately 13km south-west of the proposed mine (Figure 4-6). The ambient air quality monitoring data covers the period 01 January 2016 – 31 December 2021. Table 4-4 below provides the data capture rate for the monitoring period under review.

Dustfall data could not be provided in this AQIAr as there are no available dustfall networks operated near the project site, that could be determined.

Table 4-4: Data Capture (Ermelo AQMS)

Pollutant	Data Capture Rate (%) (January 2016 – December 2021)
PM_{10}	50.7
$PM_{2.5}$	50.4
SO_2	86.8
NO_2	52.7
CO	74.0
O_3	87.4
Average	**67**

Figure 4-6: Locality of Ermelo AQMS (yellow pin) in relation to the proposed Vlakfontein Mine (black outline). A 20km radius from the proposed mine is represented by the red solid line.

4.2.1. PM_{10} concentrations

PM_{10} concentrations at the Ermelo AQMS for the period 01 January 2016 to 31 December 2021 are provided in Figure 4-7 to Figure 4-10 below. There was 50.7 % data capture in terms of PM_{10} concentrations at the Ermelo station. Daily average PM_{10} concentrations range between 0.00 µg/m^3 – 451.85 µg/m^3, with an average of 65.34 µg/m^3 (Figure 4-8). A total of 427 exceedances of the PM_{10} daily standard of 75 µg/m^3 were observed over the monitoring period.

This is expected due to existing PM_{10} sources located in the area, such as solid fuel combustion in the townships/informal settlements, small-scale agricultural activities and vehicle dust entrainment on unpaved roads.

Annual average PM_{10} concentrations range between 34.49 µg/m^3 – 98.38 µg/m^3 for the period (Table 4-5), with 4 exceedances of the annual standard of 40 µg/m^3 recorded for the years 2017 - 2018 and 2020 – 2021. Higher PM_{10} concentrations were observed between April and August (mid-autumn to late winter), with the highest daily concentration being recorded on 16 June 2021 (451.85 µg/m^3).

In terms of the South African NAAQS, 4 exceedances of the PM_{10} 24-hour standard are permitted within a calendar year, while no exceedances of the PM_{10} annual standard are permitted.

Table 4-5: Annual Average Concentrations for PM_{10}

Year	Annual Average (µg/m^3)	Annual NAAQS (µg/m^3)
2016	36.64	40
2017	54.57	40
2018	56.75	40
2019	34.49	40
2020	91.21	40
2021	98.38	40

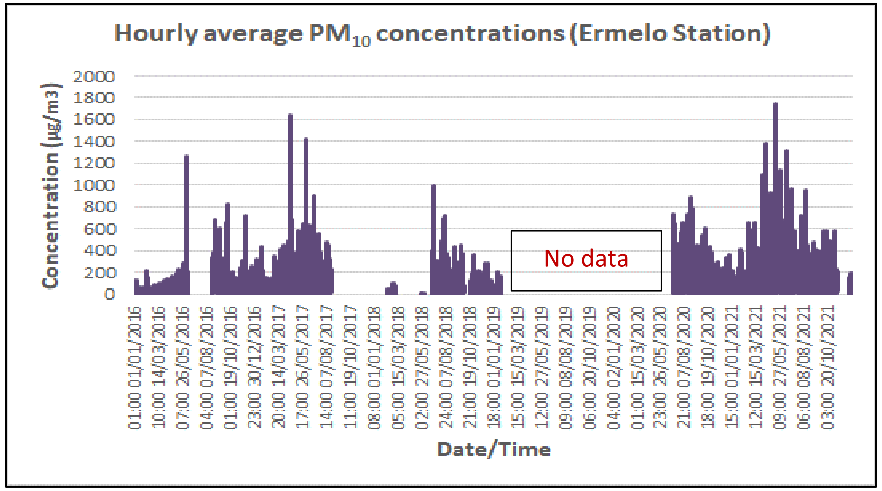

Figure 4-7: Hourly PM$_{10}$ concentrations at the Ermelo AQMS for the period January 2016 – December 2021.

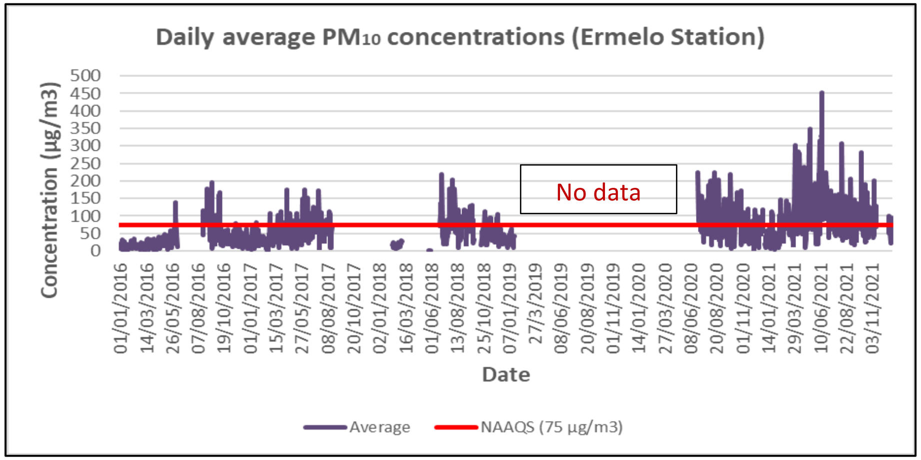

Figure 4-8: Daily PM$_{10}$ concentrations at the Ermelo AQMS for the period January 2016 – December 2021.

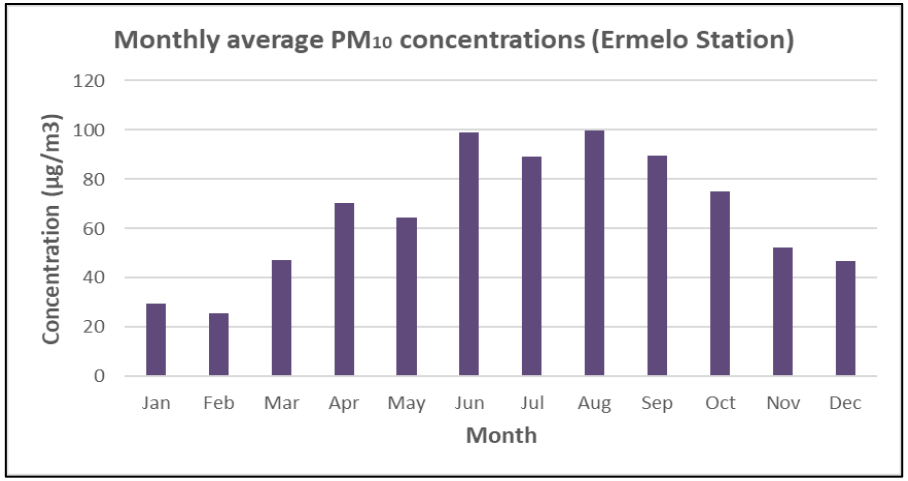

Figure 4-9: Monthly PM$_{10}$ concentrations at the Ermelo AQMS for the period January 2016 – December 2021.

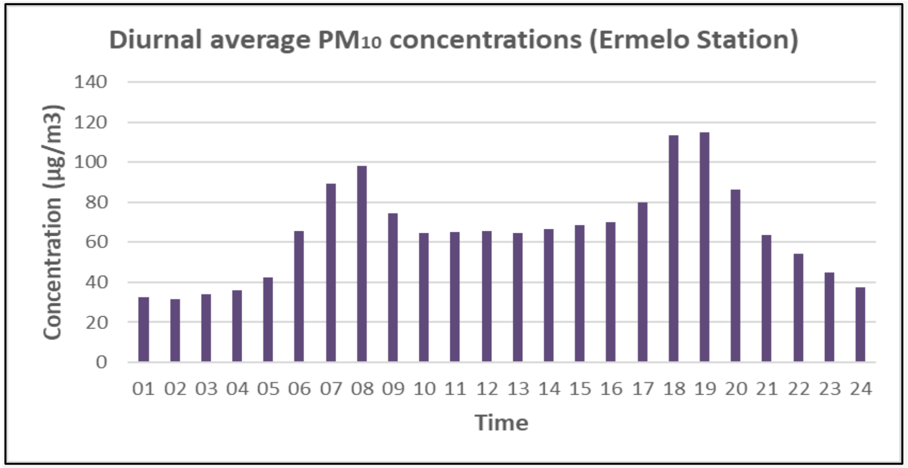

Figure 4-10: Diurnal PM$_{10}$ concentrations at the Ermelo AQMS for the period January 2016 – December 2021.

4.2.2. *$PM_{2.5}$ concentrations*

$PM_{2.5}$ concentrations at the Ermelo AQMS for the period 01 January 2016 to 31 December 2021 are provided in Figure 4-11 to Figure 4-14 below. There was 50.4% data capture in terms of $PM_{2.5}$ concentrations at the Ermelo station, with little to no data recorded between January 2019 and June 2020. Daily average $PM_{2.5}$ concentrations range between 0.03 µg/m^3 – 293.78 µg/m^3, with an average of 34.16 µg/m^3 (Figure 4-12). A total of 215 exceedances of the $PM_{2.5}$ daily standard of 40 µg/m^3 were observed over the monitoring period.

This is expected due to existing $PM_{2.5}$ sources located in the area, such as solid fuel combustion in the townships/informal settlements and small-scale agricultural activities.

Annual average $PM_{2.5}$ concentrations range between 16.12 µg/m^3 – 34.14 µg/m^3 for the period (Table 4-6), with four (4) exceedances of the annual standard of 20 µg/m^3 recorded for the years 2017 - 2018 and 2020 – 2021. Higher $PM_{2.5}$ concentrations were observed between April and September (mid-autumn to early spring), with the highest daily concentration being recorded on 16 June 2021 (293.78 µg/m^3).

In terms of the South African NAAQS, no exceedances of the $PM_{2.5}$ 24-hour standard and annual standard are permitted within a calendar year.

Table 4-6: Annual Average Concentrations for $PM_{2.5}$.

Year	Annual Average (µg/m^3)	Annual NAAQS (µg/m^3)
2016	16.12	20
2017	24.05	20
2018	24.98	20
2019	19.15	20
2020	32.84	20
2021	34.14	20

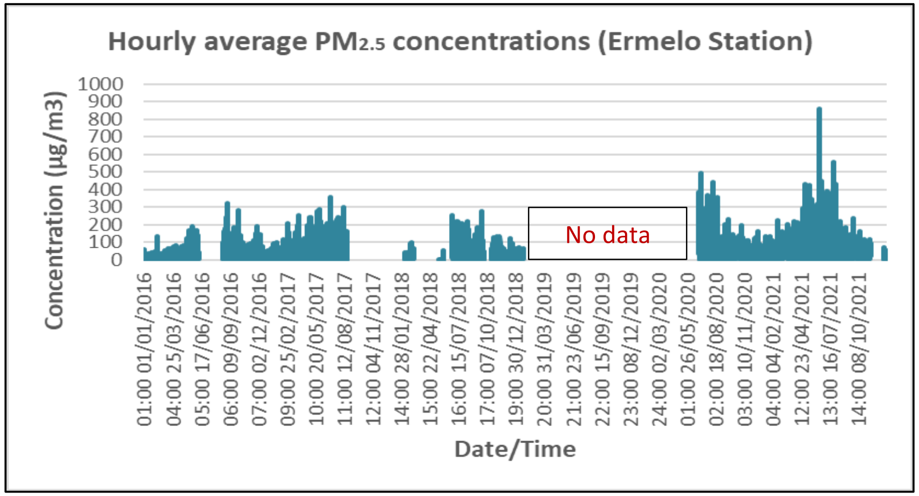

Figure 4-11: Hourly PM$_{2.5}$ concentrations at the Ermelo AQMS for the period January 2016 – December 2021.

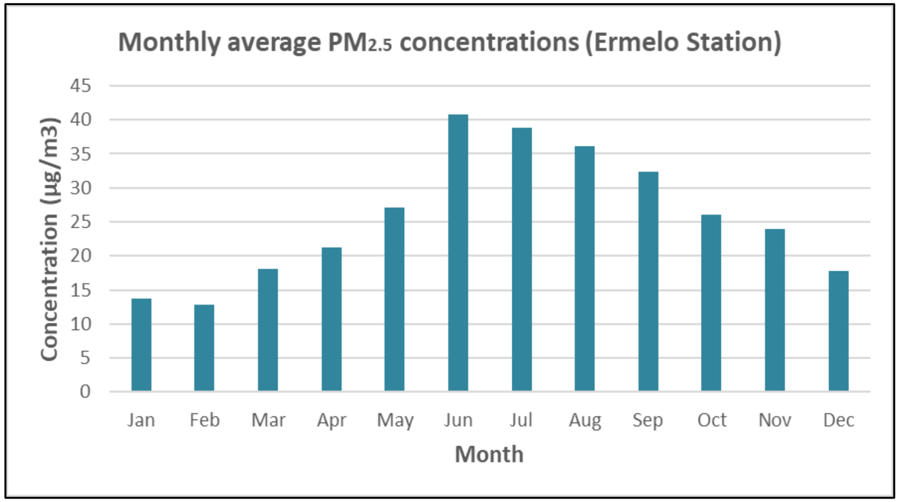

Figure 4-13: Monthly PM$_{2.5}$ concentrations at the Ermelo AQMS for the period January 2016 – December 2021.

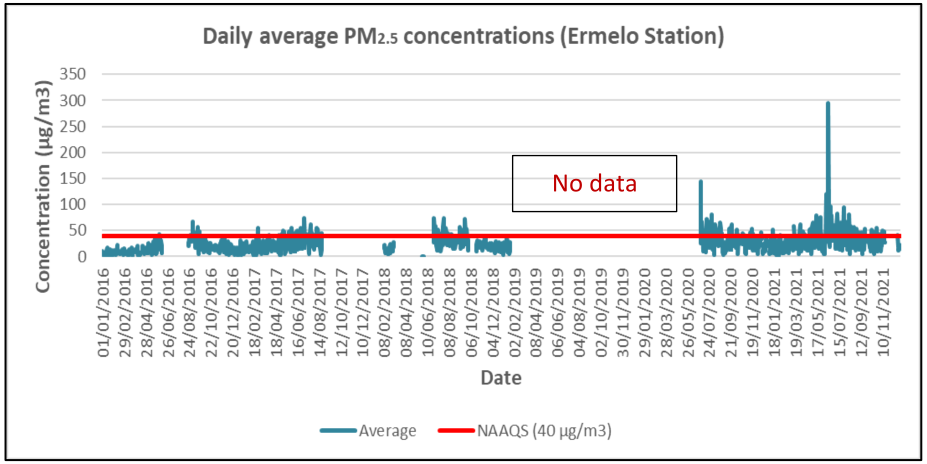

Figure 4-12: Daily PM$_{2.5}$ concentrations at the Ermelo AQMS for the period January 2016 – December 2021.

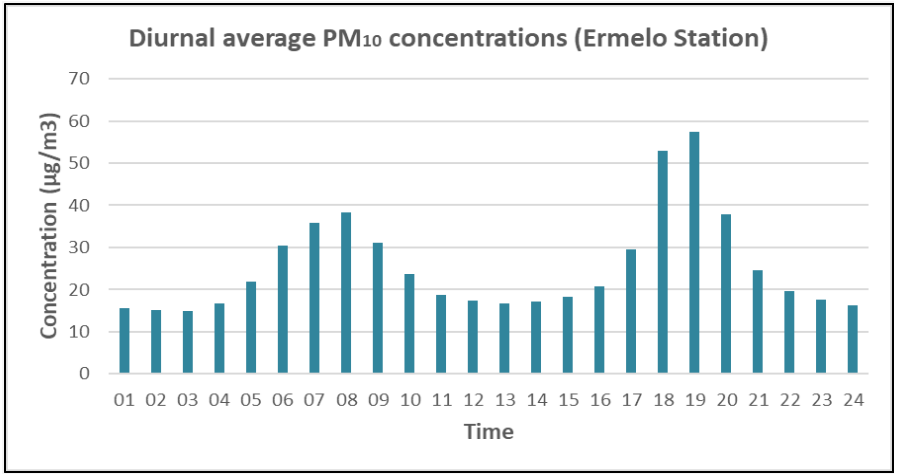

Figure 4-14: Diurnal PM$_{2.5}$ concentrations at the Ermelo AQMS for the period January 2016 – December 2021.

4.2.3. SO_2 concentrations

SO_2 concentrations at the Ermelo AQMS for the period 01 January 2016 to 31 December 2021 are provided in Figure 4-15 to Figure 4-18 below. There was 86.8 % data capture in terms of SO_2 concentrations at the Ermelo station. Hourly and daily average SO_2 concentrations range between 0.00 – 187.96 ppb and 0.01 ppb – 59.87 ppb, respectively, with average hourly and daily concentrations of 9.02 ppb and 8.96 ppb, respectively (Figure 4-15 to Figure 4-16). There were seven (7) exceedances of the hourly standard of 134 ppb and four (4) exceedances of the SO_2 daily standard of 48 ppb observed over the monitoring period.

Existing sources of SO_2 within 20km radius of the proposed mine include solid fuel combustion in the townships/informal settlements and vehicle exhaust emissions from surrounding roads.

Annual average SO_2 concentrations range between 7.92 ppb – 9.87 ppb for the years 2016 – 2021, with no exceedances of the annual standard of 19 ppb (Table 4-7). Higher SO_2 concentrations were observed between April – August (mid-autumn to late winter), with the highest daily concentration being recorded on 16 June 2021 (59.87 ppb).

In terms of the South African NAAQS, a total of 88 exceedances of the SO_2 hourly standard are permitted within a calendar year, while only 4 exceedances of the SO_2 24-hour standard are permitted. No exceedances of the SO_2 annual standard are permitted within a calendar year.

Table 4-7: Annual Average Concentrations for SO_2

Year	Annual Average (ppb)	Annual NAAQS (ppb)
2016	9.87	19
2017	9.79	19
2018	9.36	19
2019	8.05	19
2020	8.82	19
2021	7.92	19

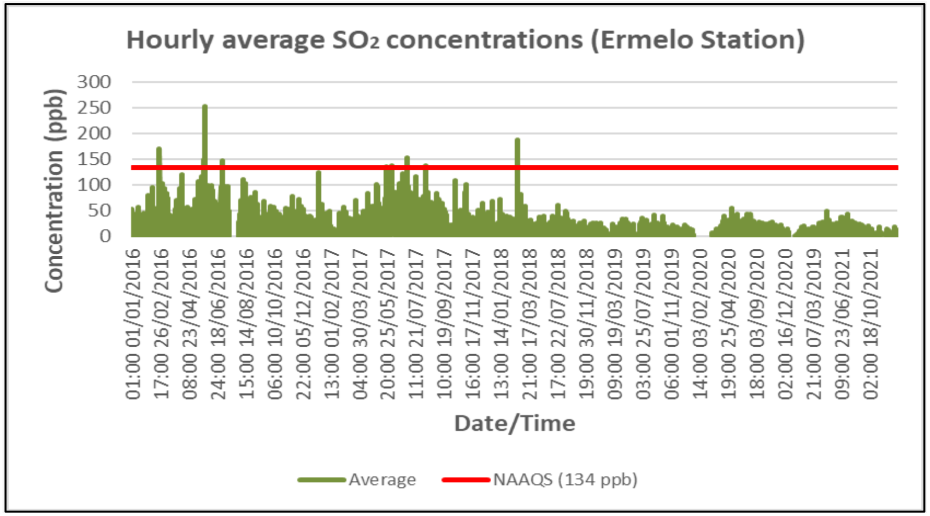

Figure 4-15: Hourly SO_2 concentrations at the Ermelo AQMS for the period January 2016 – December 2021.

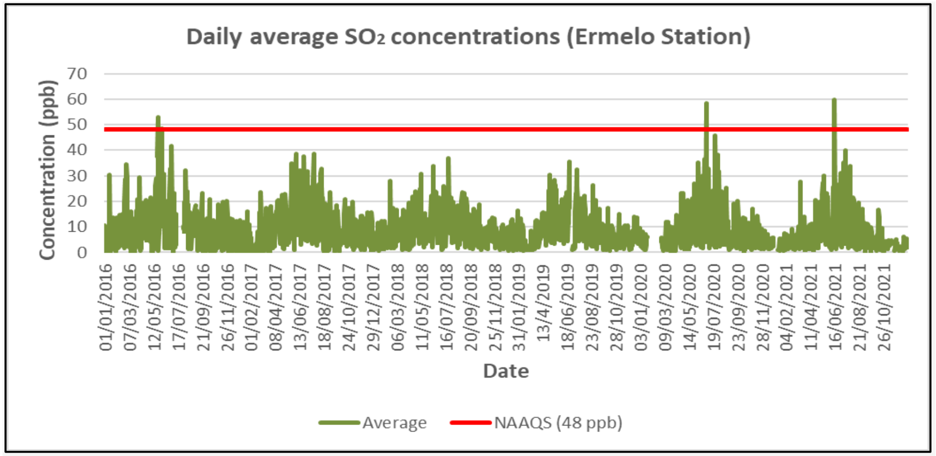

Figure 4-16: Daily SO_2 concentrations at the Ermelo AQMS for the period January 2016 – December 2021.

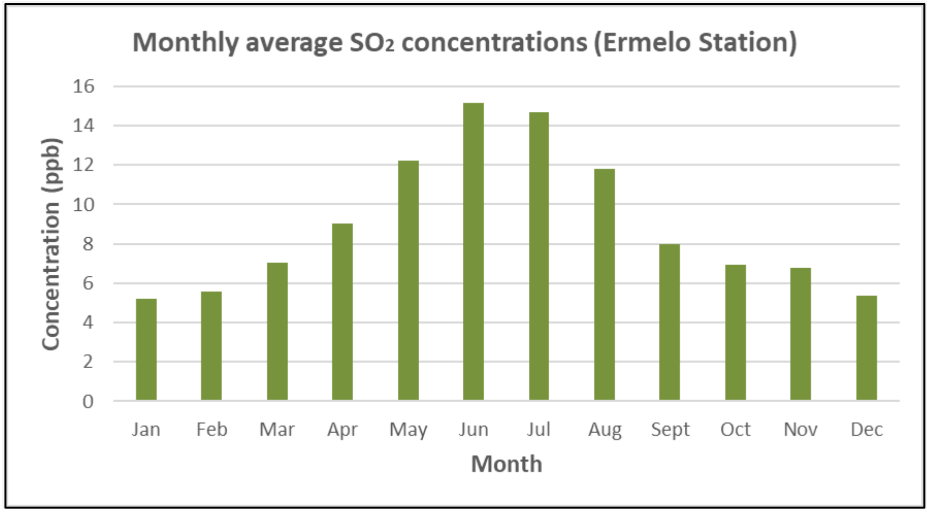

Figure 4-17: Monthly SO_2 concentrations at the Ermelo AQMS for the period January 2016 – December 2021.

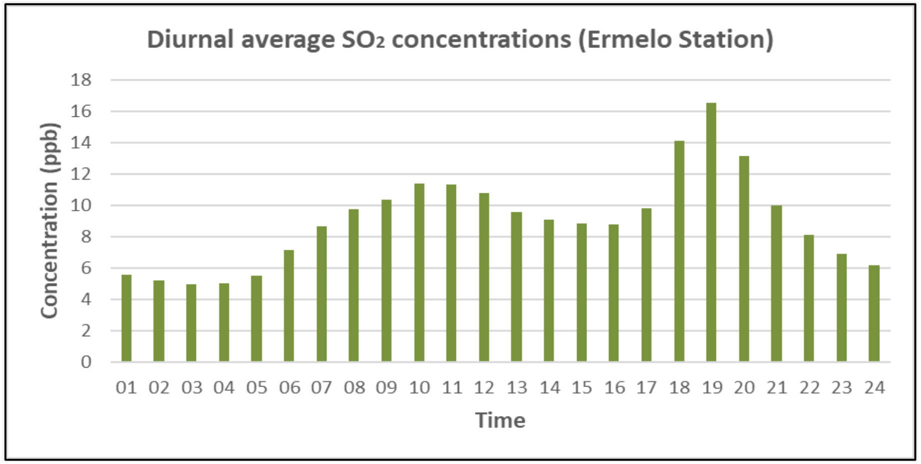

Figure 4-18: Diurnal SO_2 concentrations at the Ermelo AQMS for the period January 2016 – December 2021.

4.2.4. NO_2 concentrations

NO_2 concentrations at the Ermelo AQMS for the period 01 January 2016 to 31 December 2021 are provided in Figure 4-19 – Figure 4-22 below. NO_2 data capture at the Ermelo station was 52.7%, with no data recorded in 2021. Hourly and annual average NO_2 concentrations range between 0.00 ppb – 152.63 ppb and 3.93 ppb – 11.69 ppb, respectively, with five (5) exceedances of the hourly standard of 106 ppb and no exceedances of the annual standard of 21 ppb recorded (Figure 4-19 and Table 4-8).

Higher NO_2 concentrations were observed between April and November (mid-autumn to late spring), with the highest hourly concentration being recorded on 06 May 2019 (152.63 ppb).

In terms of the South African NAAQS, a total of 88 exceedances of the NO_2 hourly standard are permitted within a calendar year, while no exceedances of the NO_2 annual standard are permitted.

Table 4-8: Annual Average Concentrations for NO_2

Year	Annual Average (ppb)	Annual NAAQS (ppb)
2016	11.44	21
2017	11.69	21
2018	10.26	21
2019	8.29	21
2020	3.93	21
2021	No data	21

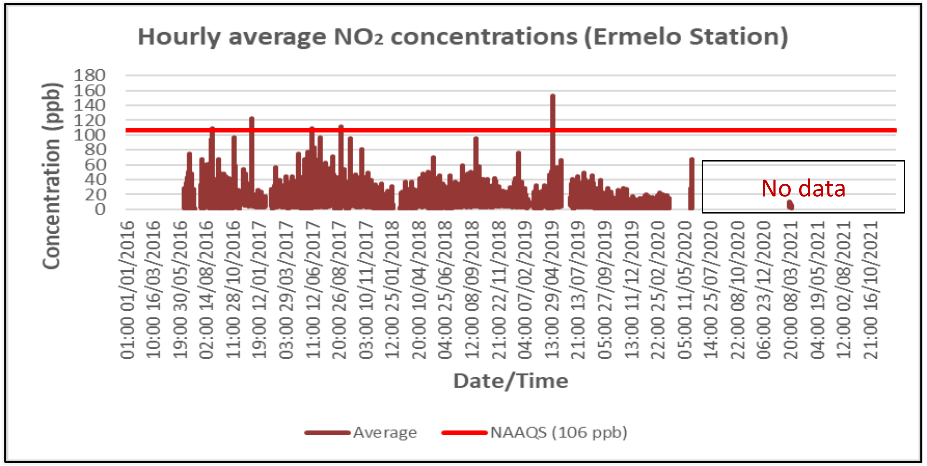

Figure 4-19: Hourly NO_2 concentrations at the Ermelo AQMS for the period January 2016 – December 2021.

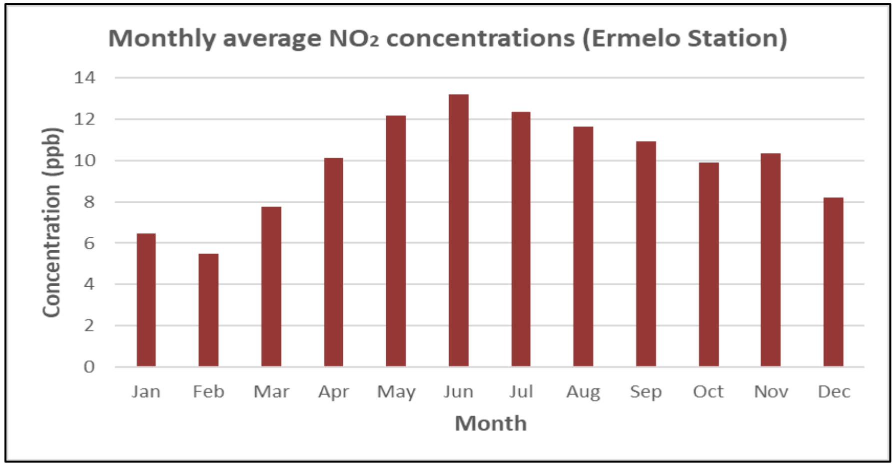

Figure 4-21: Monthly NO_2 concentrations at the Ermelo AQMS for the period January 2016 – December 2021.

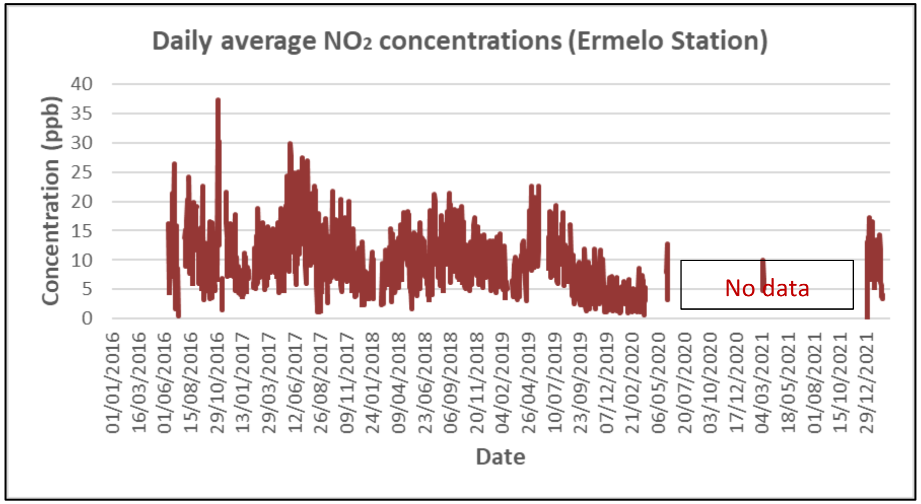

Figure 4-20: Daily NO_2 concentrations at the Ermelo AQMS for the period January 2016 – December 2021.

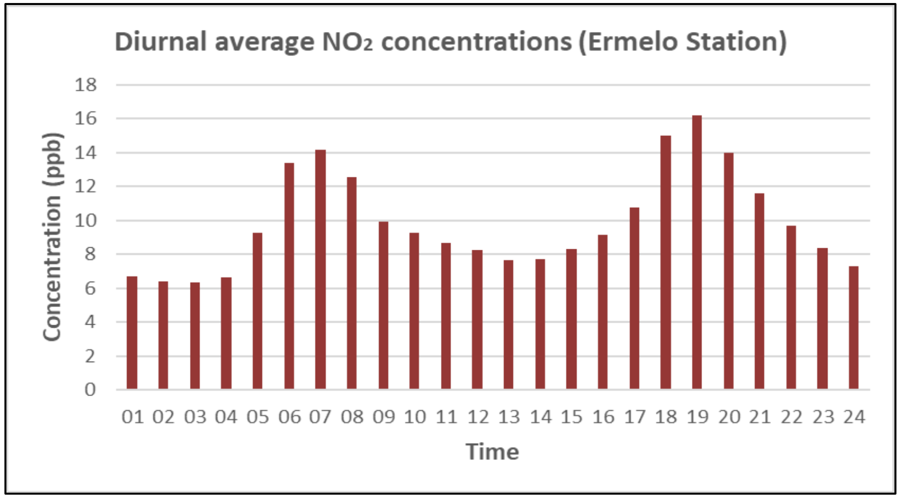

Figure 4-22:Diurnal NO_2 concentrations at the Ermelo AQMS for the period January 2016 – December 2021.

4.2.5. CO concentrations

CO concentrations at the Ermelo AQMS for the period 01 January 2016 to 31 December 2021 are provided in Figure 4-23 to Figure 4-27 below. There was 74.0% data capture in terms of CO at the Ermelo station. Hourly and 8-hourly average CO concentrations range between 0.00 ppb – 448 ppb and 0 ppb – 4 227.63 ppb, respectively, with average hourly and 8-hourly concentrations of 440.83 ppb and 440.91 µg/m^3, respectively. No exceedances of the hourly and 8-hourly standards of 26 000 ppb and 8 700 ppb, respectively, were recorded (Figure 4-23 – Figure 4-24).

Surrounding sources of CO, within a 20 km radius of the proposed mine, include vehicle exhaust emissions and solid fuel combustion in nearby informal settlements. Monthly average CO concentrations were higher between May and September (late-autumn to early spring), with the highest hourly (448 ppb) and 8-hourly (4 227.63 ppb) concentrations being recorded on 03 June 2016.

In terms of the South African NAAQS, a total of 88 exceedances of the CO hourly standard are permitted within a calendar year, while 11 exceedances of the CO 8-hourly standard are permitted.

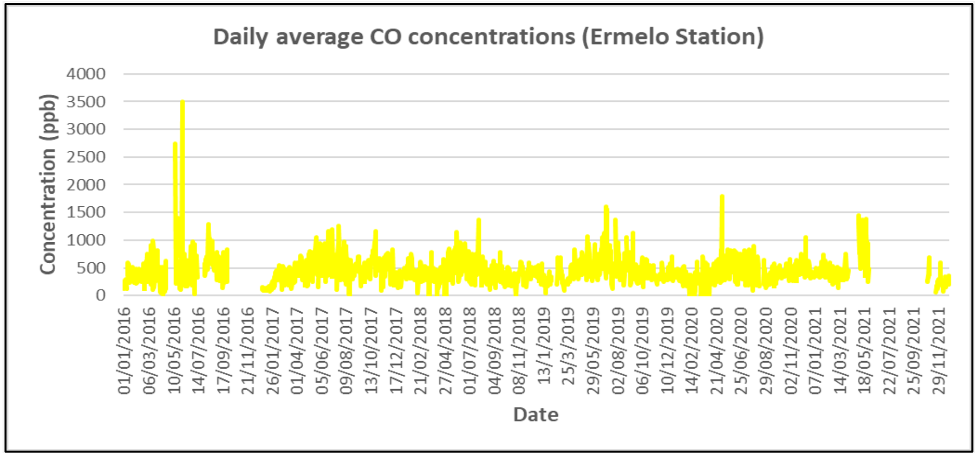

Figure 4-23: Hourly CO concentrations at the Ermelo AQMS for the period January 2016 – December 2021.

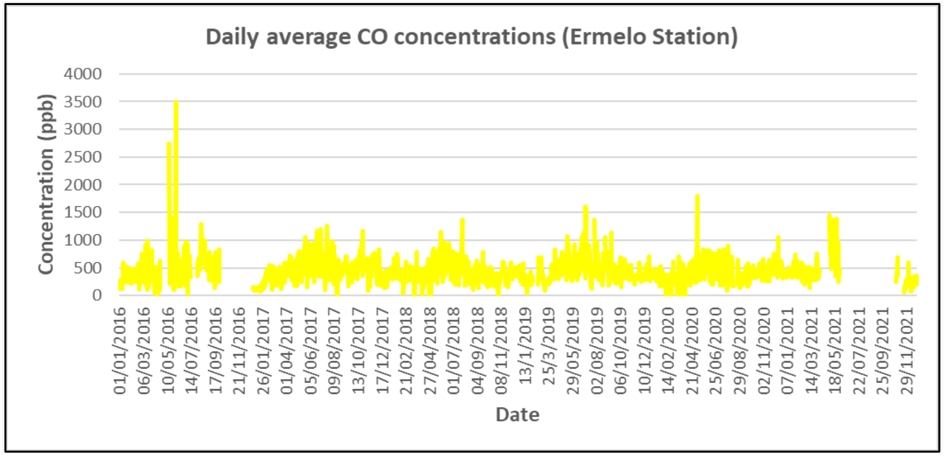

Figure 4-25: Daily CO concentrations at the Ermelo AQMS for the period January 2016 – December 2021.

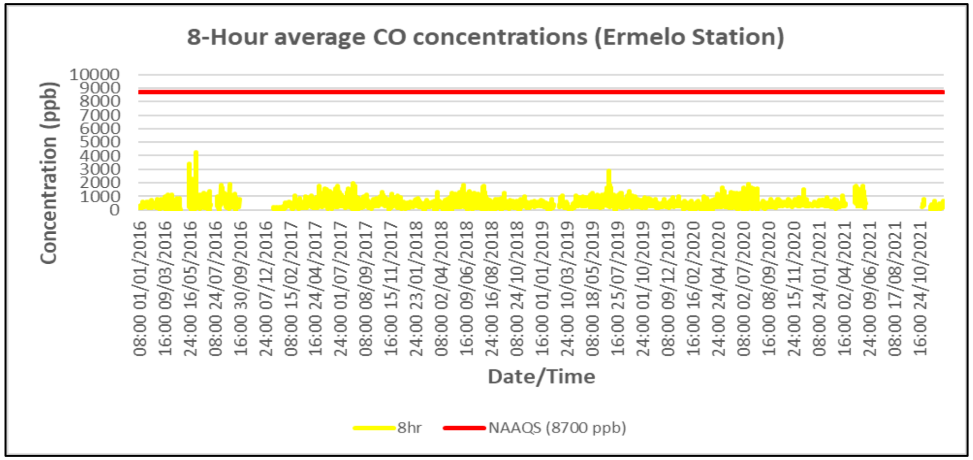

Figure 4-24: 8-Hour CO concentrations at the Ermelo AQMS for the period January 2016 – December 2021.

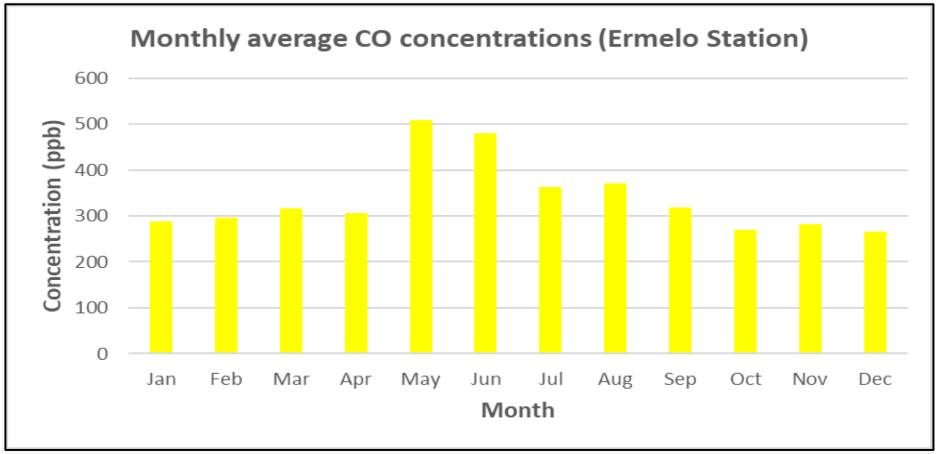

Figure 4-26: Monthly CO concentrations at the Ermelo AQMS for the period January 2016 – December 2021.

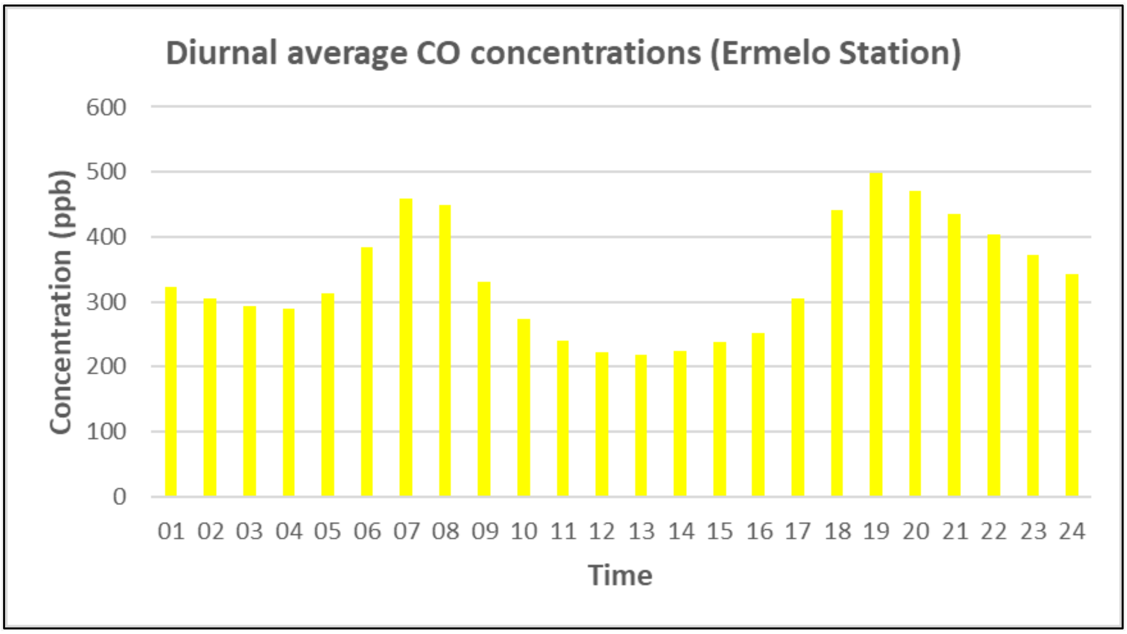

Figure 4-27: Diurnal CO concentrations at the Ermelo AQMS for the period January 2016 – December 2021.

4.2.6. O_3 concentrations

Ozone concentrations at the Ermelo AQMS for the period 01 January 2016 to 31 December 2021 are provided in Figure 4-28 to Figure 4-32 below. There was 87.4% data capture in terms of O_3 at the Ermelo station. 8-hourly average O_3 concentrations range between 0.02 ppb – 96.96 ppb, with an average of 27.69 ppb. Ninety-two (92) exceedances of the 8-hourly standard of 61 ppb were recorded (Figure 4-29).

Surrounding sources of O_3, within a 20 km radius of the proposed mine, include vehicle exhaust emissions from surrounding roads and solid fuel combustion in nearby informal settlements. However, it must be noted that O_3 is a secondary air pollutant, which is not directly emitted into the atmosphere and is dependent on the amount of sunlight and the concentration of other pollutants such as VOCs and NOx. Higher O_3 concentrations were observed between September to November and from January to February (spring and summer).

In terms of the South African NAAQS, a total of 11 exceedances of the O_3 8-hourly standard are permitted within a calendar year.

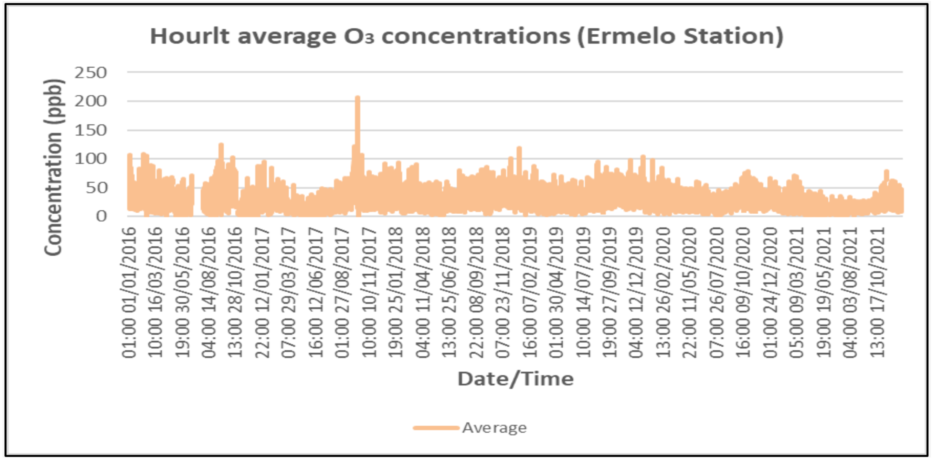

Figure 4-28: Hourly O_3 concentrations at the Ermelo AQMS for the period January 2016 – December 2021.

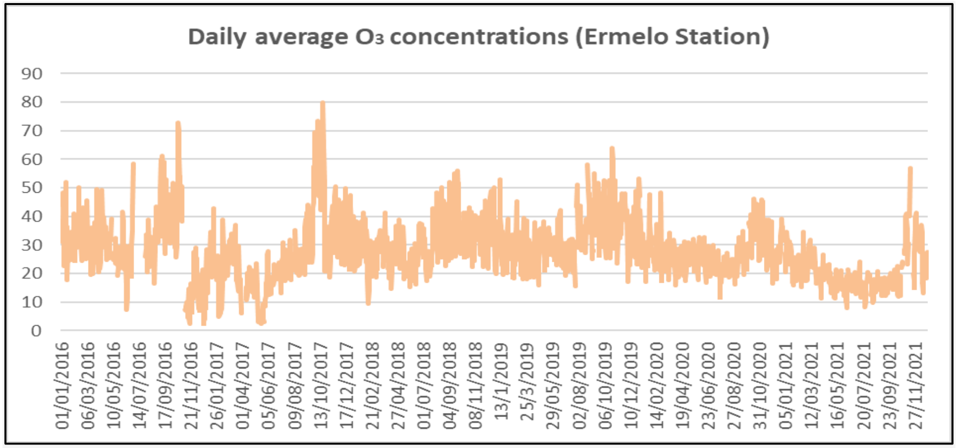

Figure 4-30: Daily O_3 concentrations at the Ermelo AQMS for the period January 2016 – December 2021.

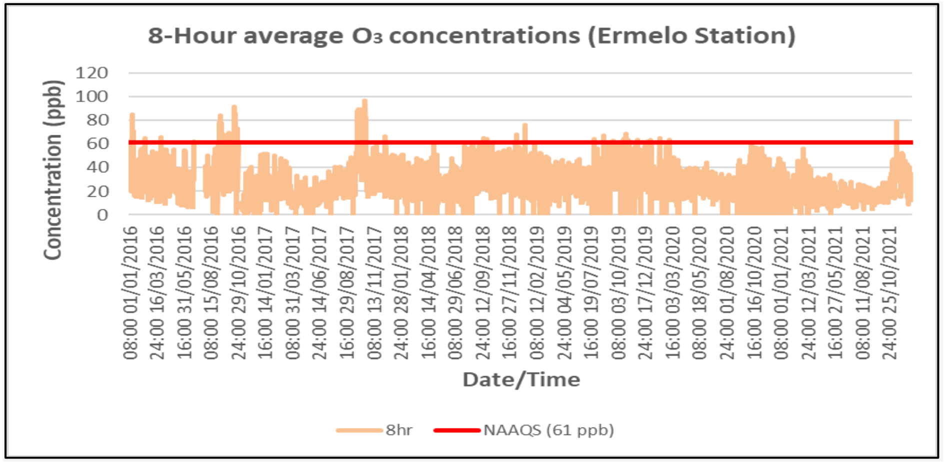

Figure 4-29: 8-Hour O_3 concentrations at the Ermelo AQMS for the period January 2016 – December 2021.

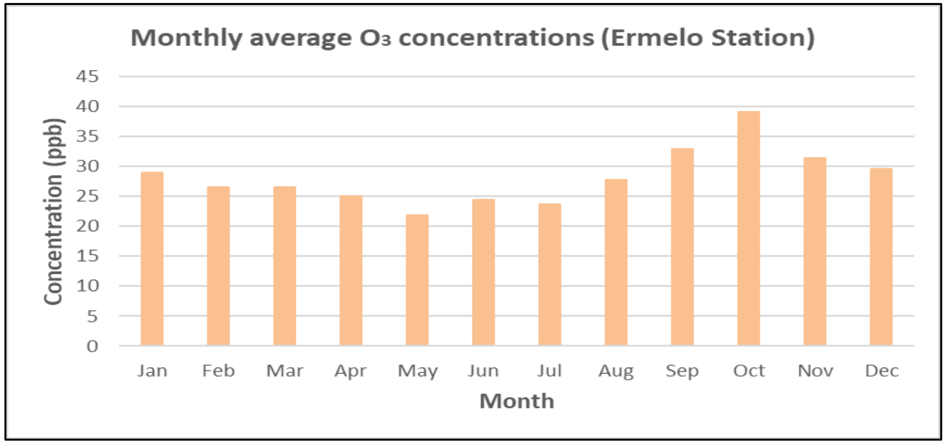

Figure 4-31: Monthly O_3 concentrations at the Ermelo AQMS for the period January 2016 – December 2021.

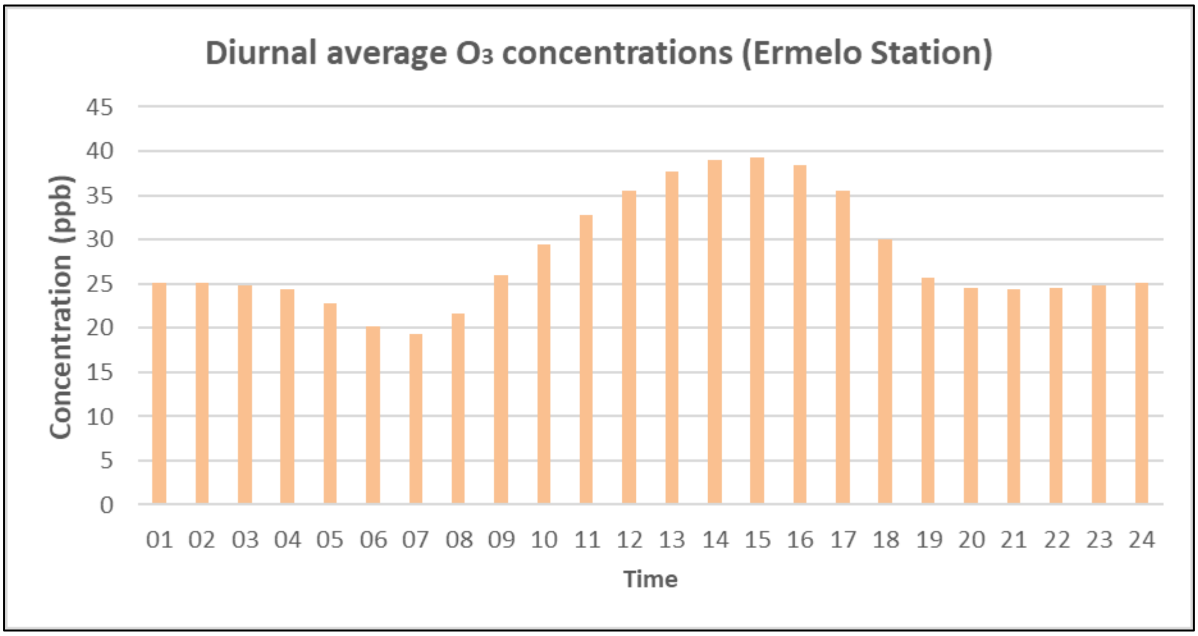

Figure 4-32: Diurnal O_3 concentrations at the Ermelo AQMS for the period January 2016 – December 2021.

4.3. Surrounding Sources of Air Pollution

Few existing key sources of air pollution surrounding the project site were identified during a desktop exercise and include (Figure 4-33 and Figure 4-34):

- Agricultural activity (temporary crops) and potential biomass burning ((surrounding areas);
- Planted forest (surrounding areas);
- Solid fuel combustion in nearby townships/informal settlements (south-west and north-west quadrants); and
- Vehicle dust entrainment on unpaved roads (surrounding areas).

Waste and resource dumps and permanent agricultural activities were identified as additional sources of air pollution in surrounding areas but to a minimal extent. Waste and resource dumps are in localised areas north, west, south-west and south of the proposed mine within a 7 – 20km radius, while permanent agricultural activities occur over 3 very small areas south-east, north-west and north-east of the proposed mine within a 5 – 20km radius.

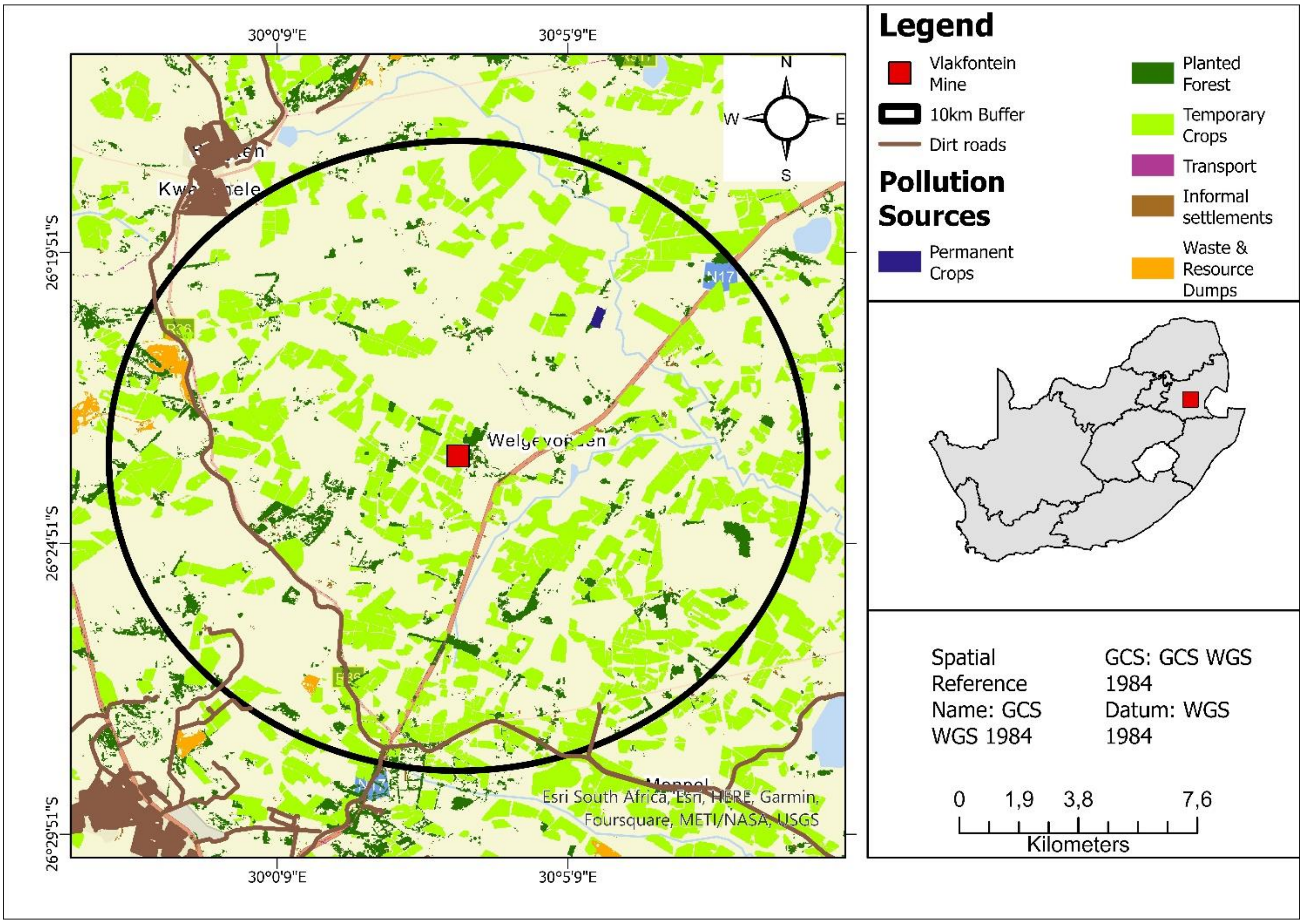

Figure 4-33: Identified surrounding emission sources within 10km of the proposed Vlakfontein Coal Mine.

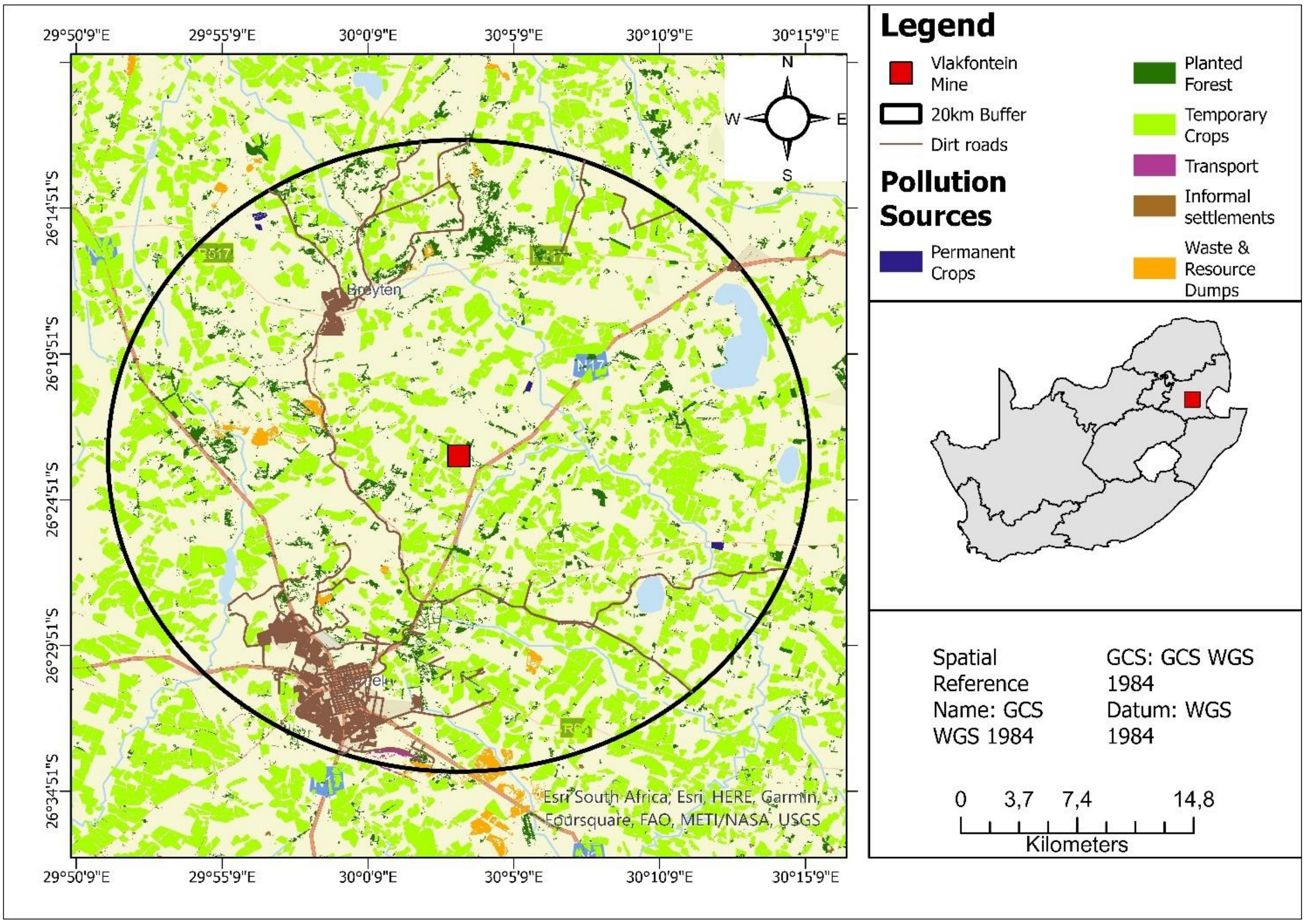

Figure 4-34: Identified surrounding emission sources within 20km of the proposed Vlakfontein Coal Mine.

4.3.1. Agricultural Activity and Potential Biomass Burning

There are several temporary small-scale agricultural areas surrounding the proposed mine. Emissions from agricultural activities are difficult to control due to the seasonality of emissions and the large surface area producing emissions. Expected emissions resulting from agricultural activities include particulates associated with wind erosion and burning of crop residue, chemicals associated with crop spraying and odiferous emissions resulting from manure, fertilizer and crop residue. Dust associated with agricultural practices may contain seeds, pollen and plant tissue, as well as agrochemicals, such as pesticides. The application of pesticides during temperature inversions increases the drift of the spray and the area of impact.

Dust entrainment from farming vehicles travelling on gravel roads may also cause increased particulates in an area. Dust from traffic on gravel roads increases with higher vehicle speeds, more vehicles and lower moisture conditions. The seasonal burning of the veld from July to September for field clearing in preparation for planting may also be a source of smoke. The nature of the activity has a potential impact on air quality in the area.

4.3.2. Forestry Activities/Plantations

Forestry activity occurs over several localised areas surrounding the proposed mine, within a 20km radius. The effects of plantations on ambient air quality are dependent on the type of plantations. Oil tree plantations, for example, are associated with production of high levels of VOCs, particularly isoprene. In general, plantations result in an increase in ambient NOx concentrations due to the frequent and heavier use of fertiliser (https://nerc.ukri.org/planetearth/stories/561). The use of mobile equipment and trucks during land preparation and removal of trees are also a source of emissions such as PM, SO_2 and NO_x.

Plantations generally have sawmills. Air pollutants generated from sawmill operations are mainly associated with combustion processes such as wood recycling and disposal, as well as boilers. Additional sources of pollutants include wood drying in kilns, sawing, machining and sanding operations. Pollutants associated with boilers are dependent on the type of wood and fuel used to power the boilers and may include sulphur oxides (SO_X), PM, NO_X, CO, and VOCs. VOCs are also emitted from wood drying in kilns and during the application of solvents, coatings and lacquers to wood. Wood dust is an additional pollutant mainly associated with sawing, machining and sanding operations (Environmental, Health, and Safety Guidelines – Sawmilling and Manufactured Wood Products, International Finance Corporation).

4.3.3. Domestic Fuel Combustion Activities

There are townships/informal settlements (that were identified during the desktop study) located within a 10 – 20km radius of the proposed mine (i.e. south-west and north-west of the project site). Domestic fuel combustion is prevalent in informal settlements where solid fuels are mostly used for cooking and indoor heating purposes. Indoor heating occurs more frequently in the cold late autumn to early spring months. Emissions from the solid fuels are thus expected to be high during the same months, and comparatively low during the warm spring and summer months. Combustion of domestic solid fuels results mainly in production of CO and particulates. If coal is being used, SO_2 and H_2S might be additionally emitted in relatively smaller quantities.

4.3.4. Vehicle Dust Entrainment on Unpaved Roads

Vehicle-entrained dust emissions from the surrounding unpaved roads in the area potentially represent a key source of fugitive dust. The movement of trucks on dirt roads associated with forestry activities (planted forest) would be a key source in this case. When a vehicle or truck travels on an unpaved road, the force of the wheels on the road surface causes the pulverisation of surface material. Particles are lifted and dropped from the rolling wheels, and the road surface is exposed to strong air currents in turbulent shear with the surface. The turbulent wake behind the vehicle continues to act on the road surface after the vehicle has passed.

5. BASELINE AIR QUALITY IMPACT ASSESSMENT

The purpose of this baseline assessment report was to determine the prevailing baseline conditions at the project site (i.e. meteorological conditions, baseline concentrations of key air pollutants of concern, existing sources of emissions, and key sensitive receptors surrounding the project site). The intention of the report was not to provide an air quality impact assessment for the proposed development, but to inform from a desktop perspective as part of the scoping report.

Dustfall, PM_{10} and $PM_{2.5}$ are key pollutants of concern associated with operational activities at the proposed Vlakfontein Coal Mine and will likely be emitted from the following key sources:

Dust and Particulate Emissions:

- Drilling and blasting at the opencast pit (to break the hard overburden and coal seams);
- Bulldozing (moving material and shaping stockpiles);
- Materials handling operations (truck loading/offloading operations);
- Transportation/hauling of Run-of-Mine (ROM) ore and overburden material (trucks);
- Material storage: Stockpiling;
- Crushing and screening;
- Excavators (stripping ore and overburden and loading trucks);
- Wind erosion from exposed areas (i.e. the open cast pit, exposed surfaces, and material stockpile areas); and
- Vehicle dust entrainment on unpaved roads.

The above-mentioned sources were identified for the proposed mine based on information provided by the client.

5.1. Plan of Study for EIA Phase

For the Environmental Impact Assessment (EIA) phase, it is recommended that a detailed emissions inventory be compiled for the proposed Vlakfontein Coal Mine operations and that the impact of these emissions on air quality be assessed through dispersion modelling using AERMOD. As there is a need to determine the distribution of pollutant concentrations and depositions in time and space for the proposed mine, a Level 2 assessment would be required. The level of assessment required (i.e. Level 2) has been determined in accordance with the National Environmental Management: Air Quality Act (Act No. 39 of 2004) (NEM:AQA) and Dispersion Modelling Regulations (Government Gazette No. 37804 of 11 July 2014). A detailed questionnaire will be given to the client prior to modelling to obtain specific details needed for input into the model and for calculation of emission rates. The conservative scenario will be assumed where information is not known for input into the model.

Regulations that must be considered during the EIA phase include the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and Environmental Impact Assessment Regulations, 2014 (as amended) (EIA Regs) - Requirements for Specialist Reports (Appendix 6), where applicable, the Dispersion Modelling Regulations (Government Gazette No. 37804 of 11 July 2014) and the regulations prescribing the format of an Atmospheric Impact Report (Government Gazette No. 36904 of 11 October), as amended (General Notice 284 in Government Notice 38633 of 02 April 2015).

To investigate the potential impact of operations associated with the proposed mine on local ambient air quality, the following air pollutants will be chosen in the quantification of emissions for the construction, operational and decommissioning phases of the project. This project will focus on dust emissions as this is a key pollutant emitted from operations at the proposed mine:

- Dustfall;
- Particulate matter (PM_{10} and $PM_{2.5}$);

The results of the assessment would include dispersion isopleth plots and a summary of predicted incremental PM concentrations and dustfall rates at the proposed mine boundary and at the identified discrete receptors. These results would be presented in the final AQIA report.

A summary of the AERMOD model that would be used is given in Section 5.2 below.

5.2. Model Overview

5.2.1. AERMOD View

AERMOD, a state-of-the-art Planetary Boundary Layer (PBL) air dispersion model, was developed by the American Meteorological Society and USEPA Regulatory Model Improvement Committee (AERMIC). AERMOD utilizes a similar input and output structure to ISCST3 and shares many of the same features, as well as offering additional features. AERMOD fully incorporates the PRIME building downwash algorithms, advanced depositional parameters, local terrain effects, and advanced meteorological turbulence calculations.

The AERMOD atmospheric dispersion modelling system is an integrated system that includes three modules:

- A steady-state dispersion model designed for short-range (up to 50 km) dispersion of air pollutant emissions from stationary industrial sources.
- A meteorological data pre-processor (AERMET) for surface meteorological data, upper air soundings, and optionally, data from on-site instrument towers. It then calculates atmospheric parameters needed by the dispersion model, such as atmospheric turbulence characteristics, mixing heights, friction velocity, Monin-Obukov length and surface heat flux.
- A terrain pre-processor (AERMAP) which provides a physical relationship between terrain features and the behaviour of air pollution plumes. It generates location and height data for each receptor location. It also provides information that allows the dispersion model to simulate the effects of air flowing over hills or splitting to flow around hills.

AERMOD includes Plume Rise Model Enhancements (PRIME) building downwash algorithms which provide a more realistic handling of building downwash effects. PRIME algorithms were designed to address two fundamental features associated with building downwash; enhanced plume dispersion coefficients due to the turbulent wake and to reduce plume rise caused by a combination of the descending streamlines in the lee of the building and the increased entrainment in the wake. AERMOD is suitable for a wide range of near field applications in both simple and complex terrain. The evaluation results for AERMOD, particularly for complex terrain applications, indicate that the model represents significant improvements compared to previously recommended models.

AERMOD has been used in various dispersion modelling studies in the United States and around the world (Perry *et al*., 2004).

5.2.2. Model Requirements

The approach to this dispersion modelling study would be based on the Code *of Practice for Air Dispersion Modelling in Air Quality Management in South Africa* (DEA, 2014). As per the *Code of Practice*, this assessment would be a Level 2 assessment. Level 2 assessments should be used for air quality impact assessment in standard/generic licence or amendment processes where:

- The distribution of pollutant concentrations and depositions are required in time and space;
- Pollutant dispersion can be reasonably treated by a straight-line, steady-state, Gaussian plume model with first order chemical transformation. Although more complicated processes may be occurring, a more complicated model that explicitly treats these processes may not be necessary depending on the purposes of the modelling and the zone of interest.
- Emissions are from sources where the greatest impacts are in the order of a few kilometres (less than 50 km) downwind.

A summary of the key variables to be input into the AERMOD model is given in Table 5-1 below. Data input into the model includes MM5 modelled meteorological data (surface and upper air) for 01 January 2019 – 31 December 2021. Terrain data at a resolution of 90 m (SRTM90) will be used for input into the model, as generated by the terrain pre-processor, AERMAP. A modelling domain of 20km × 20km will be used. A multi-tier grid with a grid receptor spacing of 250m (5km from facility), 500m (10km from facility) and 1 000m (20km from facility) (3 tiers) will be used.

Table 5-1: Key Variables to be used in the modelling study.

Parameter	Model Input
Model	**Input**
Assessment level	Level 2
Dispersion model	AERMOD Version 10.2.1
Supporting models	AERMET Version 10.2.1 AERMAP Version 10.2.1
Emissions	**Input**
Pollutants to be modelled	Dustfall, PM_{10} and $PM_{2.5}$
Scenarios	Construction, Operational and Decommissioning
Chemical transformations	N/A
Exponential decay	Rural
Settings	**Input**
Terrain setting	Elevated
Terrain data	SRTM90
Terrain data resolution (m)	90
Land use characteristics	Grassland, Cultivated Land
Grid receptors	**Input**
Farm boundary (m)	50
Modelling domain (km)	20 x 20
Fine grid resolution (m)	250 (5km from facility)

Medium grid resolution (m)	500 (10km from facility)
Large grid resolution (m)	1 000 (beyond 20km from facility)

6. SUMMARY AND CONCLUSIONS

Rayten was appointed by EMA to compile an Air Quality Impact Assessment (AQIA) baseline report for the proposed operation of BCR Coal (Pty) Ltd - Vlakfontein Coal Mine (hereafter referred to as "Vlakfontein Coal Mine"), located within the Msukaligwa Local Municipality, Mpumalanga Province.

As part of the mining right application, a scoping and EIA process must be undertaken. An AQIA was identified as a requirement in the screening report for inclusion in the EIA report. This baseline AQIA report has been compiled specifically as a supporting document to inform the Scoping Phase. The main objective of the AQIA baseline assessment is to determine the following.

- the prevailing meteorological conditions at the site;
- baseline concentrations of key air pollutants of concern;
- identify existing sources of emissions; and
- identify key sensitive receptors surrounding the project site.

MM5 meteorological data for the project area for the period 01 January 2019 – 31 December 2021 was used. Baseline air quality at the proposed Vlakfontein Coal Mine was evaluated using available monitoring data for PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO, and O_3 from a permanent ambient air quality monitoring station, i.e. at the Ermelo Station (-26.493348°S; 29.968054°E), located approximately 13km south-west of the proposed mine. The ambient air quality monitoring data covers the period 01 January 2016 – 31 December 2021, with moderate to high data capture (>50%) observed for all of the criteria air pollutants, i.e. PM_{10} (50.7%), $PM_{2.5}$ (50.4%), SO_2 (86.8%), NO_2 (52.7%), CO (74.0%), and O_3 (87.4%). Dustfall data could not be provided in this AQIA baseline report as there are no available dustfall networks operated near the project site, that could be determined.

The main conclusions based on the information obtained during the Baseline Assessment are as follows:

The proposed mine is located on Portions 2, 11 and 21 of the farm Vlakfontein 108 IT, Portions 1, 7, 14, and 12 of the farm Welgelegen 107 IT, and Portion 1 of the farm Mooifontein 109 IT, 14.5km north-east of Ermelo, within Msukaligwa Local Municipality and Gert Sibande District Municipality, Mpumalanga Province. The project area falls within the Nationally Declared Highveld Air Quality Priority Area. The land use immediately surrounding the proposed Vlakfontein Coal Mine consists mostly of grassland and cultivated land, with few areas consisting of mines and quarries, built-up areas, waterbodies, wetlands and forested land. The larger area surrounding the proposed mine is classified as rural in nature. Few existing key sources of airborne emissions surrounding the project site have been identified as follows:

- Agricultural activity (temporary crops) and potential biomass burning ((surrounding areas);
- Planted forest (surrounding areas);

- Solid fuel combustion in nearby townships/informal settlements (south-west and north-west quadrants); and
- Vehicle dust entrainment on unpaved roads (surrounding areas).

Based on the prevailing wind fields for the period January 2019 to December 2021, emissions from activities at the proposed Vlakfontein Mine will likely be transported towards the south-westerly, east-southeasterly and west-northwesterly wind directions. Moderate to fast wind speeds observed during all the time periods, may result in effective dispersion and dilution of emissions from the proposed mine operations; however, higher winds speeds can also facilitate fugitive dust emissions from open exposed areas such as stockpiles and opencast areas. Removal of particulates via wet depositional processes would be evident during the warmer (wet) seasons (spring – early autumn) thus lower ambient concentrations of dust could be expected during these seasons. Over the remainder of the year higher ambient concentrations of particulates could be expected.

There is seasonal variation in winds at the proposed Vlakfontein Coal Mine. Prevailing winds in summer originate from the north-eastern quadrant, similar to prevailing winds observed in spring. However, additional north-westerly winds are observed in spring. During the autumn season, north-easterly and west-northwesterly winds prevail, while the winter season is characterised by high frequency west-northwesterly and east-southeasterly winds. Additional less frequent north-westerly/south-westerly winds and east-southeasterly/north-northeasterly are observed in winter and autumn, respectively. Wind speeds were generally high during all seasons, which could subsequently facilitate dust emissions from stockpiles, onsite and offsite activities associated with the proposed mine.

Based on the baseline air quality data for the period 01 January 2016 to 31 December 2021, several exceedances of the PM_{10} (75 µg/m^3) and $PM_{2.5}$ (40 µg/m^3) daily standards were observed over the monitoring period (i.e. 427 and 215 exceedances for PM_{10} and $PM_{2.5}$, respectively), while exceedances of the applicable annual standards (40 µg/m^3 and 20 µg/m^3 for PM_{10} and $PM_{2.5}$, respectively) were observed between 2017 - 2018 and 2020 - 2021. For the gaseous pollutants, exceedances were observed in SO_2 hourly and daily concentrations and NO_2 hourly concentrations, for which four exceedances of the daily standard of 48 ppb were recorded for SO_2, while seven and five exceedances of the hourly standards of 134 ppb and 106 ppb recorded for SO_2 and NO_2, respectively. Additionally, 92 exceedances of the 8-hourly standard of O_3 were recorded. Annual SO_2 and NO_2 concentrations, as well as hourly and 8-hourly CO concentrations comply with applicable NAAQS. Higher concentrations for all criteria air pollutants were observed between April and October, as well as during summer (between January and February), for O_3.

Dustfall, PM_{10} and $PM_{2.5}$ are key pollutants of concern associated with the open pit mining operations at the proposed Vlakfontein Coal Mine and will likely be emitted from the following key sources:

Dust and Particulate Emissions:

- Drilling and blasting at the opencast pit (to break the hard overburden and coal seams);
- Bulldozing (moving material and shaping stockpiles);
- Materials handling operations (truck loading/offloading operations);

- Transportation/hauling of Run-of-Mine (ROM) ore and overburden material (trucks);
- Material storage: Stockpiling;
- Crushing and screening;
- Excavators (stripping ore and overburden and loading trucks);
- Wind erosion from exposed areas (i.e. the open cast pit, exposed surfaces, and material stockpile areas); and
- Vehicle dust entrainment on unpaved roads.

6.1. Assumptions and Gaps in Knowledge

The following assumptions and / or gaps in knowledge were identified during the baseline assessment:

- Data and information provided by the client was assumed to be correct at the time that this report was compiled.
- In terms of the baseline air quality data, which covered the period January 2016 – December 2021 (i.e. five years) there was moderate to high data capture observed for the criteria air pollutants included in this baseline assessment, with comparatively lower data capture for PM_{10}, $PM_{2.5}$ and NO_2. Little to no data was recorded between 2019 and 2020 for PM_{10} and $PM_{2.5}$, while no data was recorded in 2021 for NO_2. However, as per the Dispersion Modelling Regulations (Government Gazette No. 37804 of 11 July 2014), at least one year of monitoring data is required/considered sufficient to provide a representative baseline as there are usually significant seasonal differences in ambient concentrations in a single year due to atmospheric differences or the seasonal nature of some pollution sources. Thus, the baseline PM_{10}, $PM_{2.5}$ and NO_2 concentrations presented in this report are assumed to be representative of the baseline.
- Dustfall data could not be provided in this baseline AQIA report as there are no available dustfall networks operated near the project site, that could be determined.

6.2. Reasoned Opinion Regarding the Acceptability of the Proposed Activity

The anticipated impact of activities at the proposed Vlakfontein Coal Mine will be quantitatively assessed through dispersion modelling and presented in the final Level 2 AQIAr. The level of assessment (i.e. Level 2) required has been determined in accordance with the NEM:AQA (Act 39 of 2004) and Dispersion Modelling Regulations (Government Gazette No. 37804 of 11 July 2014).

It is expected that emissions from activities at the proposed mine will most likely result in air quality impacts in terms of dustfall, PM_{10} and $PM_{2.5}$. However, as the impact assessment has not yet been conducted (this will be done after the dispersion modelling exercise), no fatal flaws and red flags that could impact on the feasibility of the Mine could be determined in this baseline assessment report. Furthermore, a reasoned opinion regarding the acceptability of the project cannot be provided at this stage. These factors will be determined in the final AQIAr.

Summary of Desktop Verification Outcome

According to the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and Environmental Impact Regulations, 2014 (as amended) (EIA Regs), site sensitivity and desktop verification must be undertaken to inform the Scoping Phase and EIA process for any proposed development, where applicable. However, site sensitivity and desktop verification are not applicable for AQIAs, as these have not been developed for the South African screening tool. Furthermore, air emissions that result from the proposed mining activity will affect air quality regardless of where the mine is sited. As such, Rayten recommends that dispersion modelling be conducted as part of the EIA phase of the proposed project.

SCREENING TOOL SENSITIVITY	VERIFIED SENSITIVITY	OUTCOME STATEMENT/PLAN OF STUDY	RELEVANT SECTION MOTIVATING VERIFICATION
AIR QUALITY IMPACT ASSESSMENT			
N/A	N/A	Dispersion modelling is recommended for the EIA phase of the project to determine potential air quality impacts associated with proposed project	N/A

7. REFERENCES

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8. DECLARATIONS

DECLARATION OF ACCURACY OF INFORMATION - APPLICANT

Name of Enterprise: BCR Coal (Pty) Ltd – Proposed Vlakfontein Coal Mine

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Declaration of accuracy of information provided:

Atmospheric Impact Report in terms of Section 30 of the Act:

I ____________________________ declare that – General declaration

The information provided in this atmospheric impact 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 air quality officer is a criminal offence in terms of section 51(1)(g) of this Act.

Signed at __________________________________on this____________ day of________________________

____

SIGNATURE

____

CAPACITY OF SIGNATORY

DECLARATION OF INDEPENDENCE - PRACTITIONER

Specialist:	Rayten Engineering Solutions (Pty) Ltd		
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Name of Practitioner: Rayten Engineering Solutions (Pty) Ltd

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

Professional Registration No: 400171/15 (Gertrude Mafusire - Report Reviewer)

Declaration of accuracy of information provided:

Atmospheric Impact Report in terms of Section 30 of the Act:

I Lerato Tshisi, 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 air quality officer 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 by the air quality officer.
The information provided in this atmospheric impact 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 air quality officer is a criminal offence in terms of section 51(1)(g) of this Act.

Signed at **Randburg** on the 8H day of **August 2022**

SIGNATURE

Junior Air Quality Scientist
CAPACITY OF SIGNATORY