Proponent: **Exxaro Reductants**

Project: **Market Coke and Co-generation Plant**

Report Name: **FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT VOLUME 1**

Report Status: **FINAL**

Revision No: 05
Report Date: November 2012
Report Number: SO342/EIA05
Prepared by: Shelley Holt and Chiara D'Egidio
Reviewed by: Matthew Hemming

For Submission to: Limpopo Department of Economic Development, Environment and Tourism (LEDET), as part of the EIA in terms of the National Environmental Management Act.
LEDET as part of the Atmospheric Emissions License Application in terms of the National Environmental Management: Air Quality Act
Department of Mineral Resources, in terms of the Mineral and Petroleum Resources Development Act (No 28 of 2002) as part of the EMP amendment.

Reference No: **LEDET: 12/1/9/2-W12; NEAS Ref: LIM/EIA/0000133/2011**

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PROJECT INFORMATION SHEET

PROJECT:
Market Coke and Co-generation Plant

REPORT DETAILS

Report Name:	Market Coke and Co-generation Plant - Final Environmental Impact Assessment
Report Number:	SO342/EIA05
Report Status:	Final
Revision Number:	05
Date:	November 2012

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EXECUTIVE SUMMARY

Introduction and Project Description

Exxaro Reductants (Pty) Ltd (Exxaro Reductants) propose to construct a Market Coke Plant and electricity Co-generation Plant adjacent to an existing Char Manufacturing Plant, within the boundaries of the Grootegeluk Coal Mine. The project will also involve the construction of a new entrance gate for Exxaro Reductants which will encompass parking areas and offices.

The Grootegeluk Coal Mine is located on the farm Daarby 458 LQ, approximately 20 km west of Lephalale (formerly Ellisras) in the Limpopo Province. Exxaro Coal (Pty) Ltd holds a mining right for coal mining on the farm Daarby and several surrounding farms. Grootegeluk Mine is adjacent to the Eskom Matimba and Medupi Power Stations, two major clients of Grootegeluk Mine. About 18% of the mine's production consists of semi-soft coking and metallurgical quality coal, which is sold to local and international steel and ferro-alloy plants. The proposed Market Coke Plant will further process some of the coking coal on site before transporting it to customers.

The electricity Co-generation Plant will produce electricity from the coke oven flue, hot waste gas, produced in the coking process. The Co-generation Plant will be registered as a Clean Development Mechanism (CDM) project with the United Nations Framework Convention on Climate Change (UNFCCC) Executive Board under the Kyoto Protocol. The rationale for seeking CDM registration is that the Co-generation Plant, through the use of waste heat to generate electricity, produces less greenhouse gas (GHG) emissions in comparison with conventional electricity generation technologies and thus qualifies to earn carbon credits in the form of Certified Emission Reductions (CERs) once registered.

The motivation behind the construction of the electricity Co-generation Plant is to satisfy the energy requirements of the Grootegeluk Coal Mine operations, including that of the Char and Market Coke (Reductants) plants' operations. Moreover, the Co-generation Plant will supply electricity to the national grid, thereby indirectly lessening the Grootegeluk Coal Mine's burden on the available electricity supply, supporting the national energy security and also climate change objectives.

The proposed site of the Market Coke and Co-generation Plant is on a 49.4 ha portion of an old coal stockpile area and within a disused rail loop within the Grootegeluk Mine site. The proposed site (old coal stockpile area) is currently being used as a laydown area for the construction of other infrastructure at the mine (unrelated to the Char, Coke or Co-generation Plants). This site is also adjacent to an existing Char Manufacturing Plant which has been operational since 2009. The Char Manufacturing Plant is owned by Exxaro Reductants on land leased from the Grootegeluk Mine. The proposed Market Coke Plant and the Co-generation Plant will also be owned and operated by Exxaro Reductants on land leased by Exxaro Reductants from the Grootegeluk Mine, within the mining rights area. The new Exxaro Reductants entrance gate will also be located on Grootegeluk Coal Mine property, near the existing coal tailings dams near the D2001 road. The gate, including the parking areas and offices will be approximately 3725 m^2 in area.

In line with best practices and legislation for Environmental Impact Assessments (EIAs), certain development alternatives have been discussed and considered. The alternatives include the no-go option – namely, that the construction of the Market Coke and Co-generation Plant will not be undertaken.

No locality alternatives have been assessed as part of this report since the proposed construction will be located adjacent to the existing Exxaro Reductants Char Manufacturing Plant and that some of the existing infrastructure will be shared. The Market Coke and Co-generation Plant are conveniently located

close to the coal source (Grootegeluk Mine) that will be required to produce coke. The proposed site is located on a disturbed old coal stockpile area and the disturbance of a greenfields site is therefore avoided. Any other locality will require replication of some existing infrastructure and a larger footprint of disturbance due to additional transport requirements. Alternative localities have therefore not been considered in the environmental assessment.

Alternative technologies were investigated in the prefeasibility stage for the project. However, only one technology alternative for the Market Coke Plant and associated Co-generation Plant was found to be feasible. Thus no feasible technology options have been identified or considered during the EIA. Therefore the only alternative which has been considered is the no-go alternative.

Description of the Affected Environment

The core study area can be defined as the old coal stockpile area (current laydown area for unrelated mine projects) on which the plants will be built; the adjacent, existing Char Manufacturing Plant; the Grootegeluk Coal Mine; and adjacent areas affected by associated activities and infrastructure. The area where the new entrance gate will be constructed is a small area of relatively undisturbed mining land.

The broader area around the mine is mainly used for game farming. Other land uses nearby include a brick making operation, the Maropong Township, the Onverwacht area in Lephalale, and Eskom's Medupi and Matimba Power Stations. The area is located within the land capability classes V and VI which makes the area suitable for grazing, but not for arable land. Thus potential agricultural or other uses for the land are limited.

In terms of the environmental baseline, the aspect which is of most concern is the current level of the air quality in the area. The project site falls within the Waterberg Priority Area in terms of the National Environmental Management: Air Quality Act, (Act No. 39 of 2004) (NEM:AQA). Air quality is (and will continue to be) affected by the Grootegeluk Coal Mine and the Eskom Matimba (existing) and Medupi (under construction) Power Stations and their associated ash dumps. The emissions from the existing, adjacent Char Manufacturing Plant are currently licensed in terms of an Atmospheric Pollution Prevention Act (No. 45 of 1965) (APPA) permit (ref. CDAQMCC/23/4/2/2691) which has recently been renewed. With regard to the Market Coke and Co-generation Plant, an application for an amendment to the existing atmospheric emissions license (AEL) in accordance with the NEMAQA will be submitted during 2012.

The main source of air pollution within the immediate area of the proposed Market Coke and Co-generation Plant is from the adjacent, existing Char Manufacturing Plant. The existing plant has emissions from the two excess gas flare stacks, two liquor destructor stacks and the two boiler stacks. There is a vent pipe for each retort, but it is only used intermittently, e.g. during start-up or shut-down operations. It has also been planned to expand the existing Char plant in the near future (which will influence emissions). The Char plant expansion project is currently undergoing separate environmental applications and studies.

Approach and Methodology

The methodology for the EIA involved identifying, assessing and mitigating the potential environmental impacts. Specialist studies and consultation with the public and authorities were used to assist with the impact assessment process.

Study Team

Synergistics Environmental Services (Pty) Ltd (Synergistics) was appointed by Exxaro Reductants as the

independent Environmental Assessment Practitioner (EAP) to undertake the EIA. Several suitably qualified specialists undertook specialist studies as part of the EIA.

EIA Process

The EIA process complies with GNR 543 Sections 26 to 33 and the associated guidelines as well as the requirements of the Mineral and Petroleum Resources Development Act (No. 28 of 2002) (MPRDA) and NEM:AQA. The EIA process and public participation process are discussed in the report, with specific reference to the opportunities for consultation and participation for IAPs, Competent Authorities, and relevant State Departments and Organs of State.

Table A: Simplified EIA Process

<table>
<tr><th colspan="2" rowspan="2">Phase of Environmental Process</th><th colspan="2">Opportunities for Consultation and Participation</th><th colspan="2" rowspan="2">Schedule</th></tr>
<tr><th>Competent Authorities (LEDET, DMR and DWA)</th><th>IAPs, State Departments and Organs of State</th></tr>
<tr><td rowspan="6">Project Announcement and Application Phase</td><td rowspan="9">Specialist Baseline Studies</td><td>Initial telecommunication.</td><td>Project notification to affected landowners.</td><td>Mar 2011</td><td rowspan="6">2011</td></tr>
<tr><td></td><td>Advertisements and project notifications to potential interested and affected parties.</td><td>Mar 2011</td></tr>
<tr><td>Submit NEMA application form to LEDET. LEDET acceptance of application.</td><td></td><td>Apr 2011</td></tr>
<tr><td colspan="2">Initial consultation with authorities.</td><td>Mar 2011</td></tr>
<tr><td rowspan="2">Focused consultation with LEDET, DMR and DWA.</td><td>Initial public meetings.</td><td rowspan="2">Mar to May 2011</td></tr>
<tr><td>Focused consultation with Lephalale Municipality, Waterberg Municipality.</td></tr>
<tr><td rowspan="3">Scoping Phase</td><td>Draft scoping report to LEDET, DMR and DWA.</td><td>Review of draft scoping report (40 days, ±6 weeks).</td><td rowspan="2">Feb to May 2012</td><td rowspan="2">2012</td></tr>
<tr><td>Final scoping report to LEDET, DMR and DWA. Review and acceptance of final scoping report (30 days)</td><td>Review of final scoping report (30 days, ±4 weeks).</td></tr>
<tr><td rowspan="4">EIA Phase EMP Development</td><td rowspan="4">Specialist Assessments</td><td>Meetings with LEDET, DMR and DWA to discuss specialist studies.</td><td>Results of specialist assessments and recommendations made available for review</td><td rowspan="4">September - October 2012</td><td rowspan="6">2012</td></tr>
<tr><td>Submit draft EIA report to LEDET, DMR and DWA.</td><td>Review of draft EIA report (40 days, ±6 weeks)</td></tr>
<tr><td>Submit draft IWWMP to DWA.</td><td>Review of draft IWWMP (40 days, ±6 weeks)</td></tr>
<tr><td>Meetings with LEDET, DMR and DWA during EIA.</td><td>Possible public and authority meeting during EIA phase (14 days' notice)</td></tr>
<tr><td rowspan="4">Authority review & Authorisation Phase</td><td colspan="2">Final EIA report to LEDET, DMR and DWA. SUBMIT IWWMP with IWULA to DWA.</td><td>Review of final EIA report (21 days, ±3 weeks) Review of Final IWWMP (21 days, ±3 weeks)</td><td rowspan="4">Nov 2012 to February 2013</td></tr>
<tr><td colspan="2">LEDET Acceptance of EIA report (60 days)</td></tr>
<tr><td colspan="2">Environmental Authorisation Granted / Refused (45 days)
IWULA approved / rejected by DWA.</td><td></td></tr>
<tr><td colspan="2"></td><td>Notifications to IAPs regarding environmental authorisation (granted or refused).</td></tr>
<tr><td colspan="2">Appeal / Pre-Construction Period</td><td>Consultation during processing of appeal.</td><td>Consultants to provide guidance regarding the appeal process as and when required.</td><td>Variable</td><td></td></tr>
</table>

Four specialist studies (groundwater, surface water, air quality and traffic) were deemed necessary to assess the effects of the most significant impacts. The results of these studies are outlined in the main report. Certain environmental aspects of the study area have been subject to detailed specialist studies in the past and thus further studies of these were not required e.g. ecology and heritage.

This report provides a Final EIA-level description and assessment of potential environmental impacts (physical, biological, social and economic) associated with the proposed Market Coke and Co-generation Plant.

Public Issues and Concerns

In March and May 2011, public participation processes were undertaken for the proposed Market Coke and Co-generation Plant. The issues raised by the public and authorities included the source of water required for the project and whether suitable measures to control surface water pollution would be put in place. In addition, IAPs were concerned about air quality impacts, their effect on human health and the time period required for construction.

Environmental Legal Requirements

The key legislation applicable to the proposed project includes:

- *The National Environmental Management Act 1998 (No. 107 of 1998) (NEMA);*
- *The Mineral and Petroleum Resources Development Act 2002 (No. 28 of 2002);*
- *The National Water Act 1998 (No. 36 of 1998) (NWA); and*
- *The National Environmental Management: Air Quality Act 2004 (No. 39 of 2004).*

There will be four key deliverables for the project, each of which will be submitted to the relevant government department. These are:

- *An EIA in accordance with NEMA which will be submitted to the Limpopo Department of Economic Development, Environment and Tourism (LEDET) for activities that are listed in terms of the EIA Regulations;*
- *An EIA and Environmental Management Programme (EMP) in accordance with the MPRDA which will be submitted to the Department of Mineral Resources (DMR) for approval;*
- *An amendment to the Integrated Water Use Licence Application (IWULA) which will be submitted to the Department of Water Affairs (DWA); and*
- *An Atmospheric Emissions Licence application in accordance with the NEMAQA which will be submitted to LEDET for approval*.

Conclusions and Recommendations

This report forms part of the EIA phase of the Market Coke and Co-generation Plant Project environmental assessment. It outlines the results of the public participation and authority consultation processes undertaken in March 2011 and May 2011, explains the results of the specialist studies undertaken, assesses the environmental and socio-economic impacts and outlines mitigation measures.

The public and authority consultation conducted has revealed the following as the main issues of concern by the community:

- *Water usage*
- *Acid rain*
- *Community benefits from the project*
- *Health concerns*

- *Air quality*
- *Waste storage and management*

The potential impacts identified by the public and authorities have been considered in the EIA as well as other impacts identified by the EAP. The results of the impact assessment shows that the most significant potential impacts expected are: air quality, surface water quality, groundwater quality and traffic. These impacts were examined in more detail by specialists in these fields.

The key finding of the impact assessment of the Market Coke and Co-generation Plant is that air quality impacts will be the most significant impacts, though with mitigation, the impact on air quality will be moderate. The air quality assessment has predicted that the Market Coke and Co-generation Plant will have a negligible additional impact on air quality, but the baseline impacts in the area already exceed the permitted ambient levels for PM10 dust.

As most of the assessments were undertaken using modelling exercises, it is vital that suggested monitoring will be undertaken once the plants are operational, to ensure better understanding of the environmental impacts.

The mitigation measures which are presented in the EMP which accompanies this report are considered to be sufficient to mitigate the impacts to environmentally acceptable levels. There are no impacts which have a high significance after mitigation. There have been no fatal flaws identified during the EIA phase.
The EAP considers that the environmental process followed meets the requirements of the legislation to ensure that the regulatory authorities receive sufficient information to enable them to make an informed decision.

Synergistics Environmental Services (Pty) Ltd, as independent environmental assessment practitioners, conclude that there is no environmental reason why the development of the Market Coke and C-generation Plant Project should not be authorised with an environmental authorisation, atmospheric emissions licence and amendment of the EMP from the competent authorities.

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LIST OF TERMS, ACRONYMS AND ABBREVIATIONS

AEL	Atmospheric Emissions Licence
AMD	Acid Mine Drainage
APPA	Atmospheric Pollution Prevention Act (No. 45 of 1965)
BID	Background Information Document
BEE	Black Economic Empowerment
CDM	Clean Development Mechanism
CERs	Certified Emission Reductions
CO_2	Carbon dioxide
COFG	Coke oven flue gas
DC	Direct current
DEA	Department of Environmental Affairs
DMR	Department of Mineral Resources (formerly Department of Minerals and Energy (DME))
DWA	Department of Water Affairs
EB	Executive Board
EIA	Environmental Impact Assessment
EAP	Environmental Assessment Practitioner
EMP	Environmental Management Programme / Plan
ESP	Electrostatic precipitators
FeCr	Ferrochrome
GHG	Greenhouse Gas
GN(R)	Government Notice (Regulation)
ha	Hectares

H_2O	Water
H_2S	Hydrogen sulphide
HDPE	High density polyethylene (plastic)
IAPs	Interested and Affected Parties
IWUL(A)	Integrated Water Use Licence (Application)
IWWMP	Integrated Water and Waste Management Plan
kPa	Kilo Pascal (unit of pressure)
ktpa	Kilo ton per annum
kVA	Kilo volt ampere
LEDET	Limpopo Department of Economic Development, Environment and Tourism
LPG	Liquid petroleum gas
MCWAP	Mokolo and Crocodile Water Augmentation Project
Mℓ	Mega (million) litres = 1000 m^3
MPRDA	Minerals and Petroleum Resources Development Act
MVA	Mega volt ampere
MW	Megawatt
MWe	Megawatt electrical
MWt	Megawatt thermal
NAAQS	National Ambient Air Quality Standards
NEMA	National Environmental Management Act, 1998
NEM:AQA	National Environmental Management: Air Quality Act, 2004
NEM:BA	National Environmental Management: Biodiversity Act, 2004
NEM:WA	National Environmental Management: Waste Act, 2008
NERSA	National Energy Regulator of South Africa
NH_3	Ammonia
NHRA	National Heritage Resources Act, 1999
Nm^3	Normalized cubic metre
NO_x	Nitrogen oxides
NWA	National Water Act
O_2	Oxygen
PCD	Pollution control dam
PDD	Project Design Document
PM_{10}	Fine particulate matter with diameter less than 10 microns
POSA	Plants of South Africa
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SLA	Service level agreement
SO_2	Sulphur dioxide
TOPS	Threatened or Protected Species
tph	Tons per hour
UNFCCC	United Nations Framework Convention on Climate Change
WHRB	Waste heat recovery boiler
WWTW	Waste Water Treatment Works

GLOSSARY OF TERMS

Baseline Environment

Pre-development environmental conditions. The prevailing environmental conditions (or status quo) prior to the start of an activity or project, include current / existing environmental damage / degradation.

Baseline Impacts (Existing Impacts)
The current level of environmental degradation associated with existing developments, including those currently under construction. Determination of the current level of degradation associated with existing developments is essential to understand and enable the assessment of cumulative impacts.

By-product
A substance that is produced as part of a process that is primarily intended to produce another substance or product and that has the characteristics of an equivalent virgin product or material. (NEM:WA definition).

Calorific value
The calorific value is the heating value or energy value of a substance, usually a fuel. It is the amount of heat released during the combustion of a specified amount of the substance and is a characteristic for each substance.

Char
Char is the solid material that remains after volatile gas (e.g. coal gas) and coal tar have been driven out or released from a carbonaceous material during the initial stage of combustion, which is known as carbonisation, charring or de-volatilisation.

Co-generation (Co-gen)
Co-generation is the production of electricity in combination with other industrial processes. The Co-generation plant will utilise the heat energy of the coke oven off-gas (also termed coke oven flue gas (COFG)) in a boiler to produce electricity.

Coke
Coke is the solid carbonaceous material derived from the heating of coal to drive off its volatile constituents.

Cumulative Impacts
Combined impacts of two or more activities, or the combined impacts of an activity with that of current activities. For this report, cumulative impacts are described as:
Existing Impacts + Incremental Impacts of the project = Cumulative Impacts

Environment
Surroundings in which organisms operate, including air, water, land, natural resources, flora, fauna, humans and their inter- relations (includes bio-physical and socio-economic components).

Environmental Impact Assessment (EIA)
An EIA is an assessment of the positive and negative environmental consequences of the proposed project. The primary objective of the EIA is to aid decision-making by providing factual information on the assessment of these impacts, and determining their significance, as well as making valued judgements in choosing one alternative over another. For this EIA a combination of checklists, overlays and mapping, scoping and professional experience were used to identify the possible negative and positive impacts on the environmental components.

Incremental Impact
This is the impact of an activity looked at in isolation (impact of an individual activity), thus not considering the combined, cumulative or synergistic impacts of the activity, or the cumulative impacts of the activity with other activities or the current level of degradation. For this report, incremental impacts refer to impacts of only the rail and associated infrastructure to be relocated.

Interested and Affected Parties (IAPs)
These are individuals or groups concerned with or affected by the environmental impacts and performance of a project. Interested groups include those exercising statutory environmental control over the project, local residents/communities (people living and/or working close to the project), the project's employees, customers, consumers, investors and insurers, environmental interest groups, the general public, etc.

Mineral (in terms of the Minerals and Petroleum Resources Development Act)
Any substance, whether in solid, liquid or gaseous form, occurring naturally in or on the earth or in or under water and which was formed by or subjected to a geological process, and includes sand, stone, rock, gravel, clay, soil and any material occurring in residue stockpiles or in residue deposits, but excludes: Water, other than water taken from land or sea for the extraction of any material from such water; petroleum; or peat.

Mining
Mining is the making of any excavation for the purpose of extracting a mineral, and it includes any other associated activities and processes (MPRDA definition).

Mining Area
The area for which a mining authorisation/permission to mine has been granted. It includes:

- Any adjacent surface of land;
- any non-adjacent surface of land, if it is connected to such an area by means of any road, railway line, power line, pipe line, cableway or conveyer belt; and
- any surface of land on which such road, railway line, power line, pipe line, cableway or conveyer belt is located, under the control of the holder of such permit or authorisation and which the holder is entitled to use in connection with the operations performed or to be performed under such permit or authorization (MPRDA definition).

Off-gas
Gas produced as a by-product or waste during a manufacturing process.

PM10
Fine inhalable particles (smaller than 10 µm) found in the air. When inhaled, PM10s could cause damage to the lower airways and lungs.

Receptor
A receptor is the target or object on which the impact, stressor or hazard is expected to have an effect.

Reductant (Carbon based)
A reductant is a substance that is able to oxidise (donate an electron to) another substance. A carbon reductant (e.g. coke or char) is used with heat to change the oxidation state of a metal ore. The carbon or carbon monoxide derived from it removes oxygen from the ore to refine the metal.

Significant Impact
An impact can be deemed significant if consultation with the relevant authorities and other interested and affected parties, on the context and intensity of its effects, provide reasonable grounds for mitigating measures to be included in the environmental management report. The onus will be on the proponent to include the relevant authorities and other interested and affected parties in the consultation process. Present and potential future, cumulative and synergistic effects should all be taken into account.

Spontaneous Combustion
A type of combustion which occurs without an external ignition source. Coal reacts with atmospheric oxygen, which results in an exothermic reaction and when the temperature reaches the ignition temperature of coal,

the coal starts to burn.

Waste

Any substance, whether or not that substance can be reduced, re-used, recycled and recovered—
(a) that is surplus, unwanted, rejected, discarded, abandoned or disposed of;
(b) which the generator has no further use of for the purposes of production;
(c) that must be treated or disposed of; or
(d) that is identified as a waste by the Minister by notice in the Gazette, and includes waste generated by the mining, medical or other sector, but—

(i) a by-product is not considered waste; and

(ii) any portion of waste, once re-used, recycled and recovered, ceases to be waste. (NEMWA definition)

EXXARO REDUCTANTS
MARKET COKE AND CO-GENERATION PLANT PROJECT
Final Environmental Impact Assessment Report

PRELIMINARIES

Purpose of the Report

The purpose of this Environmental Impact Assessment (EIA) report is to present the results of the EIA process undertaken for the Market Coke and Co-generation Plant Project.

The report provides a description of the proposed Market Coke and Co-generation Plant and associated activities. It presents the environmental baseline of the site, the various specialist studies and the assessment of environmental impacts as well as the Environmental Management Programme (EMP). All the specialist studies are appended to the main report (refer to Appendices).

Report Volumes

The report is presented in 4 volumes:

- Volume 1: EIA Report
- Volume 2: EMP Report
- Volume 3: EIA Appendices 1 to 4
- Volume 4: EIA Appendices 5 to 16

List of Reports Completed for the Project to Date

The following reports have been completed to date:

- Market Coke and Co-generation Plant: Draft Environmental Scoping Report (January 2012).
- Market Coke and Co-generation Plant: Final Environmental Scoping Report (March 2012).
- Various specialist assessment reports, as appended to this report (refer List of Appendices).
- Market Coke and Co-generation Plant: Draft EIA Report (September 2012).
- Market Coke and Co-generation Plant: Draft EMP Report (September 2012).
- Market Coke and Co-generation Plant: Final EIA Report (November 2012, THIS REPORT).
- Market Coke and Co-generation Plant: Final EMP Report (November 2012, THIS REPORT volume 2).
- Public consultation report and various specialist assessment reports, as appended to THIS REPORT (refer List of Appendices).

1 INTRODUCTION

1.1 Project Background

Coke, a carbonaceous agent, is used in the metals industry as a reductant of iron ore and other metal ores (rock containing iron and its oxides (FeO_3) and other metals and their oxides) in the presence of heat at melting point, by allowing the oxides contained in the ore to react with the carbon. The proposed Market Coke and Co-generation Plant will produce 435 ktpa of dry coke product using 810 ktpa of wet coal.

About 18% of the Grootegeluk Mine's production consists of semi-soft coking and metallurgical quality

coal, which is sold to local and international steel and ferro-chrome alloy plants. The proposed Market Coke Plant will process some of the coking coal to form coke before transporting it to customers. Coke is made by heating suitable coal in coke ovens in the absence of oxygen, to a temperature of around 1200℃ for an extended period of time. During this heating cycle, coke is formed and volatile materials in the coal are released in the form of vapour, gas and smoke. The electricity Co-generation Plant will produce about 55 MW of electricity from extracting heat from the off-gas, called coke oven flue gas (COFG), produced in the coking process. It is anticipated that approval to negotiate agreements for the possible sale of electricity, with institutions like Eskom and the National Energy Regulator of South Africa (NERSA) will be granted following completion of the Bankable Feasibility Phase by February 2013.

1.2 Project Location

The Market Coke and Co-generation Plant will be located adjacent to the existing Char Manufacturing Plant, within the boundaries of the Grootegeluk Coal Mine (Figures 1.1, 1.2 and 1.5). The Grootegeluk Mine is located on the farm Daarby 458 LQ, approximately 20 km west of Lephalale (formerly Ellisras) in the Limpopo Province. Access to the mine and the existing Char Manufacturing Plant is from an east-west aligned provincial tarred road, the D2001, between Lephalale and Stockpoort.

The proposed site of the Market Coke and Co-generation Plant is on a 49.4 ha portion of an old coal stockpile area (also known as the old coal middling stockpile area), which is currently being used as a laydown area, and portion of a disused railway loop. The railway loop area will be used as a product stockpiling area. This site is also adjacent to an existing Char Manufacturing Plant which has been operational since 2009 (refer to Figure 1.3). The Char Manufacturing Plant is owned by Exxaro Reductants, on land leased from the Grootegeluk Mine (refer to Appendix 16). The proposed Market Coke and Co-generation Plant will also be owned and operated by Exxaro Reductants Pty (Ltd) (Exxaro Reductants) on land leased from the Grootegeluk Mine. The new Exxaro Reductants entrance gate will also be located on Grootegeluk Coal Mine property, near the existing coal tailings dams near the D2001 road (refer to Figure 1.4). The gate, including the parking areas and offices will be approximately 3725 m^2 in area.

As the Market Coke and Co-generation Plant will be within the Grootegeluk Mine's property, the mine and the Char Manufacturing Plant are the main neighbours whom may be affected by the Market Coke and Co-generation Plant. Neighbouring properties around the Grootegeluk Mine include private farms, which are mainly used as game farms, and the Manketti Reserve on the Grootegeluk Mine's property that is managed by Ferroland (a subsidiary of Exxaro). Other receptors which have been identified are the Marapong, Onverwacht and Lephalale residential areas located approximately 6 km, 15 km and 20 km to the south-east, respectively. The other developments and land uses nearby include two major Grootegeluk Coal Mine clients - the Eskom Matimba (existing) and Medupi (under construction) Power Stations.

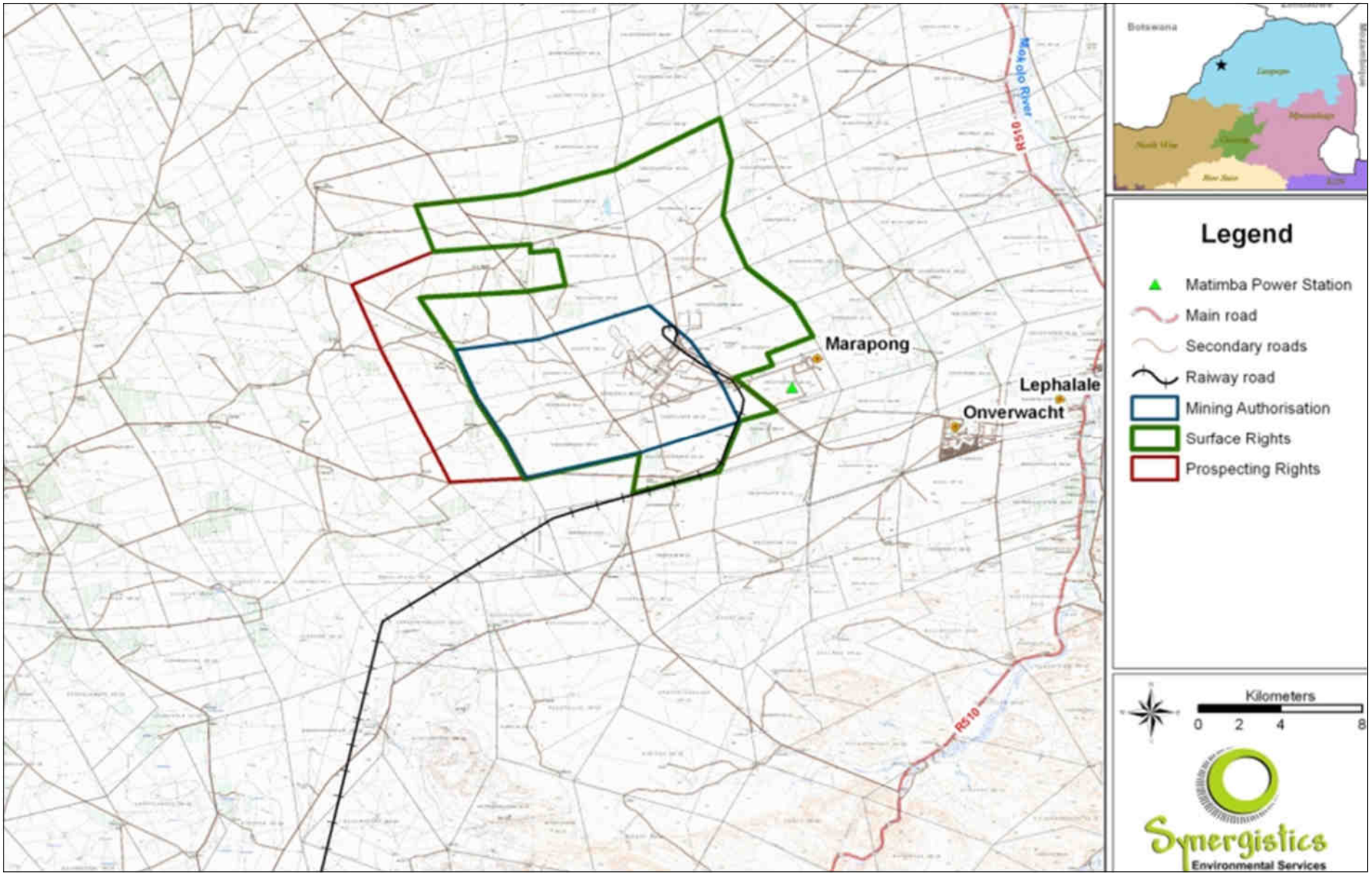


Figure 1.1: Regional Location of the Grootegeluk Coal Mine within which the Market Coke and Co-generation Plant will be constructed

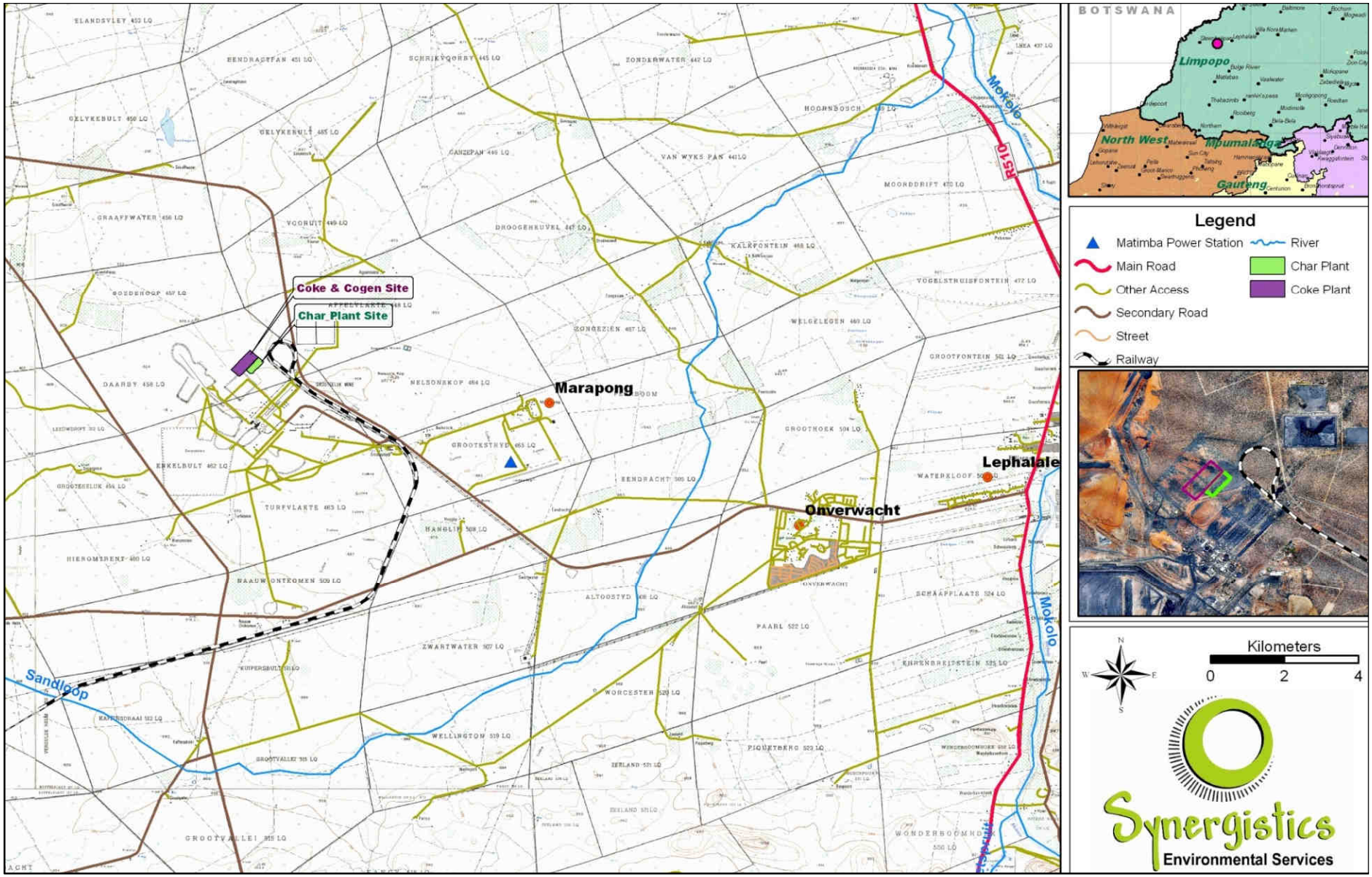


Figure 1.2: Approximate location of the Market Coke and Co-generation Plant at Grootegeluk Mine (In purple)

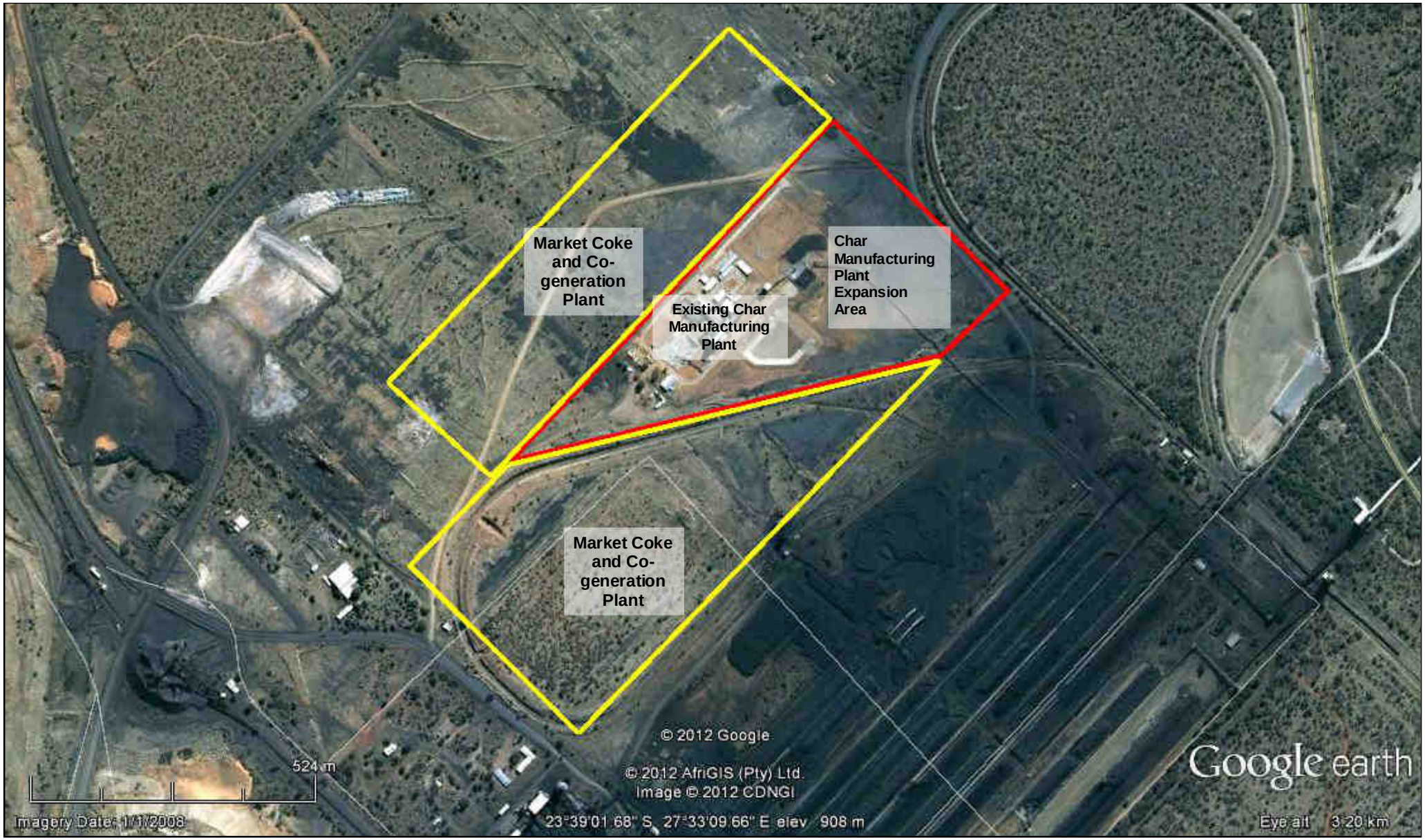


Figure 1.3: Market Coke and Co-generation Plant site (yellow outline) within the Grootegeluk Mine (aerial view)

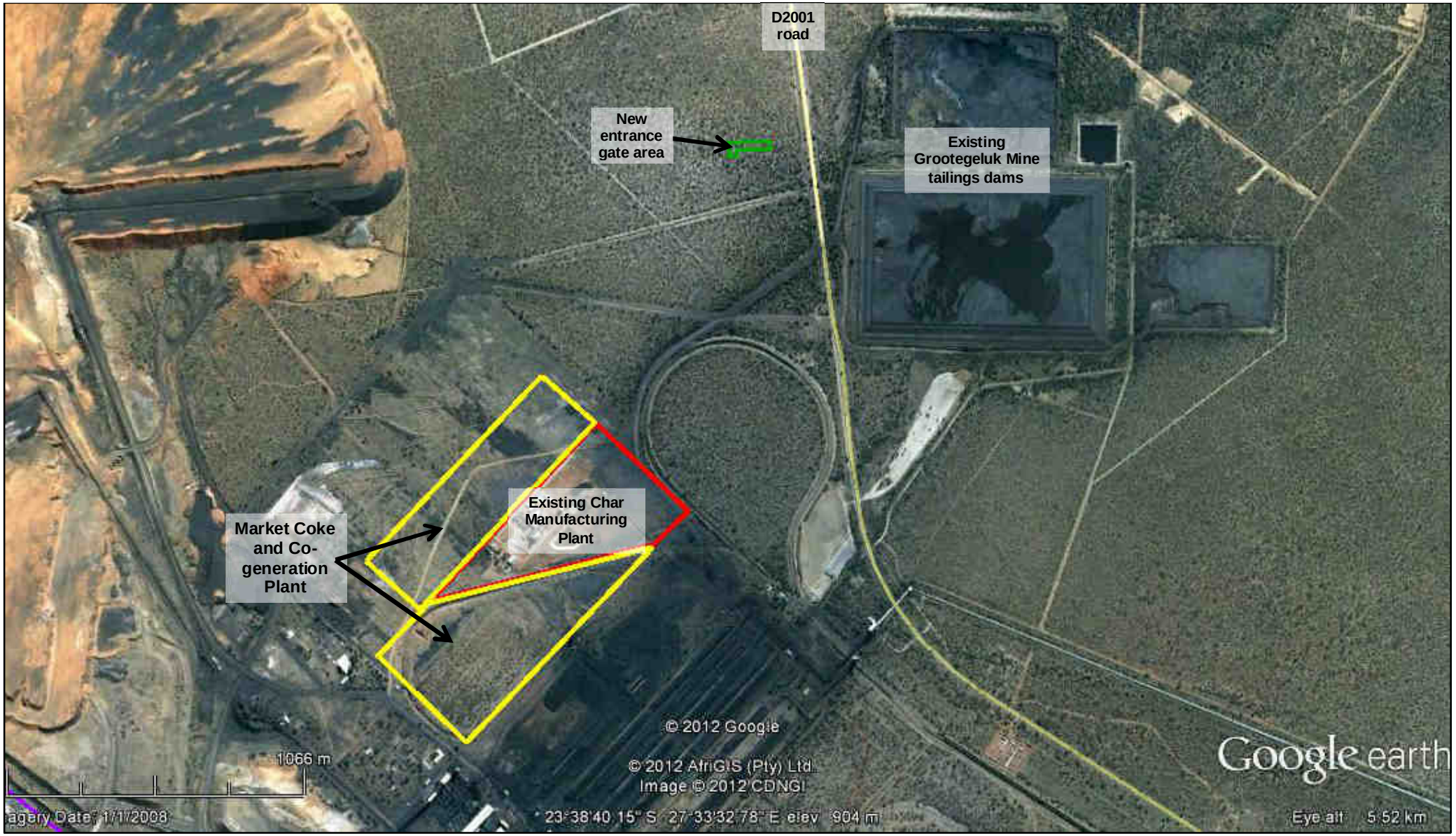


Figure 1.4: Market Coke and Co-generation Plant site (yellow outline) and New Reductants Entrance Gate (green) (aerial view)

Figure 1.5: Market Coke and Co-generation Plant site, view to the north (currently used as a laydown area)

1.3 Project motivation

Exxaro Reductants has entered into the reductants market with the existing Char Manufacturing Plant targeting the ferrochrome market. Ferrochrome is the main constituent in the production of stainless steel. There is a demand for increased production of coke within this market, which the Market Coke Plant aims to address (Figure 1.6). Exxaro Reductants is in a prime position to manufacture and supply coke with readily available coal feedstock (from the Grootegeluk Mine) and is in close proximity to their customers. Thus the primary motivation for the project is to produce coke to expand the business of Exxaro Reductants.

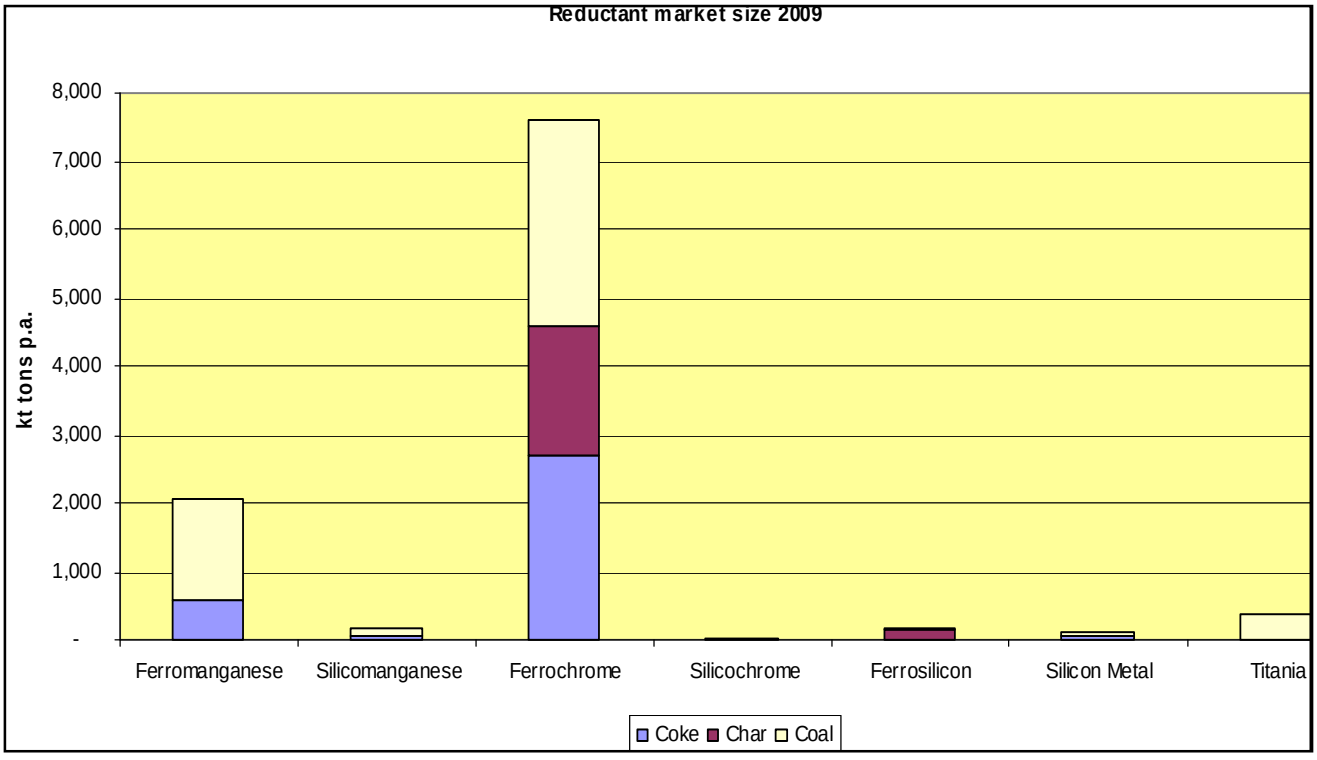


Figure 1.6: Reductant market size in 2009

In addition, Exxaro would like to invest in coke production opportunities due to the high revenue margins on this product (as shown in Figure 1.7). This figure shows that the sale of coke has ten times the revenue margin when compared to coal. Thus, the profit margins as well as the further beneficiation of coal make the production of coke a good business opportunity.

It should also be noted that the provision of coal to the Market Coke Plant will not affect the provision of coal from the Grootegeluk Mine to the Eskom Matimba and Medupi power stations. This is due to the fact that a different type of coal, mined from a different bench at the mine, will be used to supply the Market Coke Plant.

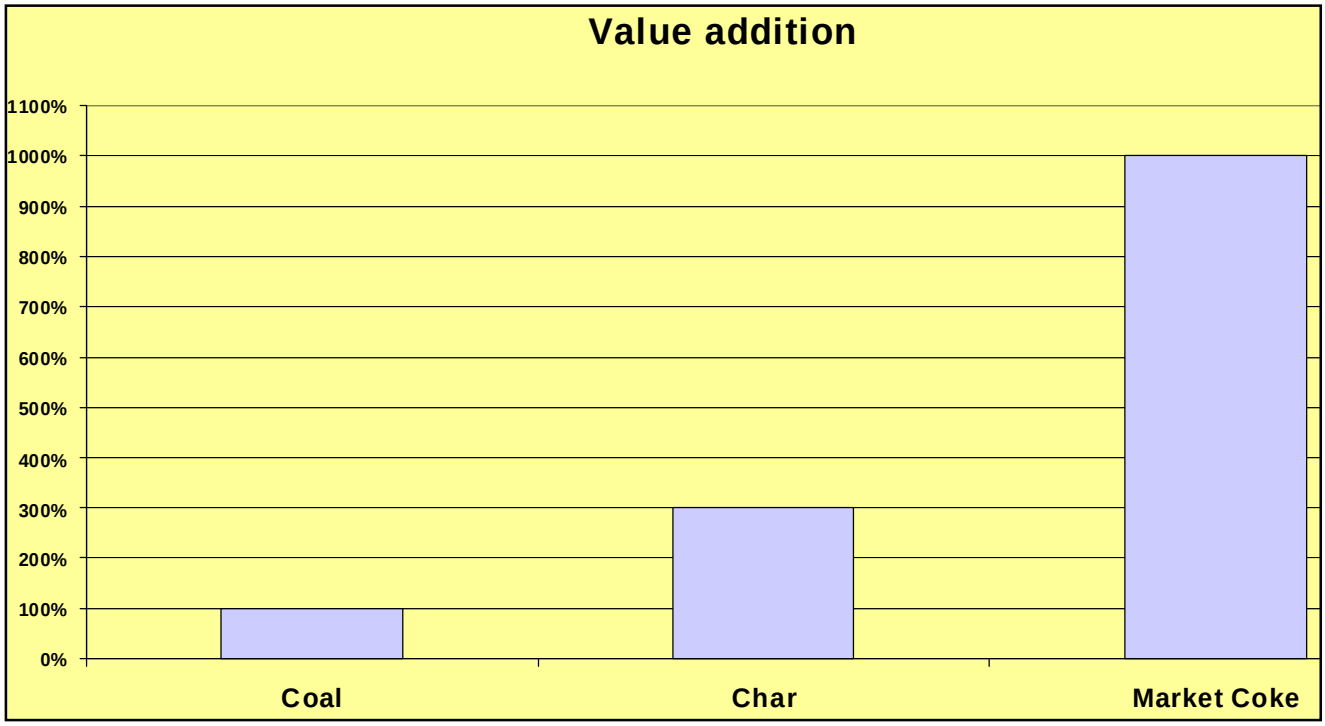


Figure 1.7: Increase in value addition created by downstream beneficiation of coal.

Exxaro Reductants is also proposing to develop an electricity Co-generation Plant which will utilise the waste heat contained in the exhaust gases of the Market Coke Plant to generate electricity. The term 'waste heat' implies that, should the heat not be used immediately, it would be lost to the atmosphere and thus 'wasted'. The COFG is fully combusted inside the coke ovens of the Market Coke Plant and the heated gas is directed to the 'waste' heat recovery, steam-generating boilers. The steam generated from the extracted thermal energy, is expanded through a steam turbine that drives a generator, to generate 'Co-generated' electrical energy. In Figure 1.8 below, a typical Coke processing plant with its associated Co-generation electricity plant is shown (courtesy Shanxi Provincial Chemical Design Institute (SPCDI)).

Additionally, the Co-generation Plant will be registered as a Clean Development Mechanism (CDM) project with the United Nations Framework Convention on Climate Change (UNFCCC) Executive Board (EB) under the Kyoto Protocol. The rationale for seeking CDM registration is that the Co-generation Plant, through the use of waste heat to generate electricity, produces less greenhouse gas (GHG) emissions in comparison with conventional electricity generation technologies. Once registered the Co-generation Plant will qualify to earn carbon credits in the form of Certified Emission Reductions (CERs). The CDM registration process is carried out as a separate process to the Scoping and Environment

Impact Assessment process and includes the compilation of a Project Design Document which is audited and validated by an independent third party assessor known as a Designated Operational Entity, before being submitted to the UNFCCC EB requesting registration.

The motivation behind the construction of the electricity Co-generation Plant is to satisfy the energy requirements of the Grootegeluk Coal Mine operations, including that of the Char and Market Coke Reductant plants' operations. Moreover, the Co-generation Plant will displace greenhouse gas (GHG) intensive electricity supplied to the Grootegeluk Coal Mine from the national grid, thereby lessening the burden on the available electricity supply and supporting national energy security and climate change objectives.

Figure 1.8: Coke Processing Plant with Associated Electricity Co-generation Plant (Courtesy SPCDI).

1.4 Project need and desirability

The construction of the Market Coke and Co-generation Plant is needed and desirable for the following reasons:

- Enable Exxaro Reductants to stay in operation and earn a profit.
- Enable Exxaro Reductants to produce a sufficient quality of coke reductant, to satisfy the various reductant requirements from its clients, mainly the stainless steel industry in South Africa.
- Ensure that South African coke consumers source more coke reductant from within South Africa and not obtain it from overseas suppliers ('import replacement').
- The construction of modern "Energy Recovery" Coke Ovens will not result in the production of solid waste, effluent or potentially hazardous by-products, which are produced in traditional "By-

product Recovery" Coke Ovens.
- Complete combustion of COFG will reduce the quantities of potentially hazardous gases.
- The Co-generation Plant will convert the available thermal energy, that otherwise would be wasted, into useful electrical energy.
- Enable Exxaro Reductants to satisfy the energy (electricity) requirements of the Grootegeluk Mine operations, including that of the Market Coke Plant's operations.
- Assist with national energy security and climate change objectives, by reducing the electricity demand of the Grootegeluk Mine.

1.5 Environmental Legal Requirements and Terms of Reference

Key legislation applicable to the Market Coke and Co-generation Plant project includes:
- The National Environmental Management Act,1998 (No. 107 of 1998) (NEMA);
- The Mineral and Petroleum Resources Development Act, 2002 (No. 28 of 2002) (MPRDA);
- The National Water Act, 1998 (No. 36 of 1998) (NWA); and
- The National Environmental Management: Air Quality Act, 2004 (No. 39 of 2004) (NEMAQA).

The existing Exxaro Reductants Char Manufacturing Plant has authorisation under the Minerals and Petroleum Resources Development Act 2002 (Refer to Appendix 13 for a copy). This MPRDA authorisation will be amended to include the Market Coke and Co-generation Plant. An application for the amendment of the approved EMP will be submitted to the Limpopo Department of Mineral Resources (DMR).

An Integrated Water Use License Application (IWULA) was compiled for the greater Grootegeluk Mine in 2007, which included the existing Char Manufacturing Plant. The Water Use License (WUL) (License number: 27072505) was obtained in June 2010 (Refer to Appendix 13 for a copy). There is also an approved Integrated Water and Waste Management Plan (IWWMP) and a Supporting Technical Report for the WUL. The proposed Market Coke and Co-generation Plant requires amendments to the existing WUL. An application for the amendment will be submitted to the Limpopo Department of Water Affairs (DWA).

The existing Char Manufacturing Plant also has an existing Atmospheric Pollution Prevention Act (No. 45 of 1965) (APPA) certificate which permits the emission of certain gases from the plant (certificate no. CDAQMCC/23/4/2/2691, refer to Appendix 13 for a copy). An application for an Atmospheric Emissions Licence (AEL) has been made by Exxaro Reductants to update this existing APPA authorisation to comply with the National Environmental Management: Air Quality Act, 2004. An application for the amendment of the AEL will then be made to also include the Market Coke and Co-generation Plant.

There will be four key deliverables for the Market Coke and Co-generation Plant project, each of which will be submitted to the relevant government department. These are:
- An EIA in accordance with NEMA will be submitted to the Limpopo Department of Economic Development, Environment and Tourism (LEDET) for environmental authorisation of activities that are listed in terms of the 2010 EIA Regulations;
- An EIA and EMP amendment in accordance with the MPRDA will be submitted to the Limpopo DMR for approval of an amendment to the approved EMP;
- An application for an amendment to the IWUL will be submitted to the Limpopo DWA; and
- An application for an amendment to the AEL in accordance with the NEMAQA will be submitted to LEDET for approval.

Synergistics Environmental Services (Synergistics) has been appointed as the independent consultants to undertake the required environmental work on behalf of Exxaro Reductants, as required by the applicable environmental legislation. The full list of legislation which has been considered for the proposed Market Coke and Co-generation Plant project is described in Table 1.1.

Table 1.1: List of Applicable Legislation and Guidelines Consulted

	Legislation	Regulations / Guidelines	Description / Requirement	Project Implication
EIA Process and Listed Activities	National Environmental Management	Section 2 of NEMA	Sets out the principles of environmental management	Section 2 principles are to be considered during the environmental impact assessment process.
		Chapter 5 of NEMA	Integrated environmental management, provides information on environmental management tools that promote the implementation of principles set out in Section 2 of NEMA	Environmental management tools are to be considered during the EIA process for the Project.
		Regulation 543	Chapter 2: Identification of the competent authority Chapter 3: Application for environmental authorisation Chapter 6: Public participation process Chapter 7: Appeal process	Scoping and Environmental Impact Assessment must be undertaken in accordance to Regulation 543.
		Regulation 544, Listing Notice 1	Lists activities requiring a basic environmental assessment	Environmental authorisation must be obtained prior to commencement with listed activities
		Regulation 545, Listing Notice 2	Lists Activities requiring an environmental impact assessment	Environmental authorisation must be obtained prior to commencement with listed activities
		Regulation 546, Listing Notice 3	Lists activities that require a basic environmental assessment at specific identified geographical areas only.	Environmental authorisation must be obtained prior to commencement with listed activity
		Guideline Series 5	Integrated Environmental Management Guideline Series 5: Companion to the NEMA EIA Regulation of 2010	The EIA process to be followed
		Guideline 4 and Guideline Series 7	Public Participation in support of the EIA regulations, 2005 Draft Public Participation Guideline (2010 EIA Regulations)	The public participation process to be followed.
		Guideline 5	Assessment of Alternatives and Impacts	The EIA process to be followed
Mining	Minerals and Petroleum Resources Development Act	Section 102 of the MPRDA	The environmental management programme cannot be amended without written consent from the minister.	Amended EMP must be submitted to the DMR for approval.
		MPRDA Regulations 527	Chapter 2 Part 3: Environmental Regulations for Mineral Development, Petroleum Exploration and Production. Chapter 2 Part 4: Pollution Control and Waste Management Regulation	EIA must be undertaken prior to operations and an Environmental Management Programme must be amended for the additional plant.
Biodiversity	National Environmental Management Biodiversity Act	National List of Ecosystems that are Threatened and in Need of Protection, GN 1002 of 9 December 2011	Lists ecosystems to be protected in terms of NEMBA.	No threatened ecosystems will be affected by the proposed development.

	Legislation	Regulations / Guidelines	Description / Requirement	Project Implication
		Threatened or Protected Species Regulations, GNR.152 of 23 February 2007	No person may carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit.	A permit will be required prior to removal of endangered, vulnerable and protected species.
	National Forests Act 84 of 1998	Notice 835 List of Protected tree species under the Act	No person may carry out a restricted activity on any protected tree except if there is a licence granted by the minister.	A licence must be obtained prior to removing any protected trees on site.
Waste Management	**National Environ-mental Management: Waste Act**	Regulation 718	Lists waste management activities that require a waste management licence prior to construction and operation.	A waste management licence is not required for this project as it does not include any waste management listed activities.
Water Use	**National Water Act**	Section 21	Lists water uses that require a licence prior to commencement	Application for a water use licence must be submitted to DWA for triggered activities.
Heritage Resources	**National Heritage Resources Act**	Section 38	Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as: (a) the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length; (c) any development or other activity which will change the character of a site- (i) exceeding 5000 m² in extent	South African Heritage Resources Agency (SAHRA) has to be notified of the proposed development.
		Section 38(2)	The responsible heritage resources authority must within 14 days of receipt of a notification in terms of subsection (1) – (a) if there is reason to believe that heritage resources will be affected by such development, notify the person who intends to undertake the development to submit an impact assessment report.	Heritage Impact Assessment is not required for the project (refer to SAHRA comments in Appendix 1).
Air Quality	**National Environmental Management: Air Quality Act**	GN 248	Lists activities that require an atmospheric emissions licence prior to construction.	An atmospheric emissions licence application must be submitted to LEDET for an AEL for listed processes.
		Declaration of The Waterberg Priority Area in Terms of Section 18(1) of NEMAQA, Notice 495 Of 15 June 2012	Describes the Waterberg Priority Area for air quality.	The priority area is declared and the air quality officers for the area are required to prepare air quality management plans to manage air quality and address any issues.

	Legislation	Regulations / Guidelines	Description / Requirement	Project Implication
Noise		Section 34	Minister may prescribe national standards to: -control noise in general, by specific machinery, activities or in specified places or areas; -for determining definition for noise and maximum levels of noise.	Applicant is to adhere to the national standards for noise.
Provincial Laws	**Limpopo Environmental Management Act 7 Of 2003**	Chapter 4, section 31 Chapter 8, section 64	Permits are required to hunt game and remove certain indigenous plants in certain areas.	The possible requirement for a permit should be determined before any wild animals or plants are removed or destroyed.
Land Use Management	**Conservation of Agricultural Resources Act 43 of 1983**	Regulation 280 of 2001	Requires the landowner to manage agricultural resources i.e. the removal of invasive species, protection of soils against water and wind erosion and the management of water resources.	An alien invasive species plan must be developed for the site and a land use and soil management plan must be developed. Alternatively the Grootegeluk Mine plans could be used.
Health and Safety	**Mine Health And Safety Act 29 of 1996**		To provide for protection of the health and safety of employees and other persons at mines.	The Market Coke and Co-generation Plant is located within the Grootegeluk Mine area and thus the Mine Health and Safety Act must be complied with.
	Occupational Health and Safety Act 85 of 1993		To provide for the health and safety of persons at work and for the health and safety of persons in connection with the use of plant and machinery.	The Occupational Health and Safety Act and any relevant regulations must be complied with at the Market Coke and Co-generation Plant.

1.5.1 National Environmental Management Act, 1998 (No. 107 of 1998)

The NEMA and the EIA Regulations (GN R 543, 544, 545 and 546, 18 June 2010) published thereunder, set out a schedule of listed activities that may not be undertaken without environmental authorisation from a competent authority. The EIA Regulations (GN R 543) define the requirements for the submission, processing, consideration and decision of applications for environmental authorisation of listed activities. In accordance with the legislation, the listed activities in Table 1.2 below require approval from the LEDET.

Table 1.2: NEMA Listed Activities Applicable to the Market Coke and Co-generation Plant (GNR 544, GNR 545 and GNR 546)

Government Notice	Activity No.	Listed Activity	Applicability to the Market Coke and Co-generation Plant
Activities requiring a Basic Assessment in terms of GNR 544 (Listing 1)			
R544, 18 June 2010	**Activity No. 9**	The construction of facilities or infrastructure exceeding 1 000 meters in length for the bulk transportation of water, sewage or storm water – (i) with an internal diameter of 0.36 metres or more; or (ii) with a peak throughput of 120 litres per second or more, excluding where: (a) such facilities or infrastructure are for bulk transportation of water, sewage or storm water or storm water drainage inside a road reserve; or (b) where such construction will occur within urban areas but further than 32 meters from a watercourse, measured from the edge of the watercourse.	The Market Coke Plant project will involve constructing pipelines and channels for the bulk transportation of storm water which will be approximately 3000 m long and have an internal diameter of 0.5 m. A pipeline will be constructed for the bulk transportation of water and will be approximately 2500 m long with an internal diameter of 0.4 m. The Co-generation Plant project will involve constructing pipelines and channels for the bulk transportation of storm water which will be approximately 1500 m long and have an internal diameter of 0.5 m. A pipeline will be constructed for the bulk transportation of water and will be approximately 1500 m long with an internal diameter of 0.4 m.
R544, 18 June 2010	**Activity No. 22**	The construction of a road, outside urban areas, (i) with a reserve wider than 13,5 meters or, (ii) where no reserve exists where the road is wider than 8 meters, or for which an environmental authorization was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Notice 545 of 2010.	The Market Coke and Co-generation Plant project will require the construction of internal roads which will be approximately 9 m wide and 3000 m long.
R544, 18 June 2010	**Activity No. 28**	The expansion of existing facilities for any process or activity where such an expansion will result in the need for a new or amendment of, an existing permit or license in terms of national or provincial legislation governing the release of emissions or pollution, excluding where the facility, process or activity is included in the list of waste management activities published in terms of section 19 of the	The Market Coke and Co-generation Plant project will require an amendment to the existing and approved Grootegeluk Mine Water Use License. The license includes information controlling polluted water and this project will increase the amount of polluted water to be controlled. The Market Coke and Co-generation Plant project will also require a new Atmospheric Emissions License. The license includes information governing the release

Govern-ment Notice	Activity No.	Listed Activity	Applicability to the Market Coke and Co-generation Plant
		National Environmental Management: Waste act, 2008 (Act No. 59 of 2008) in which case that Act will apply.	of emissions and this project will increase atmospheric emissions. However, the co-generation plant will reduce the concentrations of gaseous pollutants into the atmosphere and reduce the potential overall carbon footprint of the Market Coke plant. The "fuel" used in the Co-generation is predominantly extraction of waste heat and its conversion to useful energy from the Coke oven flue gas. Additionally, a desulphurisation plant will be constructed to decrease the sulphur emissions into the atmosphere.
R544, 18 June 2010	**Activity No. 37**	The expansion of facilities or infrastructure for the bulk transportation of water, sewage or storm water where: (a) the facility or infrastructure is expanded by more than 1000 meters in length; or (b) where the throughput capacity of the facility or infrastructure will be increased by 10% or more- excluding where such expansion: (i) relates to transportation of water, sewage or storm water within a road reserve; or (ii) where such expansion will occur within urban areas but further than 32 meters from a watercourse, measured from the edge of the watercourse.	The Market Coke Plant project will involve expanding existing pipelines and channels for the bulk transportation of storm water which will be expanded by approximately 3000 m. A pipeline for the bulk transportation of water will be upgraded by approximately 2500 m as part of this project. The Co-generation Plant project will involve increasing the capacity of pipelines and channels for the bulk transportation of storm water which will be expanded by approximately 1500 m. A pipeline for the bulk transportation of water will also be upgraded by approximately 1500 m as part of this project.
Activities requiring a full Environmental Impact Assessment in terms of GNR 545 (Listing 2)			
R. 545, 18 June 2010	**Activity No. 1**	The construction of facilities or infrastructure for the generation of electricity where the electricity output is 20 megawatts or more.	The Market Coke Plant project will involve the construction of waste heat recovery boilers which will produce approximately 60 MW (maximum) of electricity from the Coke plant's flue gas. The Co-generation Plant project will involve the construction of steam turbines and generators. Thus the total of the envisaged Market Coke plant related Co-generation will generate a total of approximately 60 MW of electricity.
R. 545, 18 June 2010	**Activity No. 15**	Physical alteration of undeveloped, vacant or derelict land for residential retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more: Except where such physical alteration takes place for: (i) linear development activities; or (ii) agriculture or afforestation where activity 16 in this Schedule will apply.	The Market Coke and Co-generation Plant project will involve the transformation of undeveloped mine land, outside an urban area, into an expanded industrial mine plant approximately 49.4 hectares in size (including stockpile areas).

Govern-ment Notice	Activity No.	Listed Activity	Applicability to the Market Coke and Co-generation Plant
Activities requiring a Basic Assessment in terms of GNR 546 (Listing 3)			
None			

LEDET is the competent authority in terms of NEMA and the EIA Regulations. An application form for environmental authorisation was submitted to LEDET on 11 March 2011 and accepted by LEDET on 20 April 2011. The reference number for the project is 12/1/9/2 – W12. The draft scoping report was submitted to LEDET on 30 January 2012 and accepted on the 2nd of February 2012. The final scoping report was submitted in April 2012 and accepted on the 24th of May 2012. The draft EIA report was submitted on 17 September 2012 and LEDET acknowledged receipt on the 27th of September 2012.

Please note that a separate EIA process is also underway for an extension to the existing Char Manufacturing Plant which is adjacent to the proposed Market Coke and Co-generation Plant (LEDET ref. 12/1/9/2-W07).

1.5.1.1 Content of an Environmental Impact Assessment Report

National Environmental Management Act and Amendments

Section 2 of the National Environmental Management Amendment Act 62 of 2008 (NEMAA), amends section 24(4) of the NEMA and stipulates the following requirements for an EIA Report:

Procedures for the investigation, assessment and communication of the potential consequences or impacts of activities on the environment - **(a)** must ensure, with respect to every application for an environmental authorisation - i) **co-ordination and co-operation between organs of state** in the consideration of assessments **where an activity falls under the jurisdiction of more than one organ of state**;	Competent Authority Review
ii) that the findings and recommendations flowing from an investigation, the general **objectives of integrated environmental management** laid down in this Act and the **principles of environmental management** set out in Section 2 are taken into account in any **decision made by an organ of state** in relation to any proposed policy, programme, process, plan or project;	Competent Authority Review
iii) that a **description of the environment likely to be significantly affected** by the proposed activity is contained in such application;	See Section 4
iv) investigation of the **potential consequences for or impacts on the environment** of the activity	See Sections 6 and 7
and **assessment of the significance of** those potential **consequences or impacts**; and	See Sections 6 and 7
v) **public information and participation procedures** which provide all interested and affected parties, including all organs of state in all spheres of government that may have jurisdiction over any aspect of the activity, with a reasonable opportunity to participate in those information and participation procedures; and	See Section 2.7, section 5 and Appendix 1
(b) must include, with respect to every application for an environmental authorisation and where applicable – i) investigation of the potential consequences or **impacts of the alternatives** to the activity on the environment	See Section 3.2.7
and assessment of the **significance of those potential consequences or impacts** [**of alternatives**],	N/A See Section 3.2.7
including the **option of not implementing the activity**;	See Section 3.2.7
ii) investigation of **mitigation measures** to keep adverse consequences or impacts to a minimum;	See Sections 6, 7 and volume 2 - the EMP

iii) investigation, assessment and evaluation of the impact of any proposed listed or specified **activity on any national estate referred to in section 3(2) of the National Heritage Resources Act**, 1999 (Act No. 25 of 1999), excluding the national estate contemplated in section 3(2)(i)(vi) and (vii) of that Act;	See Sections 1.5.7 and 6
iv) reporting on **gaps in knowledge**, the	See Section 2.3
the **adequacy of predictive methods** and	See Sections 2.2 and 2.3
underlying **assumptions, and uncertainties** encountered in compiling the required information;	See Sections 2.2 and 2.3
v) investigation and formulation of arrangements for the **monitoring and management** of consequences for or impacts on the environment,	See Sections 6, 7 and volume 2 - the EMP
and the **assessment of the effectiveness** of such [**monitoring and management**] arrangements after their implementation;	See volume 2 - the EMP
vi) **consideration of environmental attributes** identified in the compilation of information	See Section 4
and **maps** contemplated in subsection (3); and	See Table of Figures
vii) provision for the **adherence to requirements** that are prescribed **in a specific environmental management Act relevant to** the **listed or specified activity in question**.	Explained in this Section of the Report, financial provision information included in the EMP.

Section 31 of the EIA Regulations (GN R 543, 544, 545 and 546, 18 June 2010) published under NEMA, specifies the contents of EIA Reports to be:

(2) An environmental impact assessment report must contain all information that is necessary for the competent authority to consider the application and to reach a decision contemplated in regulation 35, and must include- (a) details of- (i) the EAP who compiled the report; and (ii) the expertise of the EAP to carry out an environmental impact assessment;	See project information sheet
(b) a detailed description of the proposed activity;	See Section 3
(c) a description of the property on which the activity is to be undertaken and the location of the activity on the property, or if it is- (i) a linear activity, a description of the route of the activity; or (ii) an ocean-based activity, the coordinates where the activity is to be undertaken;	See Section 1.2
(d) a description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity;	See Sections 4 and 6
(e) details of the public participation process conducted in terms of sub regulation (1), including-	See Section 2.7 and Appendix 1
(i) steps undertaken in accordance with the plan of study;	See Sections 2.6, 2.7 and Appendix 1
(ii) a list of persons, organisations and organs of state that were registered as interested and affected parties;	See Section 2.7 and Appendix 1
(iii) a summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; and	See Section 5 and Appendix 1
(iv) copies of any representations and comments received from registered interested and affected parties;	See Appendix 1

(f) a description of the need and desirability of the proposed activity;	Section 1.4
(g) a description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity;	See Section 3.2.7
(h) an indication of the methodology used in determining the significance of potential environmental impacts;	See Section 2.6.6
(i) a description and comparative assessment of all alternatives identified during the environmental impact assessment process;	See Section 3.2.7
(j) a summary of the findings and recommendations of any specialist report or report on a specialised process;	See section 7
(k) a description of all environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures;	See Section 6
(l) an assessment of each identified potentially significant impact, including- (i) cumulative impacts; (ii) the nature of the impact; (iii) the extent and duration of the impact; (iv) the probability of the impact occurring; (v) the degree to which the impact can be reversed; (vi) the degree to which the impact may cause irreplaceable loss of resources; and (vii) the degree to which the impact can be mitigated;	See Section 6
(m) a description of any assumptions, uncertainties and gaps in knowledge;	See sections 2.2 and 2.3
(n) a reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	See section 9
(o) an environmental impact statement which contains- (i) a summary of the key findings of the environmental impact assessment; and (ii) a comparative assessment of the positive and negative implications of the proposed activity and identified alternatives;	Section 9
(p) a draft environmental management programme containing the aspects contemplated in regulation 33;	Volume 2 –EMP
(q) copies of any specialist reports and reports on specialised processes complying with regulation 32;	Volumes 3 and 4 – Appendices 2 to 8
(r) any specific information that may be required by the competent authority; and	Section 5
(s) any other matters required in terms of sections 24(4) (a) and (b) of the Act.	None
(3) The EAP managing the application must provide the competent authority with detailed, written proof of an investigation as required by section 24(4) (b) (i) of the Act and motivation if no reasonable or feasible alternatives, as contemplated in subregulation 31(2) (g), exist.	Whole report

1.5.1.2 Environmental Management Programme Reports

National Environmental Management Act and Amendments

Section 8 of the NEMAA, amends Section 24N of the NEMA and stipulates the following requirements the content of an EMP:

(2) The environmental management programme must contain - (a) information on any proposed **management, mitigation, protection or remedial measures** that will be undertaken to address the environmental impacts that have been identified in a report contemplated in Subsection 24(1A),	See Section 5 of Volume 2 - the EMP

including [**management, mitigation, protection or remedial measures**] for environmental **impacts or objectives** in respect of – i) **planning and design**;	See Section 5.1 of Volume 2 - the EMP
ii) **pre-construction and construction** activities;	See Section 5.2 of Volume 2 - the EMP
iii) the **operation** or undertaking of the activity in question;	See Section 5.3 of Volume 2 - the EMP
iv) the **rehabilitation** of the environment; and	See Section 5.4 of Volume 2 - the EMP
v) **closure**, if applicable;	See Section 5.5 of Volume 2 - the EMP
(b) **details** of— i) the **person who prepared the environmental management programme**; and ii) the **expertise** of that person to prepare an environmental management programme;	See project information sheet for Volume 2 - the EMP
(c) a detailed **description of the aspects of the activity** that are **covered** by the environmental management programme;	Section 2 of Volume 2 - the EMP
(d) information identifying the **persons who will be responsible for the implementation** of the measures contemplated in paragraph (a);	See Section 4.4 of Volume 2 - the EMP
(e) information in respect of the mechanisms proposed for **monitoring compliance** with the environmental management programme and [mechanisms proposed] for **reporting on the compliance**;	See Section 5 of Volume 2 - the EMP
(f) as far as is reasonably practicable, **measures to rehabilitate** the **environment affected** by the undertaking of any listed activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development; and	See Sections 5.4 and 5.5 of Volume 2 - the EMP. The closure objectives are in Appendix 9.
(g) a description of the manner in which it intends to— i) **modify, remedy, control or stop** any **action, activity or process** which causes **pollution or environmental degradation**;	See Section 5 of Volume 2 - the EMP
ii) **remedy the cause of pollution or degradation** and **migration of pollutants**; and	See Section 5 of Volume 2 - the EMP
iii) **comply with any prescribed** environmental management **standards or practices**.	See Section 5 of Volume 2 - the EMP

1.5.2 National Environmental Management Waste Act 2008 (No. 59 of 2008)

The requirements of the National Environmental Management: Waste Act (No. 59 of 2008) (NEMWA) came into effect on 1 July 2009. The Act makes provision for the identification of various waste management activities, which may have a detrimental effect on the environment. A waste management activity identified in terms of the Act may not commence, be undertaken or conducted except in accordance with published standards or a Waste Management Licence (WML). On 3 July 2009, the list of waste management activities requiring a WML from a competent authority were published (GN 718).

In order to decrease the air pollutant emissions of the power plant, a desulphurisation plant will be constructed to remove sulphur dioxide and convert it into gypsum with the addition of lime. The gypsum will be a by-product and not a waste. The gypsum meets the definition of a by-product in terms of NEMWA and will be sold.

None of the activities included in the list of waste management activities will be conducted as part of the Market Coke and Co-generation Plant project. No waste of any kind will be disposed of on-site and no

waste will be treated in any way. Thus, a WML is not required for this project.

The Waterberg District Municipality's Integrated Waste Management Plan (IWMP) (2009) indicates that there are no waste management bylaws applicable to this area.

1.5.3 Mineral and Petroleum Resources Development Act 2002 (No. 28 of 2002)

The Market Coke and Co-generation Plant is located within the boundaries of Grootegeluk Mine and therefore forms part of the "mining area". The MPRDA defines the mining area as:
"(i) in relation to a mining right or a mining permit, means the area for which that right or permit is granted;
(ii) in relation to any environmental … matter and any … impact thereto, includes-

> (a) any adjacent or non-adjacent surface of land on which the extraction of any mineral and petroleum has not been authorised in terms of this Act but upon which related or incidental operations are being undertaken and, including-
>
> > (i) any area connected to such an area by means of any road, railway line, power line, pipeline, cable way or conveyor belt; and
> > (ii) any surface of land on which such road, railway line, power line, pipeline or cable way is located …"

Section 39 of the MPRDA requires that an EIA be undertaken and an EMP submitted for activities within a mining area. These are in place for the Grootegeluk Mine and the existing Char Manufacturing Plant. However, the current approved EMP does not cover the proposed Market Coke and Co-generation Plant project. Thus the EMP must be amended to include the impacts and mitigation of the expansion.

This EIA/EMP amendment report has been undertaken in accordance with Sections 48 – 52 of the MPRDA Regulations, which stipulate the requirements and contents of the Scoping and EIA reports. The EIA/EMP will be submitted to the Limpopo DMR for their approval.

As a full scoping and EIA is needed as per both the NEMA and the MPRDA, a single EIA/EMP report has been prepared for the project, integrating the NEMA and MPRDA requirements.

Table 1.3: Structuring of the EIA/EMP Report in terms of Section 50 of the MPRDA regulations GNR 527

Legal and Regulatory Requirement	Cross Reference to Report Section
(a) An assessment of the environment likely to be affected by the proposed mining operation, including cumulative environmental impacts;	Section 4 and section 6.
(b) an assessment of the environment likely to be affected by the identified alternative land use or developments, including cumulative environmental impacts;	Section 3.2.7, Section 4 and section 6.
(c) an assessment of the nature, extent, duration, probability and significance of the identified potential environmental, social and cultural impacts of the proposed mining operation including the cumulative environmental impacts;	Section 6 and 7.
(d) a comparative assessment of the identified land use and development alternatives and their potential environmental, social and cultural impacts;	Section 6.
(e) determine the appropriate mitigatory measures for each significant impact of the proposed mining operation;	Section 6 and Volume 2 - the EMP.
(f) details of the engagement process of interested and affected persons followed during the course of the assessment and an indication of how the issues raised by interested and affected persons have been addressed	Section 2.7

Legal and Regulatory Requirement	Cross Reference to Report Section
(g) identify knowledge gaps and report on the adequacy of predictive methods, underlying assumptions and uncertainties encountered in compiling the required information;	Section 2.2 and 2.3
(h) description of the arrangements for monitoring and management of environmental impacts; and	Section 6 and the EMP
(i) Inclusion of technical and supporting information as appendices, if any.	Appendices

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

Section 21 of the NWA lists water uses for which an IWUL must be obtained. In terms of the NWA, the following water uses are applicable for the Market Coke and Co-generation Plant:

- Section 21 g 'disposing of waste in a manner that may detrimentally impact on a water resource'. A settling pond will be in place at each coke quench tower and an extension to the existing pollution control dam (PCD) will be constructed as part of this project. The Coke product stockpiles and coal feedstock stockpiles will also be applied for due to their potential to cause water pollution if not suitably managed.
- Section 21 h 'disposing of water which contains waste from, or which was heated in, any industrial or power generation process'. The water which will collect in the PCD Extension and which will pass through the settling pond will contain waste from an industrial process (coke manufacturing) and some of the water will also have been heated in the quenching of the hot coke as part of the coke manufacturing process. The water in the PCD will be re-used in the Reductants processes.

A WUL (Licence no. 27072505) and Integrated Water and Waste Management Plan (IWWMP) is in place for the Grootegeluk Mine and for the existing Char Manufacturing Plant. The approved IWWMP will be amended to include the Market Coke and Co-generation Plant project. An IWUL amendment application will also be submitted to the Limpopo DWA for their approval. The final scoping and draft EIA reports were submitted to the DWA as the first phase in the WUL application process, and the final EIA will also be submitted to DWA.

1.5.5 National Environmental Management Air Quality Act 2004 (No. 39 of 2004)

The NEMAQA makes provision for the identification of various activities, which result in atmospheric emissions which may have a significant detrimental effect on the environment. Activities identified in terms of the Act (GN R 248, March 2010) may not commence except in accordance with an AEL and the minimum emissions standards. In terms of Section 37 of the NEMAQA an AEL is required for the Market Coke and Co-generation Plant project.

This AEL will be an amendment of the approved licence for the existing, adjacent char plant in terms of the APPA (certificate ref. CDAQMCC/23/4/2/2691) which has recently been renewed. When the AEL application is submitted to LEDET Air Quality Management section, proof will also be provided to LEDET Environmental Impact Management section. Table 1.4 gives the NEMAQA listed activities relevant for the Market Coke and Co-generation Plant.

Table 1.4: NEM:AQA Listed Activities Applicable to the Market Coke and Co-generation Plant (GN 718)

Government Notice	Activity No.	Listed activity	Common name of pollutant	Chemical Symbol	Point source emissions limit for new plants (mg/Nm^3 under normal temperature and air pressure)
GN 248 of 31 March 2010	Subcategory 3.2	Coke production and coal gasification.	Hydrogen sulphide	H_2S	7
Special Arrangement: sulphur-containing compounds to be recovered from gases to be used for combustion with a recovery efficiency of not less than 90% or remaining content of sulphur-containing compounds to be less than 1000 mg/Nm^3 measured as hydrogen sulphide, whichever is strictest.					
GN 248 of 31 March 2010	Subcategory 3.1	Combustion Installations	Particulate matter	N/A	50
			Oxides of nitrogen	NO_x expressed as NO_2	700
			Total volatile organic compounds (from non-coke oven operations)	N/A	40

The Waterberg District Municipality Air Quality Management Plan (AQMP) (2009) states that there are no current air quality by-laws at the district and local levels.

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

The National Environmental Management Biodiversity Act 2004 (No. 10 of 2004) (NEMBA) provides for the protection of threatened ecosystems and species. A biodiversity study has been conducted for the Grootegeluk Mine area. The results of this study have been included in this report. The proposed site for the Market Coke and Co-generation plant is on a previously disturbed area, used for Grootegeluk mine activities. It is therefore unlikely that protected species may occur on the site. NEMBA regulations state that no person may carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit. Thus, if threatened or protected species are found on site, a permit will be required prior to their removal. No threatened ecosystems will be affected by the proposed development. Thus this issue will not need to be considered further.

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

The National Heritage Resources Act (NHRA) provides for the protection of all archaeological and paleontological sites and meteorites. Section 38 of the Act defines the categories of development for which the responsible heritage resources authority must be notified. Under Section 38 (1)(c) *"any development or other activity which will change the character of a site - (i) exceeding 5000 m^2 … must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development."*

The footprint of the Market Coke and Co-generation Plant will be approximately 49.4 ha. However, the proposed site has been previously disturbed by coal stockpiling undertaken for the past 40 years. The possibility of artefacts of cultural or heritage significance being located at the site is therefore considered to be negligible. The area where the new entrance gate will be constructed is a small area of relatively undisturbed mining land, but as the footprint of the gate will be very small (approximately 3725 m^2) there are unlikely to be any impacts on cultural heritage.

A phase one Heritage Impact Assessment has been conducted for the entire mining rights area for the Exxaro Grootegeluk Mine (previously owned by Kumba Resources Ltd), which includes the proposed site of the Market Coke and Co-generation Plant (refer to Appendix 7). The investigation was conducted by J. van Schalkwyk of the National Cultural History Museum, who also wrote the report. The results of this report indicate that the closest archaeological site to the proposed development is 3.16km away. For this reason, it is assumed that no additional heritage mitigation is required for these developments.

In accordance with section 38 of the NHRA, a letter and a copy of the report has been sent to the SAHRA (refer to Appendix 7). SAHRA has not requested that any further heritage studies be done on the site (refer to SAHRA comments in Appendix 1).

2 APPROACH AND METHOD

This report presents the Environmental Impact Assessment and Environmental Management Programme undertaken for the assessment of the Market Coke and Co-generation Plant at Grootegeluk Mine.

2.1 Study Objectives

The objectives of the EIA are to:

- Identify legislative requirements for the proposed development to ensure compliance through the different phases of the project;
- Establish a detailed project description in order to understand the likely impacts;
- Undertake detailed specialist studies to understand the baseline environmental conditions and to inform the EIA on the projects impacts;
- Afford an additional opportunity for Interested and affected parties (IAPs) to comment on the proposed development;
- Identify environmental and socio-economic impacts of the proposed development; and
- Assess the significance of identified impacts in order to advise on the level of management and mitigation required.

The objectives of the EMP (Volume 2) are to:

- Identify and list measures to avoid, minimise, manage or mitigate the identified impacts;
- Identify the roles and responsibility for the implementation of management and mitigation measures; and
- Establish the timeframes in which the management measures are to be implemented.

2.2 Study Assumptions

It is assumed that the project description used for the assessment and as provided by Exxaro Reductants is a true reflection of the intended project with its associated operational envelopes and that Synergistics has been provided with all necessary information required to undertake an assessment of the potential impacts of the project.

It should be noted that some of the specialist studies were undertaken prior to the finalisation of the project description. The project description provided in specialist reports may thus differ slightly from that given in the EIA Report. The EIA Report however presents the most up to date project description for which the impacts have been assessed and management measures proposed.

The identification of environmental impacts, the rating of impact significance and the recommendation of mitigation measures assumes that the design parameters and standard operating conditions at the Market Coke and Co-generation Plant will be implemented with an acceptable level of management and maintenance efficiency. Occasional non-compliances or limited failures are an accepted part of operations and were thus included in the impact assessment.

2.3 Knowledge Gaps and Uncertainties

The impacts identified in this report are based on the current understanding of the baseline environment. The monitoring conducted has been considered sufficient by the specialists to undertake the necessary studies.

Models are simulations and as far as possible try to reflect the future reality. However additional monitoring and an updating of the models will be required throughout the different stages of the proposed development to ensure a thorough understanding of the impacts.

2.4 Study Area

The study area can be roughly defined as the old cleared coal stockpile area, to the north west of the existing Char Manufacturing Plant, and the disused rail loop as shown in Figure 1.3**.** This area of land is on the Grootegeluk Mining rights area. The new Exxaro Reductants entrance gate will also be located on Grootegeluk Coal Mine property. The site is a relatively undisturbed portion of the mining area which is likely to contain indigenous plant species.

2.5 Scoping Phase

The scoping report, undertaken in 2012, a site visit (and site visits by the specialists) formed the basis for obtaining baseline information for the project site. The site visits to the proposed Market Coke and Co-generation Plant Site area were undertaken by Vivienne Vorster and Shelley Holt on several occasions during 2011 and 2012, in order to view the existing operations, conduct public participation sessions and to collect additional information to incorporate into the EIA.

A scoping study was undertaken as the first phase of the EIA process. During the scoping phase:

- Project and baseline environmental information was gathered and collated;
- Landowners, adjacent landowners, local authorities, environmental authorities, as well as other stakeholders which may be affected by the project, or that may have an interest in the environmental impacts of the project were identified.
- IAPs were informed about the proposed project.
- Public meetings were arranged and IAP issues and concerns were identified.
- Environmental authorities were consulted to confirm legal and administrative requirements.
- Environmental issues and impacts were identified and described.
- Development alternatives were identified and evaluated, and non-feasible development alternatives were eliminated.
- The nature and extent for further investigations and specialist input required in the EIA phase were identified.
- The draft and final scoping reports were submitted for review by authorities, relevant organs of state and IAPs.
- Key IAP issues and concerns were collated into an issues and response report for consideration in the EIA phase.

The draft scoping report was submitted to LEDET on 30 January 2012 and accepted on the 2nd of

February 2012. The final scoping report was submitted in April 2012 and accepted on the 24th of May 2012. Scoping is a critical step in the environmental assessment process. Through scoping, significant issues, which require further investigation, were identified. Issues that were identified as having a potentially significant impact were carried forward into the EIA phase and are subsequently addressed in the EMP.

2.6 EIA Phase

2.6.1 EIA Process

The EIA component of the study includes:

- Specialist investigations which were undertaken in accordance with the terms of reference established in the scoping assessment (plan of study for EIA included in the scoping report).
- An evaluation of development alternatives and identification of a proposed option.
- An assessment of existing impacts (no-go development option), environmental impacts that may be associated with the proposed project option and cumulative impacts using the impact assessment methodology as described in Section 2.6.5 and 2.6.6.
- Identification of mitigation measures to address the environmental impacts.
- Consultation with IAPs.
- Incorporation of public comments received during the scoping into the draft and final EIA reports.
- Issuing of the draft and final EIA reports for review.

2.6.2 Specialist Studies

The various specialist studies conducted as part of the Market Coke and Co-generation Plant EIA process are listed below and the reports are appended to this final EIA report. The scope of work was to assess the impact of the Market Coke and Co-generation Plant project on each aspect of the environment which was deemed to be most significant (i.e. on surface water, groundwater, air quality and traffic). The scope of work also included the identification of suitable mitigation measures for each significant impact. A detailed description of the scope of work of the individual studies is explained in each specialist report. The following specialist studies (refer to Table 2.1) were undertaken as part of the EIA process in order to understand the environmental impacts of the project:

Table 2.1: Specialist Studies undertaken as part of the EIA process (or studies undertaken on the site previously)

Specialist reports have been structured in terms of GNR 543 Section 32.

Specialist studies undertaken in 2012 specifically for the Market Coke and Co-generation Plant	
Specialist Study	**Purpose of Study**
Air Quality Specialist Study (Appendix 3)	To determine the air quality impacts as a result of the project. An emission inventory was compiled and a model was run to determine the extent to which air quality impacts will be experienced.
Groundwater Specialist Study (Appendix 5)	To determine project impacts to groundwater. The study considered impacts of groundwater contamination due to the project.
Surface water Specialist Study (Appendix 4)	To determine project impacts to surface water. The study considered impacts of surface water contamination due to the project.
Traffic Impact Study (Appendix 8)	To assess the project's impact on the public roads.
Specialist studies undertaken on site previously and relevant for Market Coke and Co-generation Plant	
Specialist Study	**Purpose of Study**
Heritage Impact	To investigate the presence of archaeological resources on site. (This study was done

Specialist studies undertaken in 2012 specifically for the Market Coke and Co-generation Plant	
Specialist Study	**Purpose of Study**
Assessment (Previous report in Appendix 7)	previously for the entire Grootegeluk Mine area).
Waste Classification and Soils Study (Previous report in Appendix 2)	To determine the nature of the wastes produced and the extent of possible soil contamination on site (done for the Char Expansion Project but also relevant for the Market Coke and Co-generation Plant Project in terms of soil contamination).
Ecological/Biodiversity Studies (Previous report in Appendix 6)	To identify sensitive habitats for faunal species as well as to identify any species of ecological significance on site. (This study was done previously for the entire Grootegeluk Mine area).

2.6.2.1 Air Quality

The air quality specialist report contains the following information:

- Air quality baseline assessment (this includes nearby projects to be commissioned before the Market Coke and Co-gen Plants);
- Review of existing information;
- Description of air quality legislation, guidelines and standards;
- Updated meteorological data;
- Description of the wind model and regional dispersion model;
- Assessment of impacts - includes concentrations of pollutants and significance of the results;
- Proposed monitoring required;
- Proposed mitigation measures.

2.6.2.2 Traffic Impact Assessment

The scope of the traffic assessment included:

- A preliminary site inspection;
- Data collection, including: traffic surveys, details of intersections, road condition, travel patterns of staff;
- Assessment of the existing roads;
- Trip generation characteristics of the project;
- Forecast of future traffic conditions and assessment of traffic impacts;
- Proposed mitigation measures.

2.6.2.3 Surface Water

The scope of this study was as follows:

- Surface water assessment for Market Coke and Co-generation Plant project including:
    - Review of existing information;
    - Water volumes required for the Market Coke and Co-generation Plant;
    - Baseline assessment;
    - Water quality sampling;
    - Water quantity and floodline determination;
    - Compilation of a storm water management plan;
    - Input regarding the pollution control dams, sewage treatment and potable water supply.
- Provision of water management and surface water impact assessment.
- Proposed mitigation measures.

2.6.2.4 Groundwater

The groundwater study covered the following aspects:

- Description of baseline groundwater characteristics.
- Compilation of hydro-census data.
- Groundwater sampling and analysis.
- Modelling to predict the movement of dissolved contaminants.
- Assessment of the risks of groundwater pollution associated with the construction and operation of the plant.
- Recommendations for the management and protection of groundwater resources.

It is also important to note that the Grootegeluk Mine has undertaken several relevant studies which included the Market Coke and Co-generation Plant site. These studies were already in existence at the time of assessing the impacts of the project and the quality of these studies was considered to be good enough to use for this EIA. These studies cover environmental issues which are unlikely to be significantly impacted on by this project. For these reasons it was not considered necessary to redo any of the following studies done before the start of Market Coke and Co-generation Plant project:

- Soil Assessment and Waste Characterisation (Appendix 2) (Done for the Char manufacturing Plant Expansion Project adjacent to the proposed Market Coke and Co-generation Plant, the soils assessment is particularly relevant to the Market Coke and Co-generation Plant);
- Biodiversity Assessment (Appendix 6);
- Heritage Report (Appendix 7).

2.6.3 Baseline Environmental Description

Baseline information has been sourced primarily from the previous EIA undertaken in 2006 for the existing Char Manufacturing Plant, which is adjacent to the Market Coke and Co-generation Plant, as well as from the specialist studies which were conducted for the Market Coke and Co-generation Plant Project. Baseline information largely remains the same as for the original Char Manufacturing Plant EIA/EMP, as the Market Coke and Co-generation Plant will be located directly adjacent to the existing plant on an old coal stockpile area.

The baseline environment represents the current prevailing environmental conditions prior to the construction of the proposed Market Coke and Co-generation Plant. It is indicative of the level of environmental degradation due to existing human activities such as mining, and existing infrastructure such as railway lines and roads.

2.6.4 Consideration of Alternatives

Development alternatives considered during the EIA phase are discussed in Section.3.2.7.

2.6.5 Identification and Description of Impacts

The identification and assessment of environmental impacts is a multi-faceted process, using a combination of quantitative and qualitative descriptions and evaluations. It involves applying scientific measurements and professional judgement to determine the significance of environmental impacts associated with the proposed project. The process involves consideration of, *inter alia*: the purpose and need for the project; views and concerns of interested and affected parties; social and political norms, and general public interest.

The methodology used for assessing impacts associated with the proposed project follows the philosophy of EIAs, as described in the booklet Impact Significance, Integrated Environmental Management Information Series 5 (DEAT, 2002b). The philosophy is summarised by the following extracts:

- "The impact magnitude [or intensity] and significance should as far as possible be determined by reference to legal requirements, accepted scientific standards or social acceptability. If no legislation or scientific standards are available, the EIA practitioner can evaluate impact magnitude based on clearly described criteria. Except for the exceeding of standards set by law or scientific knowledge, the description of significance is largely judgemental, subjective and variable. However, generic criteria can be used systematically to identify, predict, evaluate and determine the significance of impacts." (DEAT, 2002b).

- "Determining significance [of impacts] is ultimately a judgement call. Judgemental factors can be applied rigorously and consistently by displaying information related to an issue in a standard worksheet format." (Haug et al., 1984 taken from DEAT, 2002b).

For each relevant environmental component (i.e. air quality, surface water etc.), impacts will be identified and described in terms of: detectability / visibility of the impact, exposure of receptors to the impact, compliance with legislation and standards, other applicable targets, limits or thresholds of concern, the level of change / intrusion imposed, and receptor sensitivity.

The perceived sensitivity of receptors (people and/or receiving environment) will be professionally judged based on available scientific data (fact) and feedback from public participation processes (views, opinions, attitudes, and concerns). The following impacts will be described:

2.6.5.1 Existing Impacts (Impacts of Existing Developments within Project Impact Area)

The proposed Market Coke and Co-generation Plant will be located in an area surrounded by existing developments such as the existing Char manufacturing plant, the Grootegeluk coal mining activities as well as agricultural, residential, major roads and the Eskom Matimba and Medupi Power Stations. The area where the new entrance gate will be constructed is a small area of relatively undisturbed mining land, though it will be adjacent to the Grootegeluk Mine tailings dams and D2001 road.

The current level of environmental degradation (existing impacts) associated with existing developments, including those currently under construction, will be described in the environmental impact report. Defining the current level of degradation associated with existing developments is essential to understand and enable the assessment of cumulative impacts. The assessment of existing impacts is qualitative and limited to the area of impact for the individual environmental components.

2.6.5.2 Incremental Impacts (additional impact of the proposed Market Coke and Co-generation Plant)

Incremental impacts refer to the impacts of an activity looked at in isolation (impacts of an individual activity), thus not considering the combined, cumulative or synergistic impacts of the activity, or the cumulative impacts of the activity with other activities or the existing impacts. The environmental impact report will describe the incremental impacts of the proposed development.

2.6.5.3 No-go Development Impacts

The no-go option would be that the construction of the Market Coke and Co-generation Plant will not be undertaken. The implication of this would be that no production of coke or electricity would take place and that the coke required by the Ferrochrome industry in South Africa may need to be sourced from overseas suppliers. This will result in negative impacts on national economic growth and development.

2.6.5.4 Cumulative Impacts

For this project, cumulative impacts will be determined as:

Existing Impacts	**+**	***Incremental Impacts***	**=**	***Cumulative Impacts***
Existing impacts (current level of degradation) associated with existing developments and developments under construction		Impacts of the proposed Market Coke and Co-generation Plant		Existing impacts (current level of degradation) associated with existing developments and developments under construction combined with the impacts of the proposed Market Coke and Co-generation Plant

In the assessment above, existing impacts often also represent the impacts of the no-go development option. Potential future projects in the area, for which the environmental impacts are currently undefined, cannot be included in the cumulative impact assessment and will have to be assessed in separate EIA processes for these projects.

2.6.6 Rating the Significance of Environmental Impacts and Mitigation Measures

The criteria used for assessing the significance of the impact are given in Table 2.2. The impact assessment method takes into account the current environment, the details of the proposed project and the findings of the specialist studies. Cognisance has been given to both positive and negative impacts that may result from the development. The significance of the impact is dependent on the consequence and the probability that the impact will occur.

impact significance = (consequence x probability)

Where:

consequence = (severity + extent) /2

and

severity = (intensity + frequency + duration) /3

Each criterion is given a score from 1 to 5 based on the definitions given in Table 2.2. Although the criteria are used for the assessment of impacts to quantify the significance, it is important to note that the assessment is generally a qualitative process and therefore the application of these criteria is open to interpretation. The process adopted has thus involved the application of scientific measurements and professional judgement to determine the significance of environmental impacts associated with the project. The assessment thus largely relies on experience of the EAP and the information provided by the specialists appointed to undertake studies for the EIA.

Where the consequence of an event is not known or cannot be determined, the “precautionary principle” has been adhered to and the worst-case scenario assumed. Where possible, mitigation measures to reduce the significance of negative impacts and enhance positive impacts have been recommended. The detailed actions, which are required to ensure that mitigation is successful, are provided in the EMP (Volume 2) which will form part of the EIA report. The phase of the development during which the impact will occur has also been noted to assist with the scheduling and implementation of management measures.

Table 2.2: Criteria for Assessing the Impact Significance

SEVERITY CRITERIA

INTENSITY = MAGNITUDE OF IMPACT	RATING
Insignificant: impact is of a very low magnitude	1
Low: impact is of low magnitude	2
Medium: impact is of medium magnitude	3
High: impact is of high magnitude	4
Very high: impact is of highest order possible	5

FREQUENCY = HOW OFTEN THE IMPACT OCCURS	RATING
Seldom: impact occurs once or twice	1
Occasional: impact occurs every now and then	2
Regular: impact is intermittent but does not occur often	3
Often: impact is intermittent but occurs often	4
Continuous: the impact occurs all the time	5

DURATION = HOW LONG THE IMPACT LASTS	RATING
Very short-term: impact lasts for a very short time (less than a month)	1
Short-term: impact lasts for a short time (months but less than a year)	2
Medium-term: impact lasts for the for more than a year but less than the life of operation.	3
Long-term: impact occurs over the operational life of the Market Coke and Co-generation Plant Project	4
Residual: impact is permanent (remains after mine closure)	5

EXTENT = SPATIAL SCOPE OF IMPACT/ FOOTPRINT AREA / NUMBER OF RECEPTORS	RATING
Limited: impact affects the mining area	1
Small: impact extends to the neighbouring farmers	2
Medium: impact extends to surrounding farmers beyond the immediate neighbours	3
Large: impact affects the area covered by the Waterberg District Municipality	4
Very Large: The impact affects an area larger than the district	5

PROBABILITY

PROBABILITY = LIKELIHOOD THAT THE IMPACT WILL OCCUR	RATING
Highly unlikely: the impact is highly unlikely to occur	0.2
Unlikely: the impact is unlikely to occur	0.4
Possible: the impact could possibly occur	0.6
Probable: the impact will probably occur	0.8
Definite: the impact will occur	1

IMPACT SIGNIFICANCE

NEGATIVE IMPACTS

≤1	Very low	Impact is negligible. No mitigation required.
>1≤2	Low	Impact is of a low order. Mitigation could be considered to reduce impacts. But does not affect environmental acceptability.

>2≤3	Moderate	Impact is real but not substantial in relation to other impacts. Mitigation should be implemented to reduce impacts.
>3≤4	High	Impact is substantial. Mitigation is required to lower impacts to acceptable levels.
>4≤5	Very High	Impact is of the highest order possible. Mitigation is required to lower impacts to acceptable levels. Potential Fatal Flaw.

POSITIVE IMPACTS

≤1	Very low	Impact is negligible.
>1≤2	Low	Impact is of a low order.
>2≤3	Moderate	Impact is real but not substantial in relation to other impacts.
>3≤4	High	Impact is substantial.
>4≤5	Very High	Impact is of the highest order possible.

2.6.7 Project Phases

The environmental impacts for the project have been assessed over five phases of the project i.e. the planning and design, construction, operation, decommissioning and post-closure phase.

The planning and design phase refers to the stage when the feasibility studies are being undertaken, the project description is being developed and the plant is being designed. During this phase the EIA is completed and environmental authorisations are applied for. This phase started in 2011 and is anticipated to be completed in February 2013.

The construction phase will involve the physical construction of the plant and its associated infrastructure. Construction is anticipated to commence in July 2013 and end approximately in July 2016. The expected lifetime of the new plant is 20 years.

The decommissioning phase refers to the time in the plant life when operations are reduced in preparation for closure. This phase will occur once the end of the economical life has been reached. .

The closure phase refers to when the plant is shut down and no further activities are undertaken, this phase will occur after successful decommissioning has been achieved.

2.6.8 Mitigation Measures

The significance of environmental impacts are rated before and after the implementation of mitigation measures. The impact rating system considers the confidence level that can be placed on the successful implementation of the mitigation.

A **no net loss** approach has been adopted in terms of the management of impacts at the Market Coke and Co-generation Plant Project (see Figure 2.1 below):

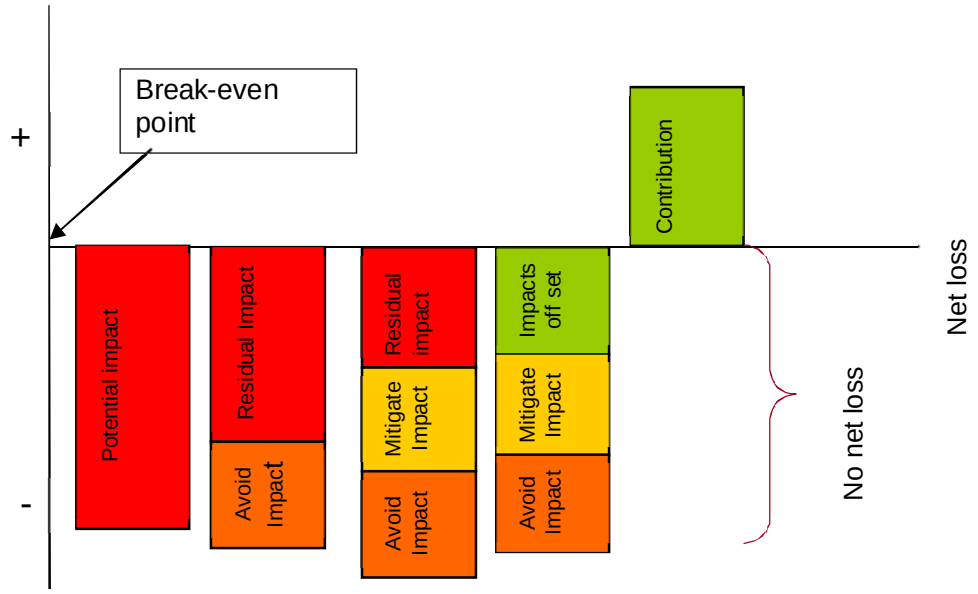


Figure 2.1: No Net Loss Approach to Environmental Management

- **Avoidance** – impacts are to be avoided where practicable e.g. through the implementation of alternatives including alternative locations or technologies;
- **Mitigation** – should it not be possible to avoid all impacts, the remaining impacts are to be mitigated to acceptable levels.
- **Offset** – should it not be possible to avoid and mitigate all impacts to acceptable levels it will be necessary to offset the remaining impacts. Suitable offsets will need to be identified.

Mitigation measures for significant impacts which cannot be avoided have been identified. The impacts have been ranked before and after the implementation of the mitigation measures. Consideration has also been given to the confidence level that can be placed on the successful implementation of the mitigation level as follows:

- **High Confidence:** mitigation measure easy and inexpensive to implement.
- **Medium Confidence:** mitigation measure expensive or difficult to implement.
- **Low Confidence:** mitigation measure expensive and difficult to implement.

Where mitigation is not sufficient to reduce the impact to acceptable levels offsets will need to be identified.

2.7 Public Participation and Authority Consultation Process

2.7.1 Identification of Interested and Affected Parties - Compilation of IAP Database

The IAPs database has been compiled using the existing IAPs database at Grootegeluk Mine as well as databases used for other projects in the area. The IAPs database includes neighbouring private farms and the Manketti Reserve on the Grootegeluk property which is managed by Ferroland (a subsidiary of Exxaro). The IAPs lists were updated telephonically to obtain the correct stakeholder contact details. Grootegeluk Mine undertakes regular meetings with the surrounding IAPs and farmers. The existing IAPs list is therefore fairly recent and most details were found to be correct.

These stakeholders were initially informed about the project via the Background Information Document

(BID), which was sent to everyone on the database via registered mail or email. The IAPs database is attached in Appendix 1. This database has also been updated as the project progressed.

2.7.2 Notifications to Interested and Affected Parties

Potential IAPs were notified about the project and the public participation process by means of:

- Direct letters and BIDs via registered mail to neighbouring and nearby landowners, posted on 7th of March 2011, in accordance with sub-regulation 54 2(b) of GNR 543.
- Press advertisements and site notices (see section 2.7.4), placed from the 5th to the 11th of March 2011.
- Individual notifications via email or registered mail to other people who may be affected by the proposed development on the 7th of March 2011.

All notifications to IAPs were sent and/or placed from the 5th to the 11th of March 2011. The notifications mentioned above included BIDs which were compiled and circulated to the list of IAPs. The time and date for the information sharing meeting was also included in the BIDs. Response sheets were attached to the BIDs, requesting written responses and comments regarding the project. Copies of the BIDs are attached in Appendix 1.

2.7.3 Notifications to Relevant Authorities

Authority consultation was initiated in March 2011. This consultation was combined for two projects: (1) the proposed Market Coke and Co-generation Plant, as well as a separate project – (2) the expansion of the existing Char Manufacturing Plant.

In accordance with the regulations, notification was sent to the authorities by registered mail, email and in person, before and during the information sharing meetings, from the 7th to the 17th of March 2011. The following authorities were sent information regarding the project (BIDs) and invited to attend information sharing meetings:

- Limpopo Department of Mineral Resources;
- Limpopo Department of Economic Development, Environment and Tourism;
- Limpopo and National Department of Water Affairs;
- Limpopo Department of Land Affairs;
- Lephalale Local Municipality; and
- Waterberg District Municipality.

In addition, the following government agencies were also notified about the project:

- The Department of Agriculture, Fisheries and Forestry
- The South African Heritage Resources Agency

Refer to Appendix 1 for copies of the notifications.

2.7.4 Press Advertisements and Site Notices

During the March 2011 rounds of public consultation, advertisements were placed in two newspapers, the Mogol Post (in English) and the Beeld (in Afrikaans), to advertise the project and to invite IAPs to the information sharing meetings. The adverts in the Mogol Pos/Post appeared on the 11th of March 2011 and the advert in the Beeld appeared on the 8th of March 2011. Copies of the adverts are attached in Appendix 1.

Site notices (some in English and some in Afrikaans) were also placed at the following locations during

the March - May 2011 rounds of public consultation, to advertise the project and information sharing meetings:

- The main gate notice board at Grootegeluk Mine (March 2011)
- The entrance to the Grootegeluk Medupi Expansion Project (March 2011)
- The entrance to the Lephalale Local Municipality (March 2011)
- Lephalale Shoprite notice board (March 2011)
- Lephalale Spar notice board (March 2011)
- Lephalale Pick n Pay notice board (March 2011)
- Lephalale Wholesale Dealer notice board (March 2011)
- Marapong Spar complex (March 2011)

Photographs of the site notices are attached in Appendix 1. The site notices contained the same text as the newspaper advertisements.

2.7.5 Registration of Interested and Affected Parties

People and/or organisations were registered as IAPs for the project if they:

- Attended one of the consultation meetings.
- Responded to notification letters and documentation, press advertisements or site posters.
- Own land adjacent to the Grootegeluk Mine.
- Contacted Synergistics telephonically, via fax, e-mail or post.
- Are an authority/organ of state with jurisdiction over an aspect of the activity.

2.7.6 Public Information Meetings

Two meetings (conducted in English and Afrikaans) were held for the public on the 17th of March and the 19th of May 2011. These meetings were also combined for two projects: (1) the proposed Market Coke and Co-generation Plant, as well as a separate project – (2) the expansion of the existing Char Manufacturing Plant. The purpose of the meetings was to give more detailed information about the projects, to present the environmental processes to be followed and to provide an opportunity for attendees to ask questions and raise concerns. The meetings were facilitated by Synergistics Environmental Services. The minutes of the public meetings and attendance registers are attached in Appendix 1. A summary of the questions and/or issues raised at the public meetings are included in Section 5 of this report. No issues/questions were raised at the second public meeting held in May of 2011.

2.7.7 Focussed Authority Meetings

The following meetings were held with individual authorities:

- Limpopo DMR on 16 March 2011;
- LEDET on 16 March 2011;
- DWA (Polokwane office) on 16 March 2011;
- Lephalale Local Municipality on 17 March 2011. A representative of the Lephalale Local Municipality also attended the second public meeting held on 19 May 2011;
- Waterberg District Municipality on 17 March 2011;
- LEDET on 23 February 2012 (during a site visit for the project) and
- LEDET on 3 April 2012 (to discuss the AEL).

The purpose of the meetings was similar to that of the public meeting, giving more detailed information about the project, presenting the environmental processes to be followed and to provide an opportunity for the authorities to ask questions. The minutes of the meetings and attendance registers are attached

in Appendix 1 (except the LEDET site visit). A summary of the questions and/or issues raised at the authorities meetings are included in Section 5.

2.7.8 Review of the Draft and Final Scoping Reports

The draft scoping report was made available for public and authority review. The public and relevant authorities were given a 40 day period to review the report and to add any comments. It also allowed them the opportunity to assess whether all their issues have been correctly captured. Registered IAPs were notified via email and/or registered mail from the 31st of January to the 1st of February 2012 that the draft report was available for review. The report was available at the Grootegeluk Mine main gate, at the Lephalale library as well as electronically on the Synergistics website. IAPs were informed that an electronic copy of the report, on CD-ROM, would be sent to anyone who requested it.

Relevant authorities were notified via email, registered mail or courier on the 31st of January 2012 that the draft report was available for review. The report was available at the Grootegeluk Mine main gate, at the Lephalale library as well as electronically on the Synergistics website. The following authorities were sent CDs of the report:

- Department of Water Affairs;
- Department of Mineral Resources;
- Lephalale Local Municipality; and
- Waterberg District Municipality.

The LEDET was sent hardcopies of the report.

Following the closure of the review period for the draft scoping report, final modifications were made. The final scoping report was made available for public and authority review (using the same methods as for the draft scoping report) for 40 days from 18 April 2012 until 28 May 2012. Authorities all received hard copies and/or CD copies of the final scoping report. All registered IAPs were notified in writing of the availability of the document for review and were requested to submit comments. However, no comments were received from IAPs. All comments received from authorities on the final scoping report are collated in Section 5.

Refer to Appendix A for copies of the notifications sent.

2.7.9 Review of the Draft and Final EIA Reports

Under the NEMA process, the draft EIA report was made available for public and authority review for 40 calendar days from the 18th September 2012 to 29th October 2012. IAPs were notified that a copy of the report for public review was placed at the Main Gate Office at the Grootegeluk Coal Mine and at the Lephalale Public Library. In addition, the Draft EIA could be viewed on the Synergistics website at www.synergistics.co.za. CDs of the report and appendices were also available upon request. Authorities all received hard copies and/or CD copies of the draft EIA report. All registered IAPs were notified in writing of the availability of the document for review and were requested to submit comments.

All comments received on the draft EIA report are collated in Section 5.

Under the NEMA process, the final EIA report will be made available for public and authority review for approximately 3 weeks (21 calendar days). The review periods for IAPs and authorities are in accordance with GNR 543 for both the scoping and EIA reports (note that these regulations do not specify review periods for final reports).

2.7.10 Public Feedback Meeting during the EIA Phase

Due to the very low level of public interest in the project, it was not considered necessary to schedule a public meeting during the EIA Phase to present the results of the specialist studies.

2.8 Study Team

Synergistics has been appointed by Exxaro Reductants as the independent environmental consultant to undertake the EIA. Matthew Hemming, a director of Synergistics, is the Environmental Assessment Practitioner (EAP) for the project. Several specialists have undertaken specialist studies as part of the EIA.

The environmental study team members and specialists that were involved in the EIA are listed in the table below. Their roles and responsibilities on the project and their qualifications are provided in Table 2.3.

Table 2.3: Study Team

Name and Affiliation	Qualification	Role
Environmental Study Team		
Matthew Hemming Synergistics Environmental Services	MSc Conservation Biology	- Environmental Assessment Practitioner - Project Leader
Shelley Holt Synergistics Environmental Services	BSc Hons Zoology	- Project Manager - EIA and EMP report
Chiara D'Egidio Synergistics Environmental Services	MSc Ecology, Environment and Conservation	- EIA Report - IWWMP report
Vivienne Vorster Synergistics Environmental Services	BA Hons Environmental Management	- Previous Project Manager (2010/2011)
Bheki Khumalo Synergistics Environmental Services	BSc Hons Environmental Modelling and Monitoring	- GIS and Mapping
Mike Palmer Jones and Wagener	MSc Eng (Civil)	- Hydrological Impact Report
Gerrit Kornelius Airshed Planning Professionals	PhD Air Pollution Control Technology	- Air Quality Impact Report
Victor von Reiche Airshed Planning Professionals	BEng (Chem)	- Air Quality Impact Report
Elize Herselman Golder Associates	PhD Soil Science	- Waste Characterisation Study
Cornelia Hutchinson WSP Engineers	B.Eng Hons (Civil)	- Traffic Impact Study
Marius van Biljon Jones and Wagener	M.Sc. Hydrogeology	- Geohydrological Impact Report

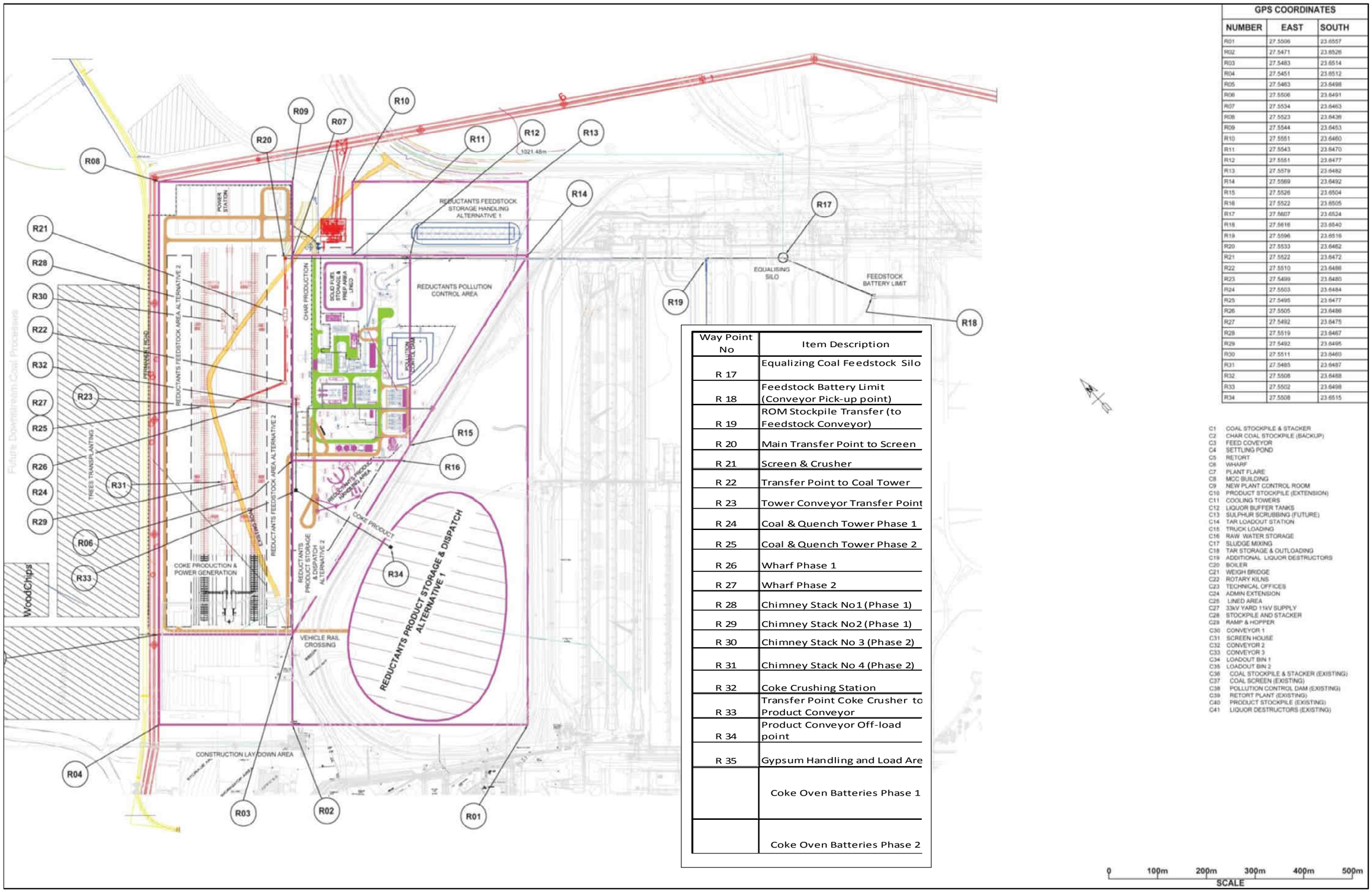
3 PROJECT INFORMATION

3.1 Scope of Work

The proposed project entails the construction of a Market Coke and Co-generation Plant and a new entrance gate. The location of the plants and entrance gate are shown on figures 1.3 and 1.4. The proposed site layout of the infrastructure for the plants is shown in Figure 3.1 and 3.2. The layout of the structures required for the new entrance gate are shown in Figure 3.3.

The Market Coke and Co-generation Plant will be located directly adjacent to the existing Char Manufacturing Plant and will be located within the Old Middling Coal Stockpile area, previously used by Grootegeluk Mine for the stockpiling of coal. The Market Coke and Co-generation Plant will occupy approximately 49.4 ha of the Exxaro Reductants site.

As previously mentioned, a separate EIA process is currently underway for an expansion to the existing Char Manufacturing Plant. The location of the existing Char Manufacturing Plant and proposed expansion is also indicated on figure 1.3.



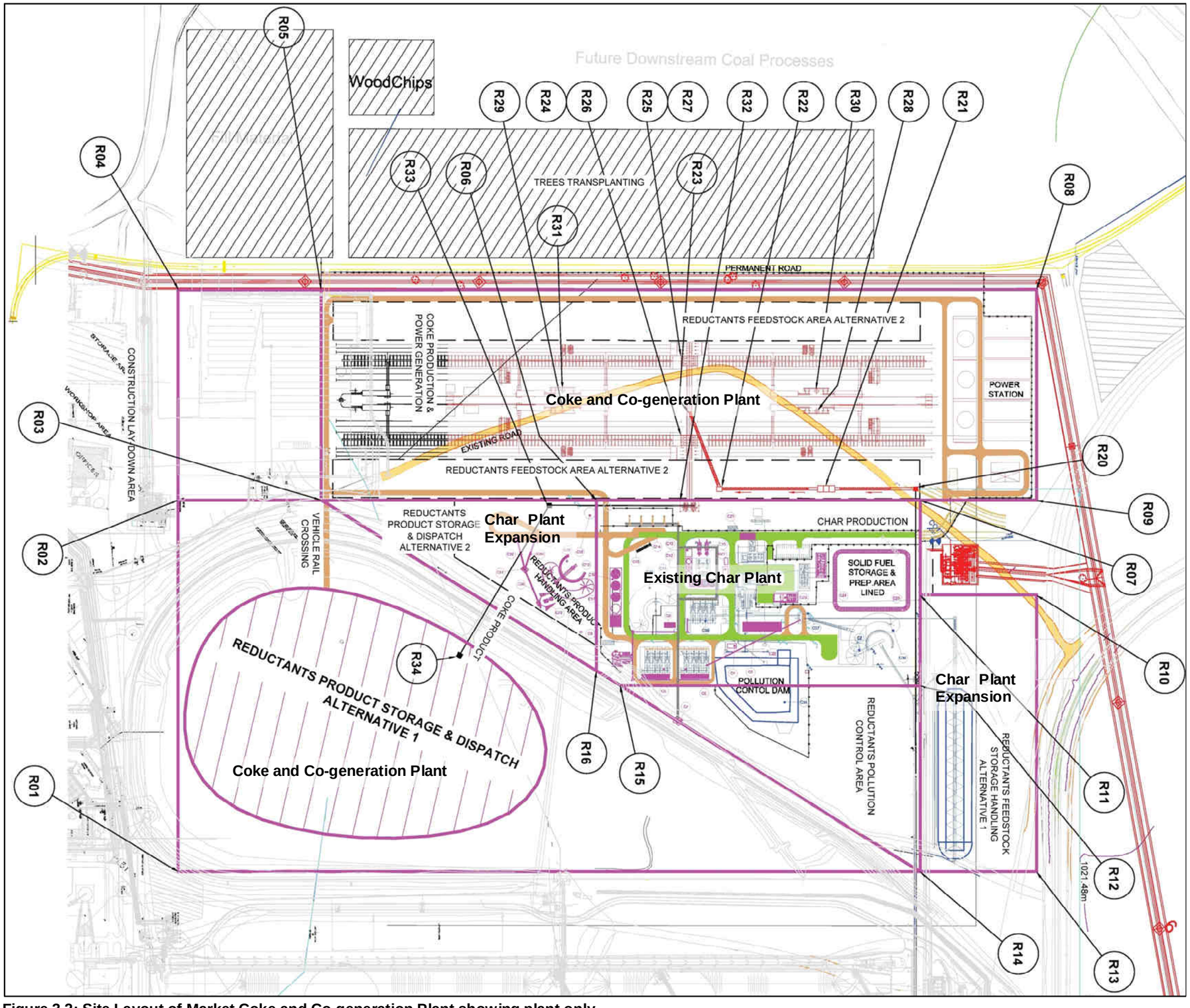
Way Point No	Item Description
R 17	Equalizing Coal Feedstock Silo
R 18	Feedstock Battery Limit (Conveyor Pick-up point)
R 19	ROM Stockpile Transfer (to Feedstock Conveyor)
R 20	Main Transfer Point to Screen
R 21	Screen & Crusher
R 22	Transfer Point to Coal Tower
R 23	Tower Conveyor Transfer Point
R 24	Coal & Quench Tower Phase 1
R 25	Coal & Quench Tower Phase 2
R 26	Wharf Phase 1
R 27	Wharf Phase 2
R 28	Chimney Stack No1 (Phase 1)
R 29	Chimney Stack No2 (Phase 1)
R 30	Chimney Stack No 3 (Phase 2)
R 31	Chimney Stack No 4 (Phase 2)
R 32	Coke Crushing Station
R 33	Transfer Point Coke Crusher to Product Conveyor
R 34	Product Conveyor Off-load point
R 35	Gypsum Handling and Load Are
	Coke Oven Batteries Phase 1
	Coke Oven Batteries Phase 2

GPS COORDINATES		
NUMBER	EAST	SOUTH
R01	27.5506	23.6557
R02	27.5471	23.6526
R03	27.5483	23.6514
R04	27.5451	23.6512
R05	27.5463	23.6498
R06	27.5508	23.6491
R07	27.5534	23.6463
R08	27.5523	23.6438
R09	27.5544	23.6453
R10	27.5551	23.6460
R11	27.5543	23.6470
R12	27.5551	23.6477
R13	27.5578	23.6482
R14	27.5569	23.6492
R15	27.5526	23.6504
R16	27.5522	23.6505
R17	27.5607	23.6524
R18	27.5616	23.6540
R19	27.5596	23.6516
R20	27.5533	23.6462
R21	27.5522	23.6472
R22	27.5510	23.6486
R23	27.5499	23.6480
R24	27.5503	23.6484
R25	27.5495	23.6477
R26	27.5505	23.6486
R27	27.5492	23.6475
R28	27.5519	23.6467
R29	27.5492	23.6495
R30	27.5511	23.6460
R31	27.5485	23.6487
R32	27.5508	23.6488
R33	27.5502	23.6498
R34	27.5508	23.6515

C1 COAL STOCKPILE & STACKER
C2 CHAR COAL STOCKPILE (BACKUP)
C3 FEED COVEYOR
C4 SETTLING POND
C5 RETORT
C6 WHARF
C7 PLANT FLARE
C8 MCC BUILDING
C9 NEW PLANT CONTROL ROOM
C10 PRODUCT STOCKPILE (EXTENSION)
C11 COOLING TOWERS
C12 LIQUOR BUFFER TANKS
C13 SULPHUR SCRUBBING (FUTURE)
C14 TAR LOADOUT STATION
C15 TRUCK LOADING
C16 RAW WATER STORAGE
C17 SLUDGE MIXING
C18 TAR STORAGE & OUTLOADING
C19 ADDITIONAL LIQUOR DESTRUCTORS
C20 BOILER
C21 WEIGH BRIDGE
C22 ROTARY KILNS
C23 TECHNICAL OFFICES
C24 ADMIN EXTENSION
C25 LINED AREA
C27 33kV YARD 11kV SUPPLY
C28 STOCKPILE AND STACKER
C29 RAMP & HOPPER
C30 CONVEYOR 1
C31 SCREEN HOUSE
C32 CONVEYOR 2
C33 CONVEYOR 3
C34 LOADOUT BIN 1
C35 LOADOUT BIN 2
C36 COAL STOCKPILE & STACKER (EXISTING)
C37 COAL SCREEN (EXISTING)
C38 POLLUTION CONTROL DAM (EXISTING)
C39 RETORT PLANT (EXISTING)
C40 PRODUCT STOCKPILE (EXISTING)
C41 LIQUOR DESTRUCTORS (EXISTING)

0 100m 200m 300m 400m 500m
SCALE

Figure 3.1: Site Layout of Market Coke and Co-generation Plant showing conveyors and silos



Way Point No	Item Description
R 17	Equalizing Coal Feedstock Silo
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R 24	Coal & Quench Tower Phase 1
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R 28	Chimney Stack No1 (Phase 1)
R 29	Chimney Stack No2 (Phase 1)
R 30	Chimney Stack No 3 (Phase 2)
R 31	Chimney Stack No 4 (Phase 2)
R 32	Coke Crushing Station
R 33	Transfer Point Coke Crusher to Product Conveyor
R 34	Product Conveyor Off-load point
R 35	Gypsum Handling and Load Area
	Coke Oven Batteries Phase 1
	Coke Oven Batteries Phase 2

Figure 3.2: Site Layout of Market Coke and Co-generation Plant showing plant only

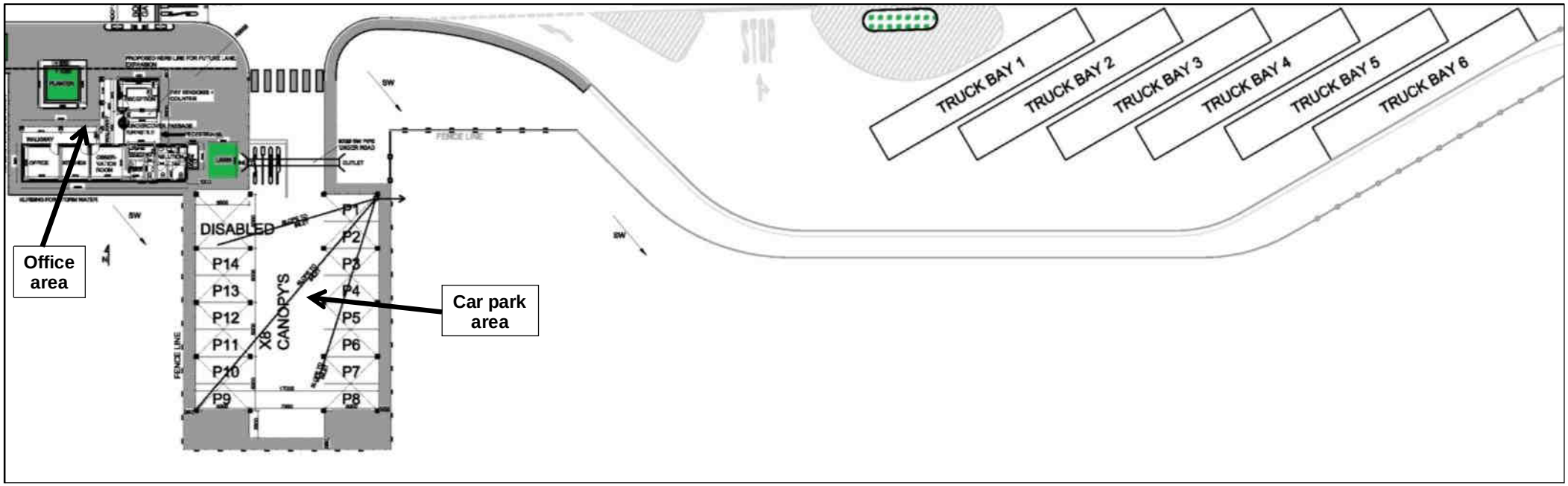


Figure 3.3: Site Layout of New Reductants Entrance Gate

3.2 Project Description

3.2.1 Overview of the Market Coke and Co-generation Plant

Coke is made by heating suitable coal in coke ovens, the absence of oxygen, to a temperature of around 1200℃ for an extended period of time. During this heating cycle, coke is formed and volatile materials in the coal are released in the form of vapour, gas and smoke. The coke oven flue gas (COFG) will be burned in stages inside the ovens to provide process heat and surplus heat energy which will be converted into electrical energy (co-generation). An overview of the process is shown in Figure 3.4 and Figure 3.5. The Market Coke and its Co-generation Plant consist of the following sub-systems which are described in further detail in the sections below:

- The material handling system; coal stockpiles, conveyors, mineral sizing
- 3 x 1000 ton (approximate) day silos at the Coke plant site
- Coal crushing and compaction system
- Push-charge and discharge machines and rail system
- Coke oven batteries (a total of approximately 120 coke ovens), structures and door mechanisms
- Coke oven flue gas ducting system
- Coke quench car and rail system
- Coke quench tower and water pumps
- Settling and clarifying ponds for quench water
- Sediment extraction system
- Coke wharf
- Product conveyor and coke stockpile
- Product screen and mineral sizing system
- Product Weigh bridge
- Product loading and despatch (transport by truck or rail)
- Waste heat recovery boilers (WHRB)
- Flue Gas Desulphurising (FGD) Plant
- Gypsum by-product stockpile and loading area
- Chimney stack system
- Common steam header system
- Steam turbine system
- Dry steam condensing system
- Electricity generation system
- The electricity connecting and transmission equipment.

The proposed Market Coke Plant will involve an energy recovery coke making process, which has fewer environmental impacts than traditional coke making processes in respect of air quality, effluent and solid waste.

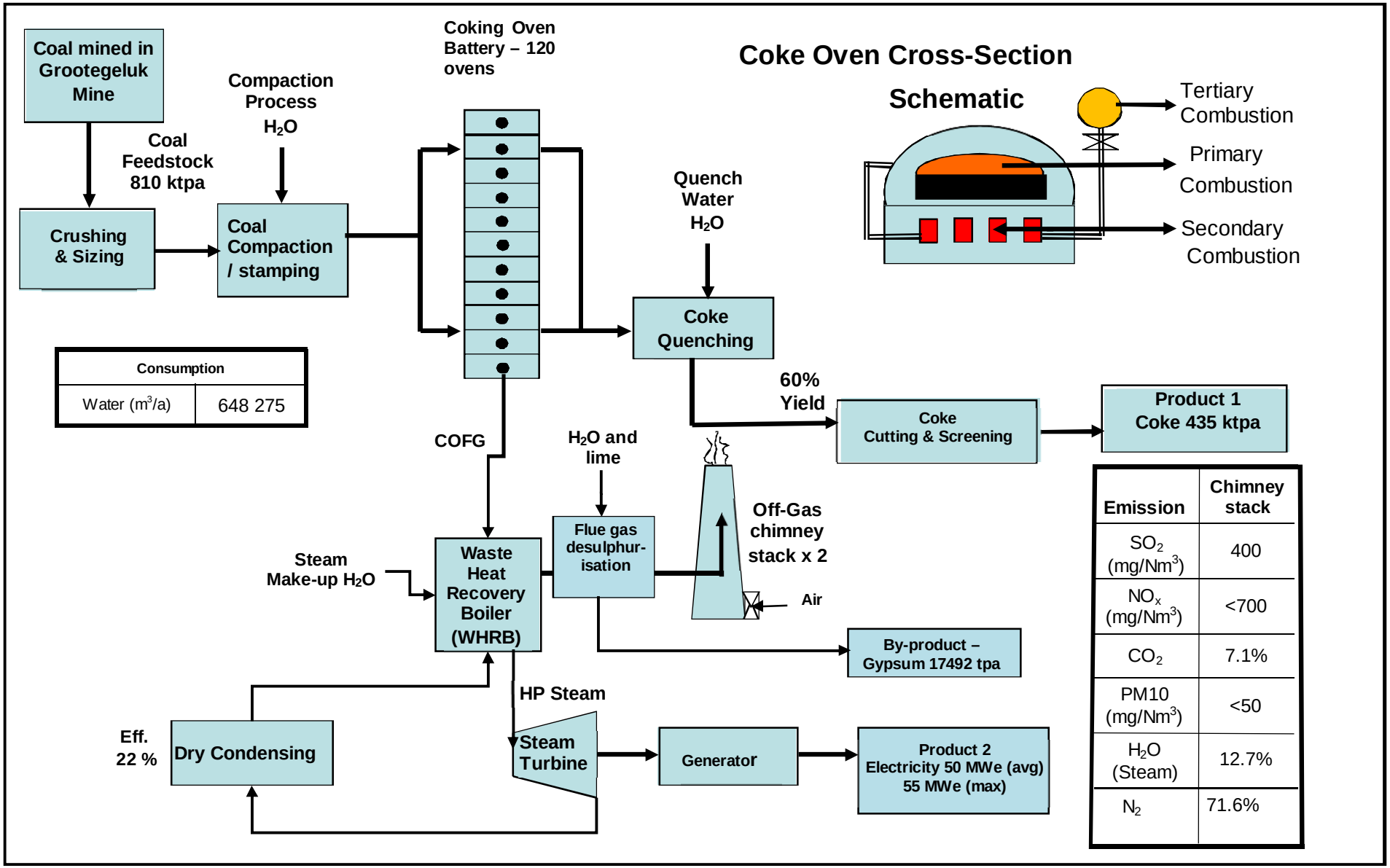
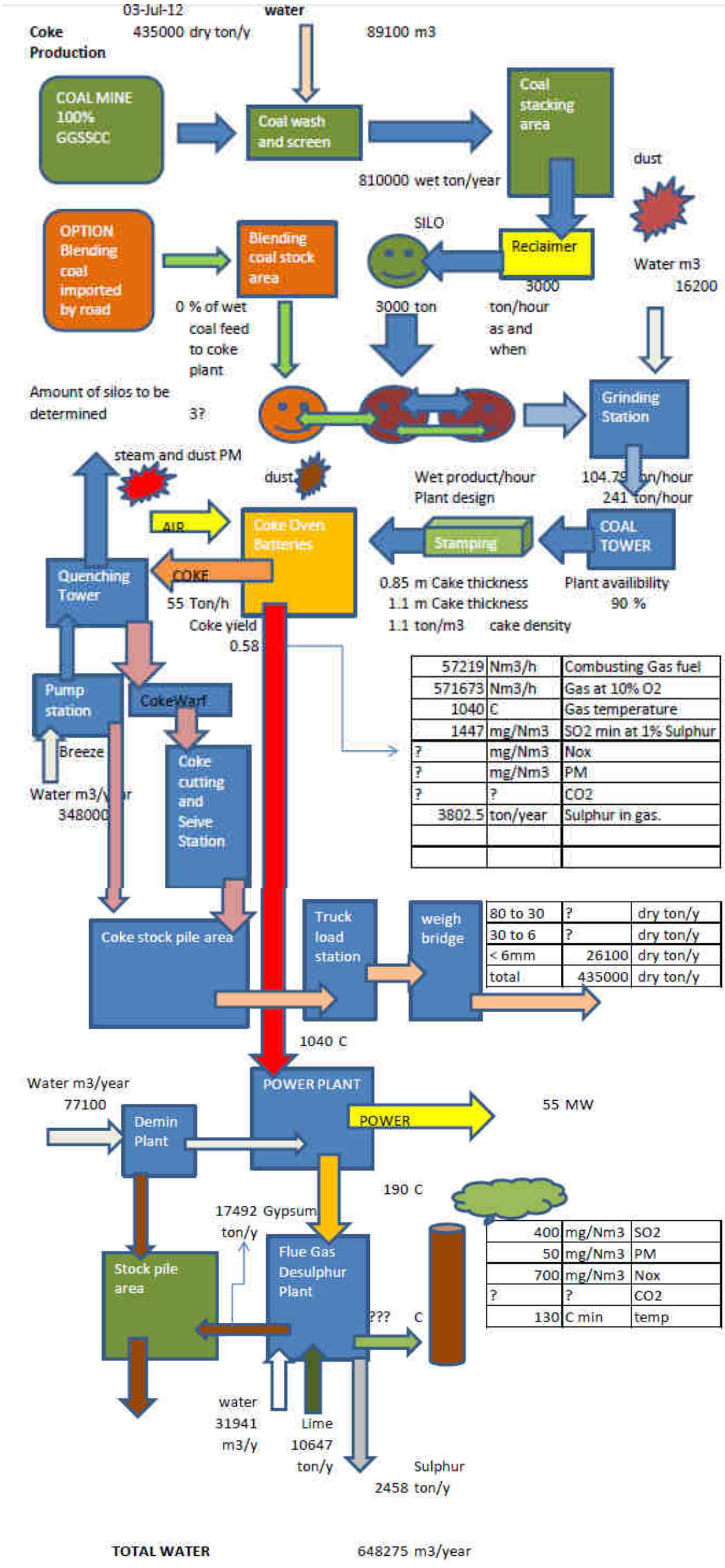


Figure 3.4: Schematic Market Coke and Co-Generation Power Plant – Process Block Diagram



57219	Nm3/h	Combusting Gas fuel
571673	Nm3/h	Gas at 10% O2
1040	C	Gas temperature
1447	mg/Nm3	SO2 min at 1% Sulphur
?	mg/Nm3	Nox
?	mg/Nm3	PM
?	?	CO2
3802.5	ton/year	Sulphur in gas.

80 to 30	?	dry ton/y
30 to 6	?	dry ton/y
< 6mm	26100	dry ton/y
total	435000	dry ton/y

400	mg/Nm3	SO2
50	mg/Nm3	PM
700	mg/Nm3	Nox
?	?	CO2
130	C min	temp

Figure 3.5: Process flow diagram for Market Coke and Co-Generation Power Plant (preliminary)

3.2.2 Market Coke Manufacturing Process

3.2.2.1 Coal Feed System

Exxaro Reductants intends to use the Grootegeluk Mine's semi-soft coking coal as the only feedstock to the plant. Using only one type of coal significantly simplifies the feedstock handling for the plant. The Market Coke oven plant will be supplied with coal from the existing Grootegeluk metallurgical coal stockpiles. The coal will be delivered to the coking coal silos via conveyor belts from the mine.

3.2.2.2 Coal Stockpiles and Storage

Storage of the coking coal will take place in two stages. The first stage will be in a concrete surge silo with a likely capacity of 5200 tons, which will be built along the route of the conveyor from the mine's washing and screening plant. From there it will be conveyed to 3 x 1000 ton (approximate) silos at the coke plant.

The second stage will be the conveying of the coking coal to the Market Coke Plant's two 1000 ton day-silos. The storing of coking coal in silos and not stockpiling is to limit ageing (oxidizing) of the coal so as to prevent deterioration of the coal's coking capabilities. Thus stockpiling is to be carefully managed and any storage will be of the first in, first out type. This implies feeding coal storage bins (hoppers) at the top and withdrawing material at the bottom.

Normally more than 80% of the coal will be smaller than 3 mm particle size. The coal is wetted to an optimum moisture content of normally 10% by mass. The coal is then conveyed to the coal tower bin.

3.2.2.3 Coal Compaction

The quality of coke made from any given coal blend, can be dramatically improved by compacting the coal before feeding it into the oven. Coal is loaded from the coal tower into a compacting box where compaction takes place. This will involve the compression of the coal layers (refer to the example in Figure 3.6). Practical considerations of reliability, availability and operating constraints demand two compaction stations. There will be two stationary compaction stations placed next to one another in the middle of the coke oven battery.

Compaction, and consequently the strength of the resulting coal cake, is improved by increasing the moisture content of the crushed coal. The moisture content of the feedstock is controlled by the addition of water, providing an opportunity for disposal of contaminated water which is used as compacting fluid and for coke quenching. Recycled, contaminated water will be used for this purpose, as the contaminants are destroyed in the coking process. The high temperatures in the oven, the passage of the gas and vapour combination through the high temperature coking zone and the high temperatures in the combustion process all combine to break down and oxidise any contaminants brought in by the water.

The size of the coal cake is determined by the size of the coke oven (refer to Figure 3.7 and Figure 3.8). Additional constraints on the coal cake size are the door design and the sizes and capacities of the push-charging and discharge machines and the quenching towers. Mechanical loading and unloading of the coal cakes limits the size to approximately 12 m in length. The thickness of the cake varies between 800 mm and 1100 mm and is governed by temperatures, coke oven floor conductivity, radiation from the oven dome, heat capacity of the oven and operating schedules and settings. A typical coal cake would have a mass between 30 and 45 tonnes with the density of the coal cake after compaction being up to 1.1 ton/m^3.

Figure 3.6: Coal cake being compressed by stamping machine (Courtesy Sinosteel)

Figure 3.7: Part of a coke oven battery (similar to proposed Market Coke Plant).

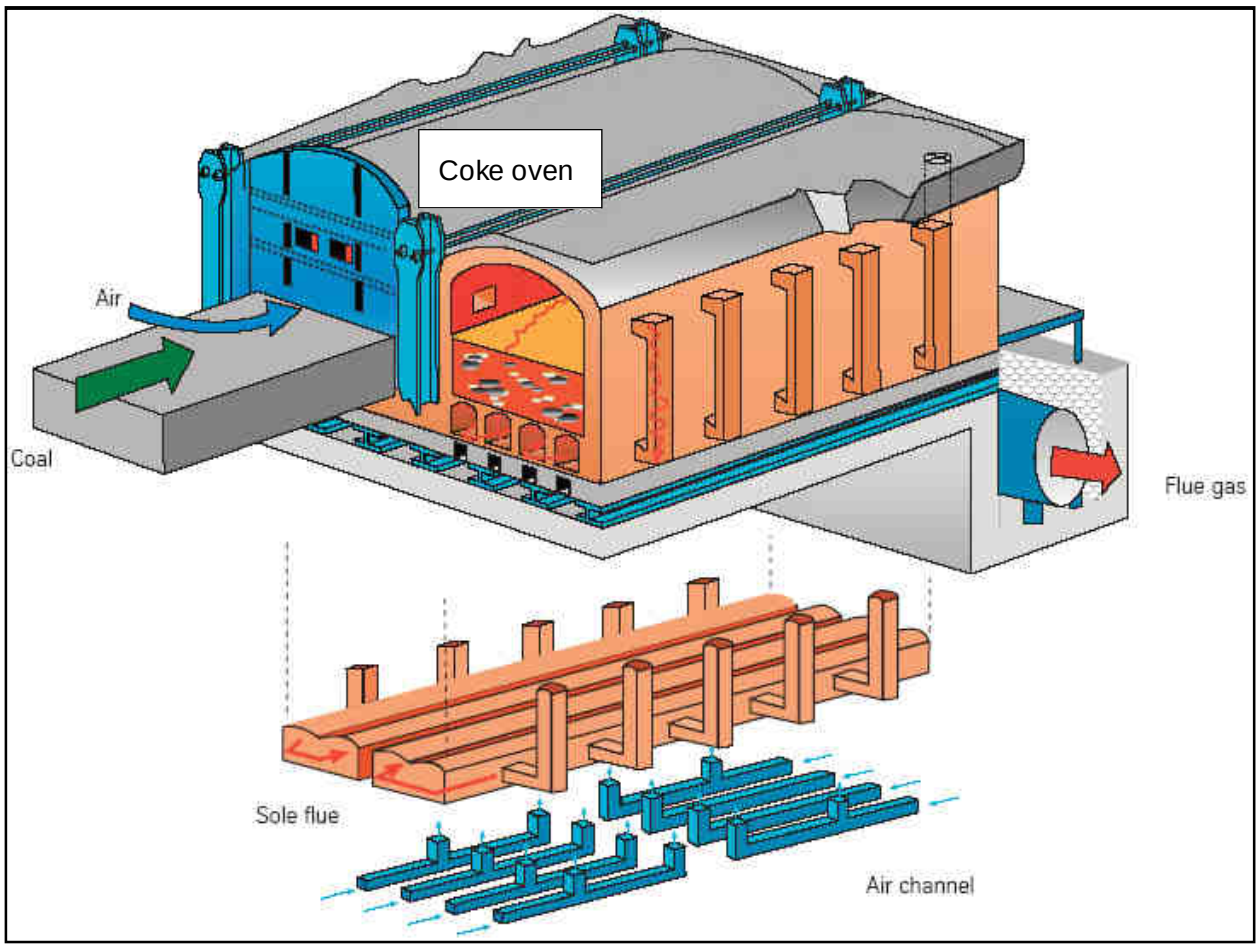


Figure 3.8: Proposed design of a typical Market Coke Plant coke ovens with underground common gas flue.

3.2.2.4 Loading the Coal Cake (Charging) and Unloading the Coal Cake (Pushing)

After stamping, the shaped and compacted coal cake is transferred to the charging / pushing car and is transported to the coke oven to be charged. The coke ovens are combined to form batteries (18 to 30 coke ovens form one battery) (see Figure 3.7) which are designed to give mechanical structural strength to contain the expansion of the ovens on heating.

Before charging (loading) an oven with a new coal cake, the coke already in the oven is pushed out onto the quenching car that is to receive the coke on the opposite side of the oven (refer to Figure 3.9 and Figure 3.10).

Figure 3.9: A coke cake which has been heated and is being pushed out of the coke oven (Courtesy Sinosteel).

Figure 3.10: A coke cake which has been pushed out of the coke oven onto the quenching car (Courtesy Sinosteel).

The oven is charged (loaded) horizontally from the front with coal in the form of a stamped cake with dimensions to suit the oven. The combined charging / pushing machine loads and transports the coal cake to the selected oven, removes the coke oven door, checks with the control system for proper alignment of the quenching car, pushes out the coke already in the oven, pushes the new coal cake into the oven and closes the door (see Figure 3.11). The charging / pushing car is a large travelling machine (200 to 400 tons) running on rail tracks spaced about 10 to 15 m apart. It has a mechanism for opening

oven doors, a long ram for pushing the already coked cake out of the oven and a mechanism for charging the fresh stamped cake into the oven (shown in Figure 3.11).

Figure 3.11: Pushing/charging machine opening coke oven door. View of heated coke cake in oven (Courtesy Sinosteel)

The pushing-charging process is the one part of the coking cycle when pollutants (such as unburnt hydrocarbon gas) could be released to the outside air when the coke is pushed before complete coking has taken place. In the waste heat recovery type of coke oven, this problem has been greatly reduced, mainly by operating the coke oven under a slight negative pressure (vacuum). This negative pressure is much more easily maintained because there is no cooling water obstruction in the off-gas ducts.

3.2.2.5 Heating the Coal Cake

The coke heating time is mainly determined by the smallest dimension of the coal cake, and the coking temperature. Coke quality is partially dependent on attaining a high oven temperature. Insufficient time inside the oven causes the coke to release smoke and other pollutants when discharged too soon (so called “green coke”). The maximum achievable coking temperature is constrained by the oven construction. The coke is heated by the combustion of the volatile gas which is released from the coke during heating (refer to Figure 3.8). With the 37% volatile gas content of the Grootegeluk coking coal, the “fuel” energy (i.e. coke oven flue gas) for reaching high temperatures is available. Once the volatile gas has been driven off the coal cake, the cake should be kept at a temperature above 800ºC for a number of hours to allow the sintering (solidifying) process of the coke to complete.

Figure 3.8 shows that above the coal cake there is an arched free space where the released vapours are partially combusted, heating the coal cake from above. The hot gas is drawn through side ducts to the space below the oven floor where more combustion takes place; controlled by the amount of air added. This process heats the coal cake from below by heat conducted through the coke oven floor. From the ducts below the floor, the hot gas is drawn into the flues that run across the length of the coke oven battery. The flues, also termed COFG ducts, conduct the hot gas to the WHRBs.

3.2.2.6 Quenching the Coke

Coke is pushed out of the oven by the pushing-charging car onto a quenching car (Figure 3.10). Coke

is pushed from the oven red hot (temperatures higher than 900ºC) and would burn away if not quenched (cooled with water). Quenching is done by stopping the quenching car under a quenching tower (Figure 3.12), where the load of coke is sprayed with water. Approximately 700 ℓ of quenching water evaporates for each ton of coke quenched (shown in Figure 3.13). The remaining water condenses in the quenching tower and is recycled after particulates are removed by means of a settling pond. This is a convenient way of disposing of plant effluents, but most of the soluble contaminants remain. Once the concentration of pollutants becomes too high, the re-cycled water is added to coal cake as compaction fluid. The quenching cycle duration is controlled to adjust the moisture content of the quenched coke to the desired value.

The quenching system comprises pumps for quenching water, a quenching tower, settling tank and a means of extracting fine coke sediment from the quenching water, typically a moving chain grate system. A typical quenching tower would be between 20 m and 30 m high, the lower part of concrete with a steel structure for the top part (Figure 3.12).

Figure 3.12: Typical quenching tower with quenching car underneath the tower (similar to proposed Market Coke Plant) (Courtesy Sesa Goa Ltd).

Figure 3.13: Coke cake undergoing quenching (Courtesy Sinosteel).

3.2.2.7 Market Coke Processing

After quenching, the quenching car dumps the load of coke onto a coke wharf (see Figure 3.14). This comprises a door opening mechanism, coke receiving tank and control mechanisms. The bin receiving the hot coke measures about 15 m by 3.6 m by 1.3 m and can be tilted to more than 30 degrees. The two side plates and base plates are lined with heat-resistant cast iron sheet.

Figure 3.14: Discharging quenched coke on to a coke wharf (similar to proposed Market Coke Plant) (Courtesy Sinosteel).

Coke is discharged from the coke wharf onto the wharf discharge conveyor and transported to a cutting and screening plant. The sizing screen will be equipped with a double screening deck with an aperture of 80 and 30 mm. Coke is sold either as lumps of coke sized between 30 mm and 80 mm, or as fines - pieces smaller than 6 mm. Coke lumps larger than about 80 mm are cut with a coke cutter to required sizes. The coke will be stored in the different sizes. Depending on conditions, storage can be in separate bins or separate heaps. The stockpiles (shown in the plant layout Figures 3.1 and 3.2) will be located on a concrete base to facilitate the operation of a front-end loader in reclamation and feeding the screening plant. The coke product will be loaded onto trucks, weighed on a weighbridge and dispatched.

3.2.3 Electricity Co-generation from the Coking Process

In the energy recovery coke making process the volatile off-gas released during coal carbonisation is fully combusted by the controlled introduction of air (oxygen) to the different stages. The heat generated is used for coking the coal cake, so no external heating is required. The high temperatures and controlled addition of air combust the volatile hydrocarbon off-gas.

Only a portion of the heat generated by combustion is required for maintaining the coke oven temperatures for the coking process; the remaining heat is used downstream for raising steam in waste heat boilers. The steam is used to drive turbine-generators for generating electric power (refer to the process flow diagram in Figure 3.4).

3.2.3.1 Coke gas collection

A coke oven battery has large COFG ducts running the length of the battery (refer to Figure 3.8). All of the coke ovens in the battery discharge their hot off-gas into these flues. The flues transport the hot gas to the waste heat recovery boilers. In order to maximise the amount of energy that can be obtained from the gas, the flues are well-insulated and lined with refractory material. It is envisaged that each oven battery (of 30 ovens) will be equipped with a waste heat boiler.

3.2.3.2 Gas composition

COFG, which is produced during the heating of soft coking coal, is the primary source of energy available for co-generation. The expected temperature and flow rate of the gas is given in Table 3.1 below.

Table 3.1: Coke oven flue gas conditions at oven exit.

Description	Min	Max	Unit
COFG Temperature at Oven Exit	1100	1250	˚C
COFG Volumetric Flow Rate per Oven	1940	2143	Nm^3/hr

After combustion, the COFG exits the WHRBs with a temperature of 130 ˚C minimum at a rate of 488 530 Am^3/h. After desulphurizing and dust filtering the gas will exit the two boiler chimneys at a height of 50 m above the ground. The chimney stacks will be 5 m wide at the base and 2.5 m wide at the tip.

The flue gas which exits the WHRBs contains relatively high concentrations of sulphur dioxide (SO_2). In order to decrease the SO_2 gas emissions, the flue gas will pass through a Flue-Gas Desulphurisation (FGD) Plant where the majority of the SO_2 will be removed. The removal of SO_2 in the FGD plant occurs through a semi-dry recirculating fluidized bed scrubbing process, which involves spraying the flue gas

with a scrubbing liquid so as to remove the SO_2. A lime (Calcium carbonate, $CaCO_3$) scrubbing reagent will be used for the wet scrubbing which will produce calcium sulphate ($CaSO_4$). The calcium sulphate (more commonly known as gypsum) will form a by-product which will be sold.

The following estimated gas and dust levels (see Table 3.2) will exit the boiler chimney stacks after flue gas desulphurisation. The coke oven flue gas has no calorific value.

Table 3.2: Gas and Dust Levels in emissions from COFG after flue gas desulphurisation and WHRB Heat Extraction.

Description	Value	Unit
Sulphur Dioxide (SO_2)	400	mg/Nm^3
Nitrogen Oxides (NO_x)	700	mg/Nm^3
Dust (PM_{10})	50	mg/Nm^3
Hydrogen Sulphide (H_2S)	0	mg/Nm^3
Carbon dioxide (CO_2)	7.1%	%

3.2.4 Steam System

The steam header and power generation system includes the waste heat recovery boilers, turbines, generators, ducting, pumps, piping, cladding and associated equipment such as valves, electrical switch gear, automation, instrumentation, de-aerators, dust disposal systems, fans, stacks, dry cooling condensers and water demineralisation treatment plants.

The design of the boilers requires all the gas to be completely combusted in the coke ovens. The steam produced by heating water in the boilers drives the turbines. Four 80 MWt (thermal energy) boilers will be installed which will provide heat for the 55 MWe (electrical energy) rated capacity turbines. The nominal electrical power output is estimated at 50 MWe.

3.2.4.1 Condensers and cooling

The preferred method for cooling the condensers of the co-generation plant, will be dry cooling, due to the scarcity of water in the region.

3.2.4.2 Electricity transmission

The electricity supply to the Grootegeluk Mine (and therefore to the project site) is through a 132 kV overhead line from the nearby Eskom Matimba power station. Dual 33 kV overhead lines are used for site distribution. The main Grootegeluk transformer sub-station capacity was recently upgraded with the addition of another 80 kVA transformer rendering total capacity of 160kVA. The Co-generation Plant will make use of the existing power distribution network at the Grootegeluk Mine. Electricity will either be supplied to the Grootegeluk Mine or to the Eskom grid.

3.2.5 Market Coke and Co-generation Plant Infrastructure and Equipment

Infrastructure and equipment associated with the Market Coke and Co-generation Plant that will be constructed as part of this project includes:

Market Coke Plant:

- Coal storage and reclaiming;
- Coal conveyor to Coke plant;
- Coal storage silos and hoppers;

- Coal compacting box;
- Hydraulic/mechanical/vibration coal compactor;
- Four coke oven batteries comprising 30 ovens each, i.e. a total of 120 coke ovens;
- Pushing/charging car;
- Coke quenching car;
- Coke quenching tower;
- Coke wharf;
- Coke quench water settling ponds
- Extension to existing PCD
- Coke product stockpile;
- Coke conveyor to screening plant;
- Screening plant;
- Truck loading bins;
- The COFG system.
- Internal roads and pipelines for water, storm water and sewage

Co-generation Plant:

- The steam system (waste heat boilers, , turbines, generators and dry condensing system);
- Water demineralization treatment plant, feed water pumps, control and instrumentation switchgear and equipment;
- The electricity generating plant, buildings and associated infrastructure;
- COFG desulphurisation plant (off gas treatment system);
- Exhaust gas dust cyclone and bag filter system;
- Chimney stacks;
- The connecting and transmission equipment;
- Utilities – water, electricity, diesel (for back-up generators).

Other infrastructure such as admin offices, stores and a workshop will also be constructed.

Two new workshops may be constructed, one for plant maintenance and one for the maintenance of the steam turbines and generating plant. They will be located in close proximity to the plants they are to serve. The coke oven workshop will make provision for the maintenance of the coke ovens, conveyors, coal crushers, battery machines and associated plant. The electricity generating plant workshop will make provision for the specialised demands made by the maintenance of plant like steam turbines, large generators, high tension switchgear and control gear for the co-generation system.

Reductants Entrance Gate:

The new Reductant Entrance Gate will comprise the following structures (refer to Figure 3.15):

- A truck parking area with 6 truck bays;
- A car parking area with 15 car parking bays;
- A reception office which will include a small kitchen, ablution facilities and offices;
- Fencing around the parking and reception areas.

The roads going to and from the new entrance gate have already received environmental authorisation as part of a separate project. Thus the construction of roads at the entrance gate are excluded from this project.

3.2.6 Market Coke and Co-generation Plant Services

The majority of the utilities required for the Market Coke and Co-generation Plant are supplied through the Grootegeluk Mine infrastructure.

3.2.6.1 Water

The Grootegeluk Mine has an allocation of 7.6 million m³ per annum of raw water from the Mokolo Dam of which 1.6 million m³ per annum has been allocated to the Market Coke and Co-generation Plant. The Market Coke and Co-generation Projects when running at full capacity will require approximately 1.5 million m³ of water per annum. This amount of water is available from the mine's raw water supply line and a supplementary source will not be required.

Potable water, raw water and process water will be supplied to the Market Coke and Co-generation Plant via HDPE pipelines.

Potable water

Potable water is used for domestic purposes and washing of small plant spares at the workshop. Potable water is currently supplied to the mine and the Municipality of Lephalale from the Zeeland purification works.

Raw and Process Water

Raw water is suitable for use as process water, though the water for the boilers is demineralised and stabilized in accordance with steam standards and recirculated in the steam cycle. Approximately 1-3% of water used in the steam cycle, is used during boiler blow-down and or turbine control operations.

The boiler / steam turbine systems will be closed re-circulatory systems fed with demineralised water. The demineralised water will be obtained from an on-site demineralisation plant. The effluent from the demineralisation plant (brine) will be added to the water used in the quenching towers of the Market Coke plant and or used in the semi-dry flue gas desulphurization process.

3.2.6.2 Storm Water Runoff and Pollution Control

Run-off from plant areas are classified as polluted water and will be contained in the existing PCD (part of the adjacent Char Plant Site) and the proposed PCD Extension (adjacent to the existing PCD) at the plant site. Water from this area will be directed to the PCD and PCD extension and recycled as part of process water. A silt trap will be installed (as part of a separate project) to prevent siltation of the catchment dam and it will be lined with 2 mm HDPE lining. Storm water channels will consist for the most part of natural earth channels and concrete-lined V-drains. Concrete culverts will be provided at road crossings.

Run-off from the areas outside the plant is classified as unpolluted water and will be prevented from running through the plant site by means of cut-off berms and catchments dams. Concrete culverts will be provided underneath roadways.

Water entering the Market Coke Plant will be retained in the system and will only exit the plant as moisture in the coke product, steam from the coke quenching towers and as moisture in the stack discharge. The plant will have no effluent water leaving the process, as all contaminated water will be treated in the PCDs. Due to re-circulation in the quenching towers the water quality will deteriorate to such extent that corrosion and scaling could occur. The cooling tower design makes provision for this and the water will not require further treatment.

3.2.6.3 Sewage

The domestic waste water system for the Market Coke Plant and Co-generation plant, will be integrated with the existing mine system. The sewage for the Market Coke and Co-generation Plant will be collected in an existing sump at the existing Char Manufacturing Plant. This sump has capacity for a total of 300 people and thus has sufficient capacity to also handle the increased demand. From the sump, two pumps (one duty and one standby – already installed) will pump the sewage via the existing 100 mm diameter HDPE pipeline to the Grootegeluk Waste Water Treatment Works (WWTW).

3.2.6.4 General Waste Management

Solid waste has the potential to impact on surface water through contaminated runoff and the generation of leachate. The waste management proposed for the site is discussed below. The following sources will generate waste on the site:

- Site offices
- Workshops

It is anticipated that both hazardous and general waste will be produced. General and hazardous waste disposal will tie in with the current practices and facilities of the existing Char Manufacturing Plant, adjacent to the Market Coke and Co-generation Plant.

Currently the domestic waste from the existing Char Manufacturing Plant is collected by the Grootegeluk Mine Services Department and taken to the Lephalale Municipal Landfill site for disposal. The Waterberg District Municipality's Integrated Waste Management Plan (IWMP) (2009) indicates that there are unfortunately no permitted landfill sites in Lephalale. The IWMP states that the Waterberg District Municipality has a role to ensure that waste management systems are in place in all its local municipalities.

This same practice will be followed for the Market Coke and Co-generation Plant. The colour coded bin system that is implemented by the existing Char Manufacturing Plant for the recycling of paper, glass, plastic and tins will also be implemented for the Market Coke and Co-generation Plant. The scrap metal produced will also be included in the current contract with Reclam, where the scrap metal is collected in skips and removed from site for processing. All other, commercial, industrial waste, builders' rubble and other waste classified as General Waste (G) under the South African Minimum Requirements for waste disposal (Department of Water Affairs and Forestry, 1998) will be removed from the site by an appropriately licensed waste removal contractor and disposed of at a licensed general waste facility.

3.2.6.5 Hazardous Waste Management

Some of the waste classified as hazardous (H or h), including grease, oils, acids, fluorescent tubes, medical waste etc. of the Market Coke and Co-generation Plant will also be handled and disposed of by the existing Char Manufacturing Plant through their existing systems which will involve disposing of the waste at a licensed hazardous waste site through an authorized Hazardous Waste Service provider like Wastech or Wasteman.

As mentioned previously, a waste management licence (WML) is not required for this project as it does not include any waste management listed activities. The general and hazardous waste stored temporarily on site will not be in sufficient quantities to require a WML.

3.2.6.6 Power and Fuels

The Market Coke and Co-generation Plant will be linked to the existing electricity network of Grootegeluk Mine. Electricity at Grootegeluk Mine is supplied through an Eskom network, from the Matimba Power Station. Electricity for the Market Coke and Co-generation Plant will be changed from the existing 11 kV supply from a substation supplying the Grootegeluk coal stockpile area, to a new supply directly from the Grootegeluk main substation.

An extension of the 33 kV dual feed and switchyard adjacent to the existing Char Manufacturing Plant, as well as the raw and potable water lines have been completed in 2011, as part of a separate project. A 20 MVA transformer will provide electricity through two separate feeder breakers to the existing char buildings and the proposed Market Coke and Co-generation Plant buildings. Reliability of electrical supply from Grootegeluk Mine has played a major role in production losses at the existing Char Manufacturing Plant, but electricity supply for the Market Coke and Co-generation Plant should improve from the more direct feed currently constructed.

A 9000 litre diesel bulk tank is installed on the Grootegeluk Mine site and a service level agreement is in place with Total for the supply of diesel when required. The existing tank capacity is sufficient to handle the increase in demand. The diesel is delivered by road truck and the same SLA (refer to Appendix 17) will remain in place to provide diesel for the Market Coke and Co-generation Plant. Diesel is used to refill the trucks transporting the Reductant products from the site to the clients and as fuel for front loader tractors loading product onto the trucks.

3.2.6.7 Lighting

Lighting for security purposes will be provided at the new entrance gate. The new buildings, plants, stock yards, etc. of the Market Coke Plant, will have lighting installed for safety of employees and moving equipment. Along all conveyors lighting masts will be erected as is current standard practice.

3.2.6.8 Equipment, Vehicles and Traffic

Tools and equipment for operational and maintenance purposes will include light delivery vehicles, forklift trucks, mobile cranes, trucks, special tools, lifting tackle etc.

During the construction period, which will begin in approximately July 2013, additional traffic will be generated in the nearby area.

Fill material for earthworks will be transported from the Grootegeluk Mine area. Building materials will be transported to the site on flatbed trucks and the transportation of large equipment will require abnormal loads. Abnormal load arrangements will be made as required by regulations. Process equipment and some construction material will be transported to site in 3 ton to 30 ton trucks.

The products of the Market Coke Plant will be transported by road. It is expected that this will cause an increase in the number of haul trucks and thus Exxaro Reductants intends to move the haulers away from the existing mine entrance to a new gate where a weighbridge will also be situated.

During the operation of the Market Coke Plant, loading of the coke product will take place 24 hours a day, 7 days a week with 70% of loading during night-time and 30% during daytime. Coke will be transported with back tipper trucks (18 m long) or side tipper trucks (19 m long) which will be covered with tarpaulins.

Regular cleaning of silt traps and handling of by-product material requires the use of a Bobcat with load

bucket and forklift attachments. An extendable boom type forklift will also be required for removing of skips from bunded areas.

3.2.6.9 Roads

A new access road 400 m x 9 m wide will be constructed as from the Reductants area to the main road coming from the new Entrance Gate, leading to GMEP area. Within the Market Coke and Co-generation sites, product truck loading facilities will be constructed. New roads will be required in the Market Coke and Co-generation Plant with a total length of approximately 3000 m and a width of 6 m.

3.2.6.10 Temporary infrastructure

Temporary facilities are required for Market Coke and Co-generation Plant project team members and contractors during the construction phase of the expansion project. These facilities will include the contractor lay-down area which will be supplied with potable water and power from the existing Char Manufacturing Plant facility as well as a mini substation that was utilised for this purpose during the initial plant construction period. The contractors will however provide for their own communication, chemical toilets and washing facilities.

Project team members will be accommodated in rented temporary offices with telephone, facsimile and network connections to the existing infrastructure. Ablution and kitchen facilities will be shared with the plant personnel until use of these facilities in the new training building becomes available. Temporary project personnel will be equipped with desktop computers to enable controlled access to the Exxaro network while permanent personnel will make use of laptop computers. Network access will be required to the mail exchange server as well as document control system.

3.2.6.11 Accommodation

No accommodation will be provided on the mine premises. All employees or contractors will be accommodated in the Marapong, Onverwacht or Lephalale townships. These are well-established townships with schools, hospitals, shopping centres, sports facilities, etc. However due to the time constraint in obtaining serviced stands, most contractors may have to be accommodated in temporary housing in these townships.

3.2.7 Development Alternatives

3.2.7.1 No Go Alternative

The no-go option would be that the Market Coke and Co-generation Plant will not be undertaken. There are no advantages that have been identified for the environment and the community, should the No Go alternative be chosen. The implication of this would be the following disadvantages on the environment and the community:

- No increase in coke production will take place and that the coke required by the ferrochrome industry in South Africa will need to be sourced from overseas suppliers. This will result in negative impacts on national economic growth and development.
- Exxaro Reductants would not be able to satisfy the energy (electricity) requirements of the Grootegeluk Mine operations, including that of the Market Coke Plant's operations.
- Enable Exxaro Reductants to produce a sufficient quality of coke reductant, to satisfy the various reductant requirements from its clients, mainly the stainless steel industry in South Africa.
- Exxaro Reductants would not be able to assist with national energy security and climate change objectives, by reducing the electricity demand of the Grootegeluk Mine.
- Exxaro Reductants would not be able to employ an additional 275 people.

3.2.7.2 Locality Alternatives

No locality alternatives have been assessed as part of the EIA process. The proposed expansion will be located adjacent to the existing Char Manufacturing Plant and some of the existing infrastructure will be utilised in the Market Coke and Co-generation Plant. The Market Coke and Co-generation Plant is conveniently located within the boundaries of the mine and thus it is close to the coal source required to make coke. The proposed site is in a highly disturbed old coal stockpile area, and thus is not a sensitive environment. Any other locality will require:

- A large amount of additional infrastructure.
- Additional transport of coal and would thus be more expensive.
- It would also require disturbance and environmental and socio-economic impacts on a new, possibly undisturbed area.

It is neither sensible nor feasible to evaluate another locality in detail.

3.2.7.3 Technology Alternatives

Technology alternatives were assessed during the pre-feasibility stage and the decision was made to use energy recovery type coke ovens as they reduce the risk of flue gases escaping from the coke ovens.

Only one technology alternative for each of the Market Coke and Co-generation Plant were found to be feasible. Thus no feasible technology options have been identified or considered during the EIA.

3.2.8 Possible future options – NOT PART OF THIS APPLICATION

The following future option will be subject to the required applications and authorisations before implementation. The proposed Market Coke and Co-generation Plant will produce 435 ktpa of dry coke product (this project). A future potential second phase is envisaged where the production will increase to 1000 ktpa of dry coke product produced. In Phase II the electrical power produced will increase from the proposed 50 MWe to approximately 115 MWe.

3.2.9 Employment

As mentioned, the proposed Market Coke and Co-generation Plant will generate approximately 275 jobs. Contractors are responsible for finding suitable accommodation for their construction personnel.

3.2.10 Land Tenure

Grootegeluk Mine is owned by Exxaro Coal (Pty) Ltd. The proposed Market Coke and Co-generation Plant is owned by Exxaro Reductants and is a separate entity from Exxaro Coal (Pty) Ltd. Exxaro Reductants leases the land on which the Market Coke and Co-generation Plant will be built from the Grootegeluk Mine.

3.3 Project Implementation Schedule

Construction of the Market Coke and Co-generation Plant is due to begin in July 2013 and operation of the plants is scheduled to begin in July 2016.

The initial phase of construction (this project) will produce 435 000 tons of coke per annum from the coke oven batteries. Expansions in increments may be proposed in future, up to a production of 1 000 ktpa once Phase II is operational.

4 DESCRIPTION OF THE AFFECTED ENVIRONMENT

The baseline environmental characteristics of the site for the Market Coke and Co-generation Plant at Grootegeluk Mine and its surroundings are described in this chapter.

4.1 Physical Environment

4.1.1 Climate

The Environmental Management Framework (EMF) compiled by the Waterberg District Municipality (2011) states that the meteorological conditions of the area will have an effect on the ambient air quality and that these conditions need to be taken into account when considering the effects of air pollution in the various regions. For this reason, a description of the existing meteorological conditions have been included in the sections below. The full Air Quality Impact Assessment Report with the detailed description of the baseline climatic conditions is included in Appendix 3.

4.1.1.1 Temperature

The area experiences average maximum temperatures of between 30 ℃ and 36 ℃ and average minimum temperatures of between 7 ℃ and 3 ℃ (Airs hed, 2012). The long term maximum and minimum average monthly temperatures recorded at the South African Weather Service (SAWS) station in Lephalale are shown in Figure 4.1 and Figure 4.2 respectively. A visual representation of average temperatures throughout the day and year is provided in Figure 4.3, which depicts data recorded at the SAWS station at Lephalale in 2006. For more detailed temperature information, please refer to the Air Quality Impact Assessment report in Appendix 3.

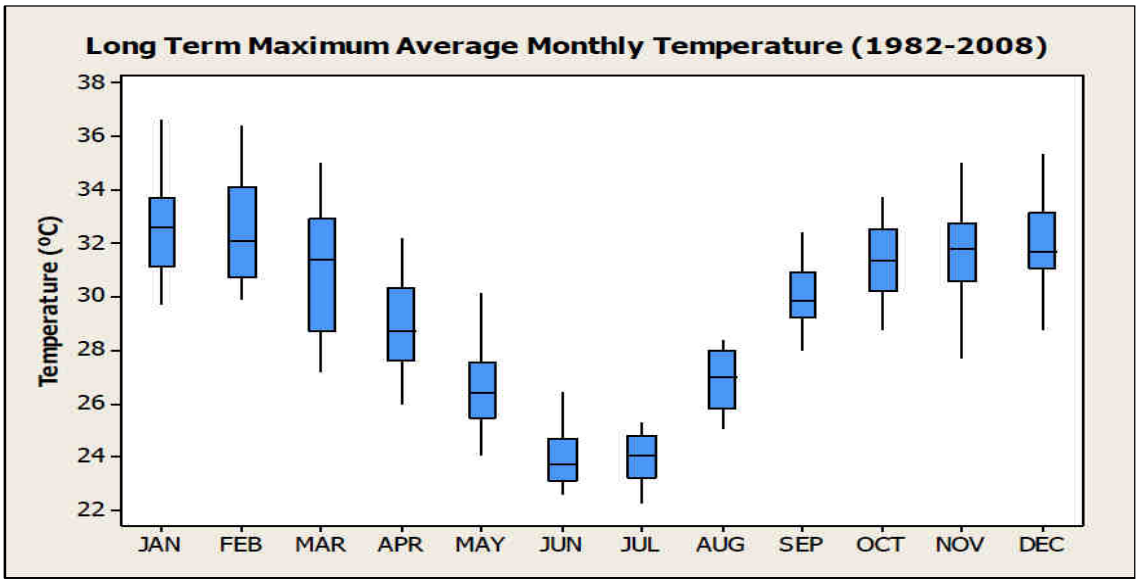


Figure 4.1: Long-term average maximum temperature for Lephalale (1982 – 2008) (Airshed, 2012).

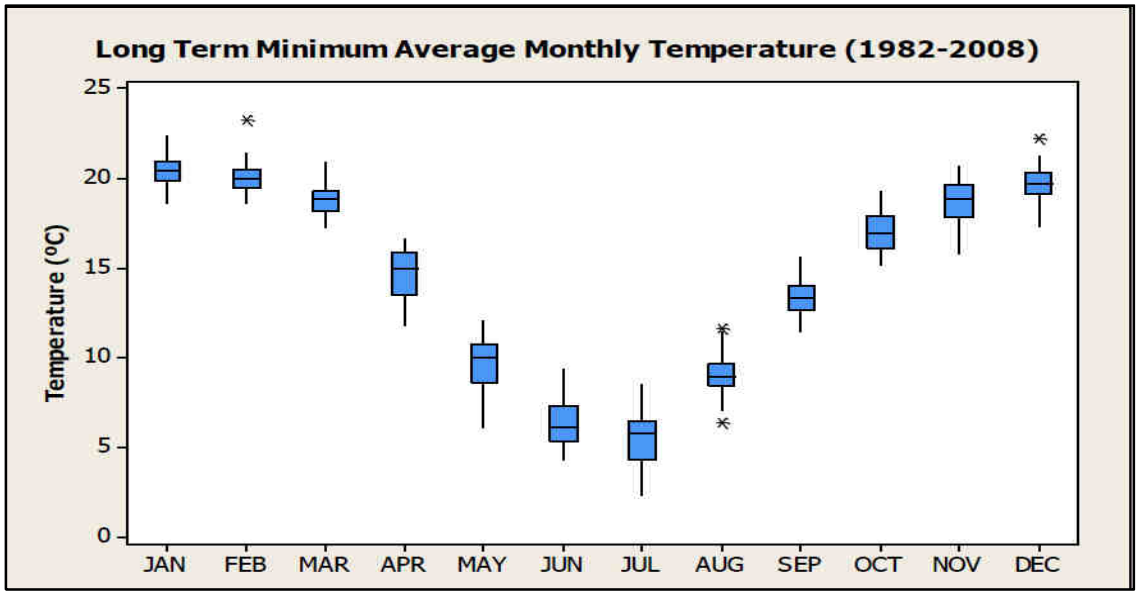


Figure 4.2: Long-term average minimum temperature for Lephalale (1982 – 2008) (Airshed, 2012).

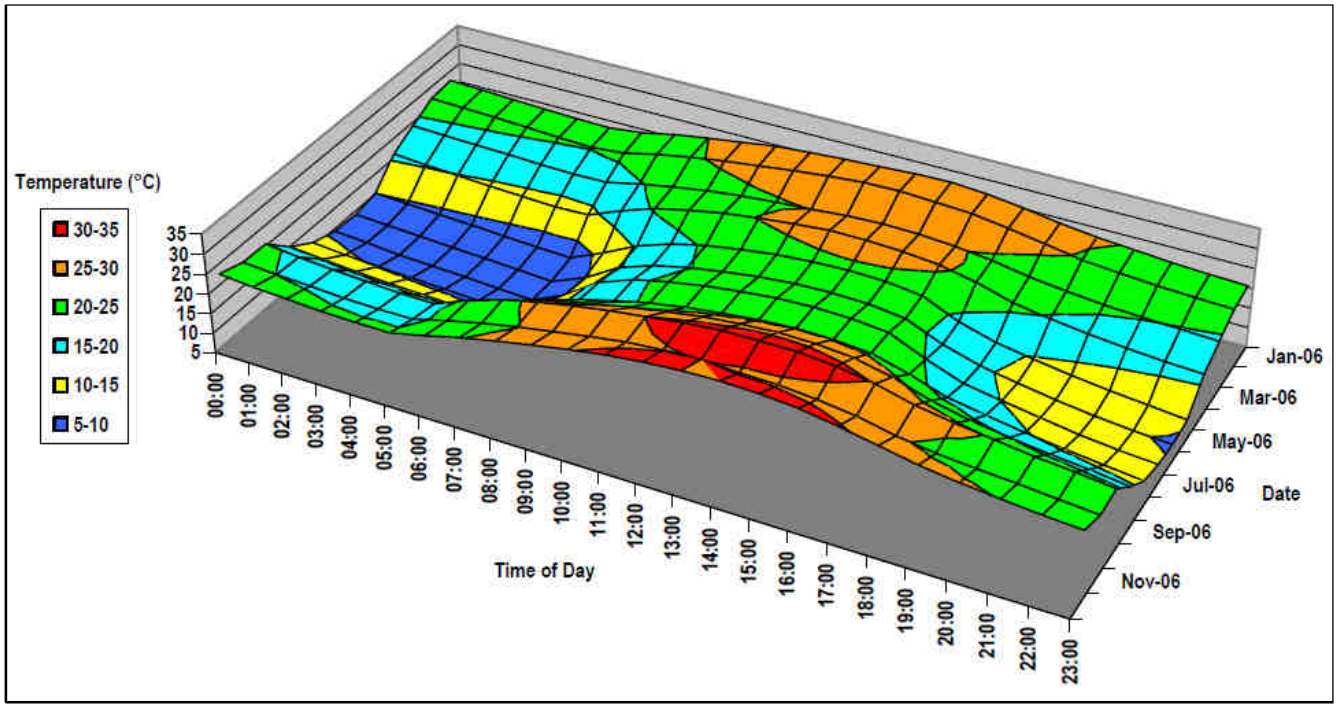


Figure 4.3: Monthly daily temperature profile of Lephalale in 2006 (Airshed, 2012).

4.1.1.2 Precipitation and Evaporation

The study area is characterised by hot, moist summers and mild dry winters. The long-term annual average rainfall is 420 mm, occurring mostly between October and April, with the peak for the area being in January (AGIS, 2002). Long-term average rainfall, as recorded at the SAWS station in Lephalale, is depicted in Figure 4.4.

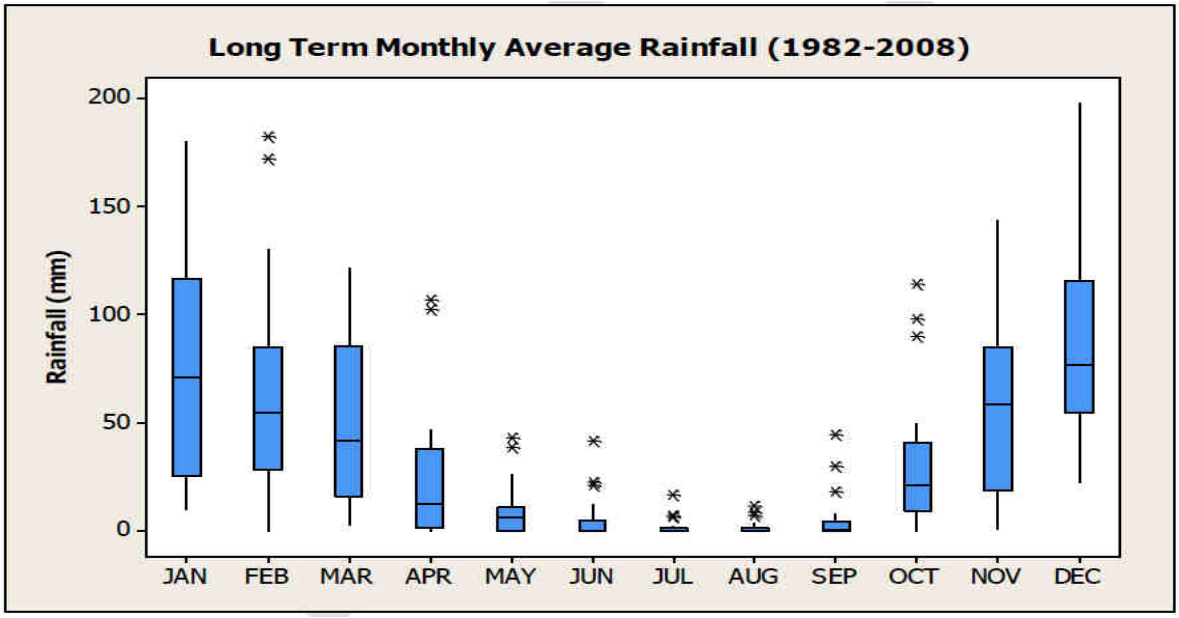


Figure 4.4: Monthly average rainfall for Lephalale (Airshed, 2012).

The mean annual precipitation characterises the long term quantity of water available to a region for hydrological and agricultural activities. The Lephalale area falls within the annual rainfall category of 200-400 mm. Monthly rainfall recorded at Bulklip station is shown in Figure 4.5.

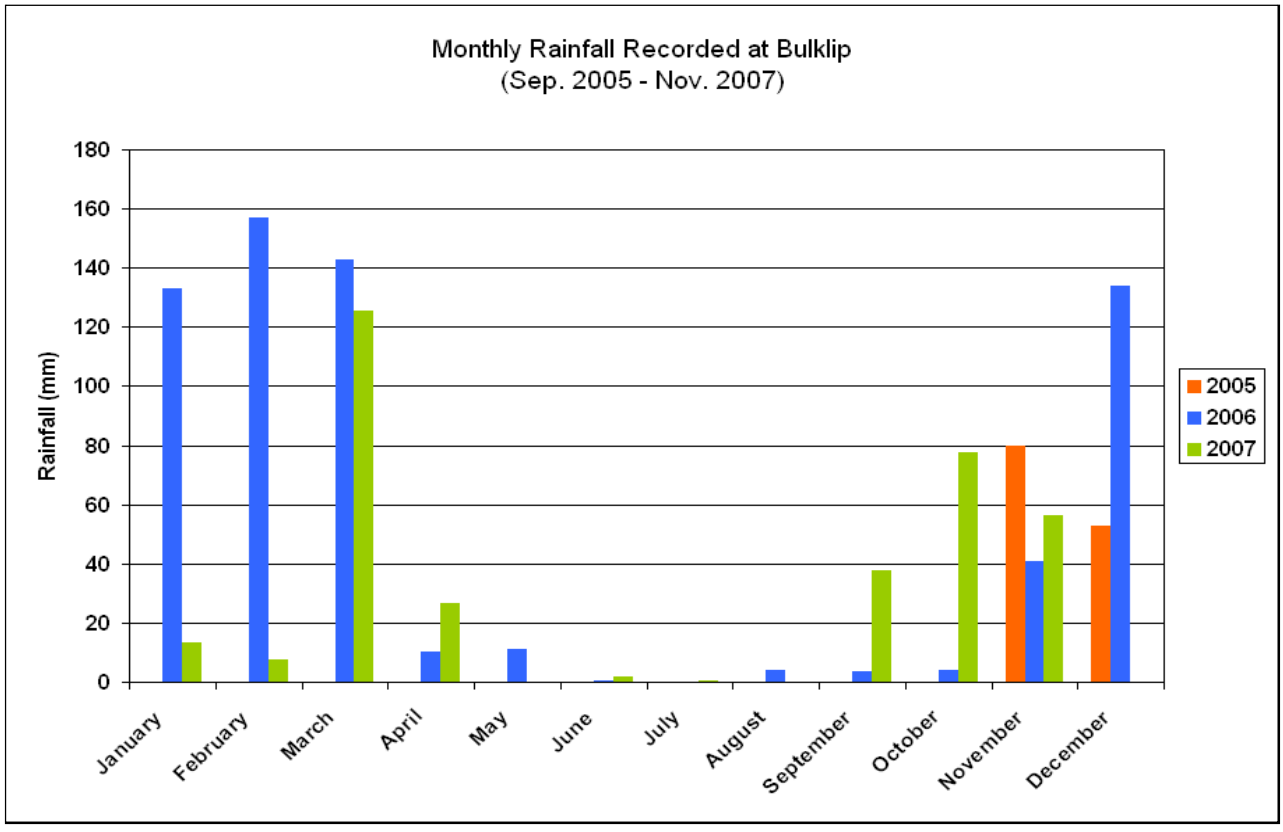


Figure 4.5: Recorded monthly average rainfall (Bulklip, Sep. 2005 – Nov. 2007)

Evaporation in the area is high, with the annual evaporation being approximately 2 281 mm (refer to Figure 4.6). Average monthly evaporation data for the Limpopo Province is summarised in Table 4.1 below.

Table 4.1: Monthly average evaporation data for the Limpopo Province (Airshed, 2012)

Month	Mean Value	Maximum Value	Minimum Value
January	237 mm	292 mm	168 mm
February	193 mm	238 mm	146 mm
March	191 mm	222 mm	124 mm
April	152 mm	165 mm	132 mm
May	135 mm	152 mm	120 mm
June	114 mm	128 mm	101 mm
July	125 mm	136 mm	112 mm
August	164 mm	181 mm	142 mm
September	202 mm	239 mm	166 mm
October	233 mm	294 mm	187 mm
November	239 mm	287 mm	179 mm
December	234 mm	288 mm	175 mm

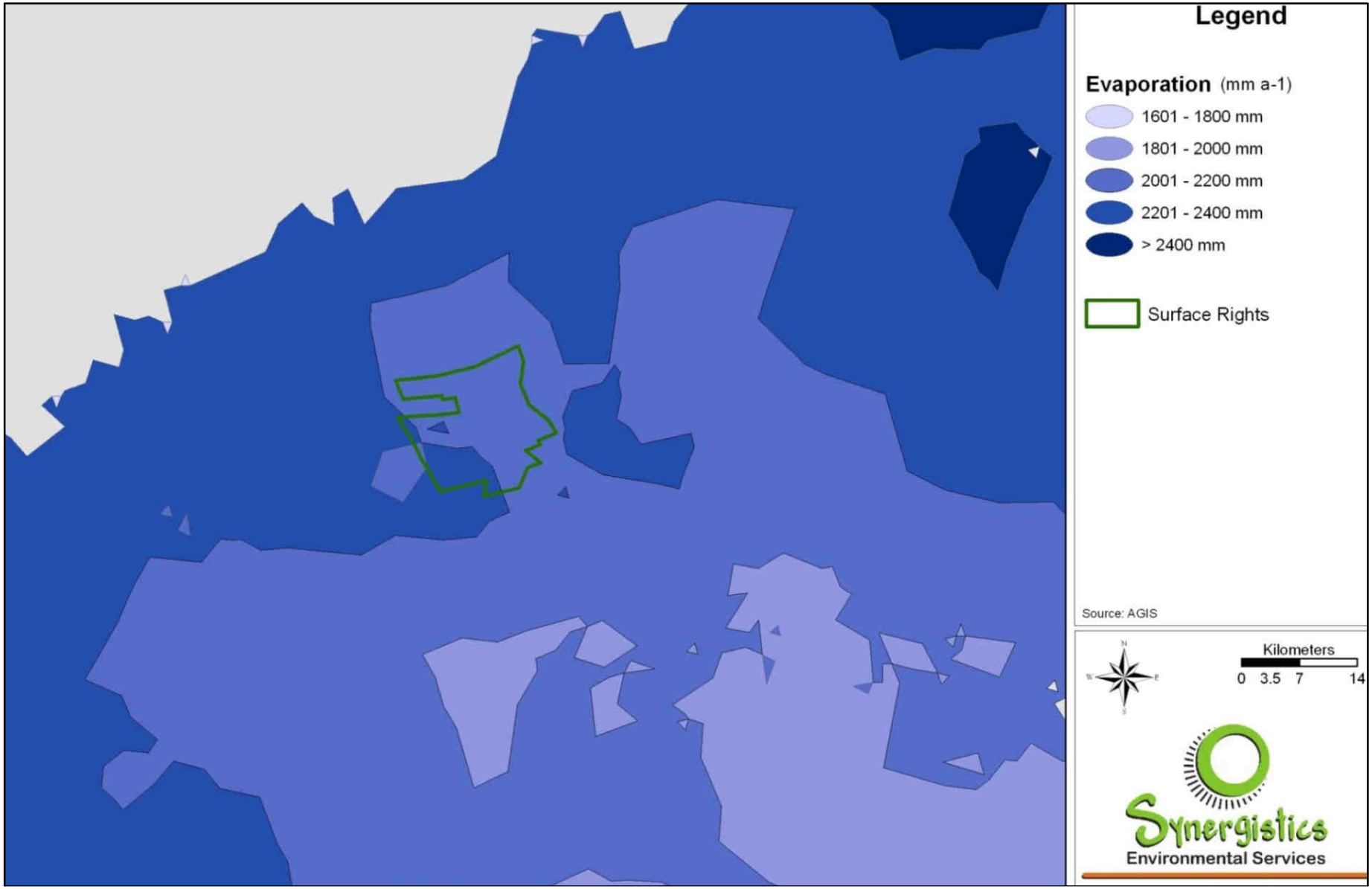


Figure 4.6: Annual Evaporation in the Study Area (from AGIS database, 2002)

4.1.1.3 Wind Patterns

Wind data were obtained from Airshed, 2012, who used hourly average meteorological data recorded at the Lephalale SAWS station, Eskom ambient stations at Grootestryd and Marapong (approximately 10 km west of Lephalale) and the Anglo Coal Station at Bulklip approximately 20 km north of the Grootegeluk mine for the period January to December 2006 (Figure 4.9). The wind pattern of the area is dominated by east-north-easterly and north-easterly winds, as may be expected due to the continental high pressure. Winds are infrequently experienced from a westerly and south-easterly direction. East-north-easterly and north-easterly winds increase in frequency during summer months, and the percentage of north-easterly winds decreases in winter months. The highest wind speeds were recorded during the spring months (August to October). It is apparent that the wind field is fairly uniform over the study area, based on the data from the three weather stations (Airshed, 2012). More detailed information can be found in the Air Quality Impact Assessment report in Appendix 3.

An annual average wind rose for the area is depicted in Figure 4.7 and seasonal average wind roses in Figure 4.8.

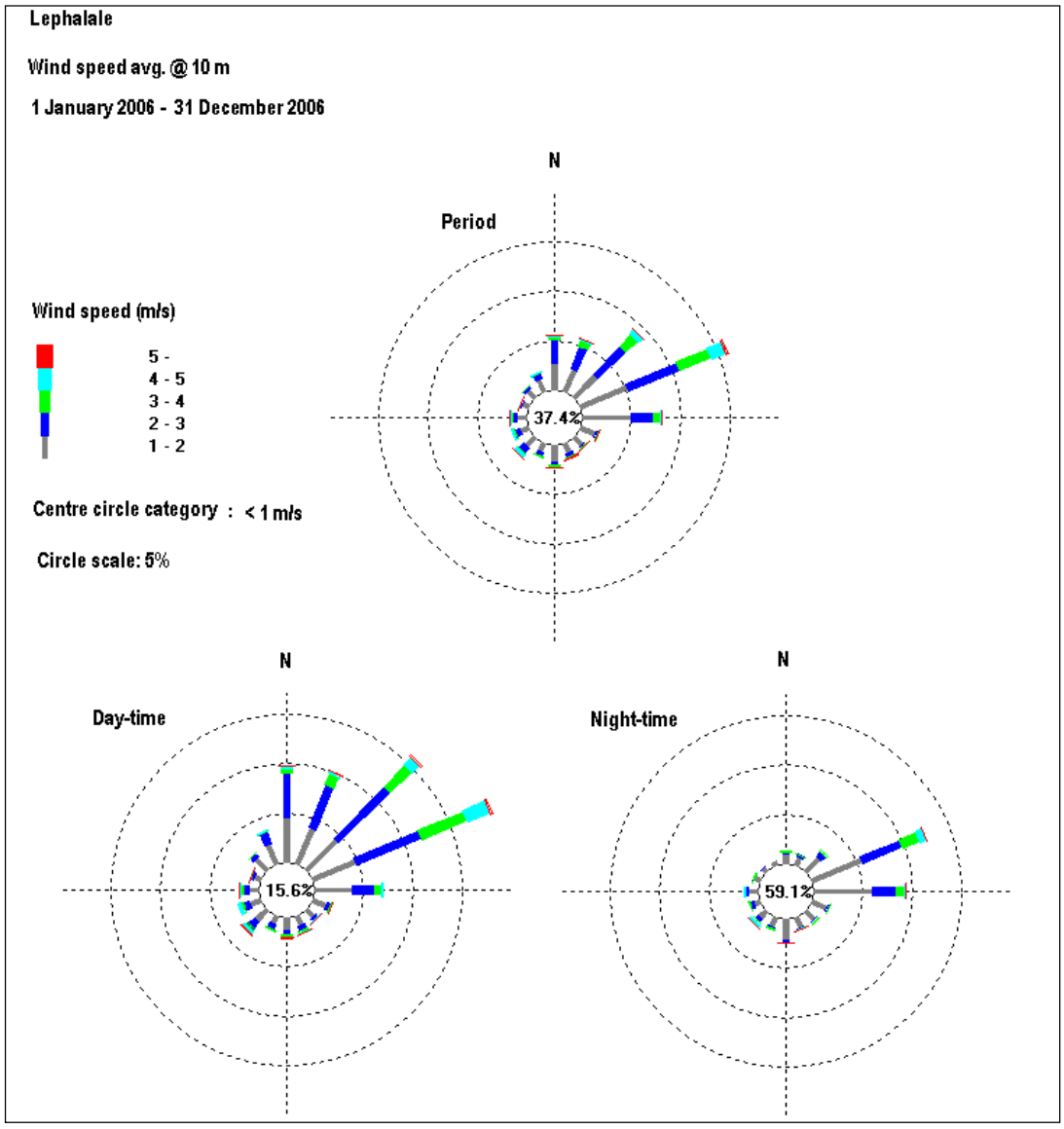


Figure 4.7: Period, Day and Night-time Wind Roses for the Lephalale (Ellisras) SAWS Station (2006) (Airshed, 2012)

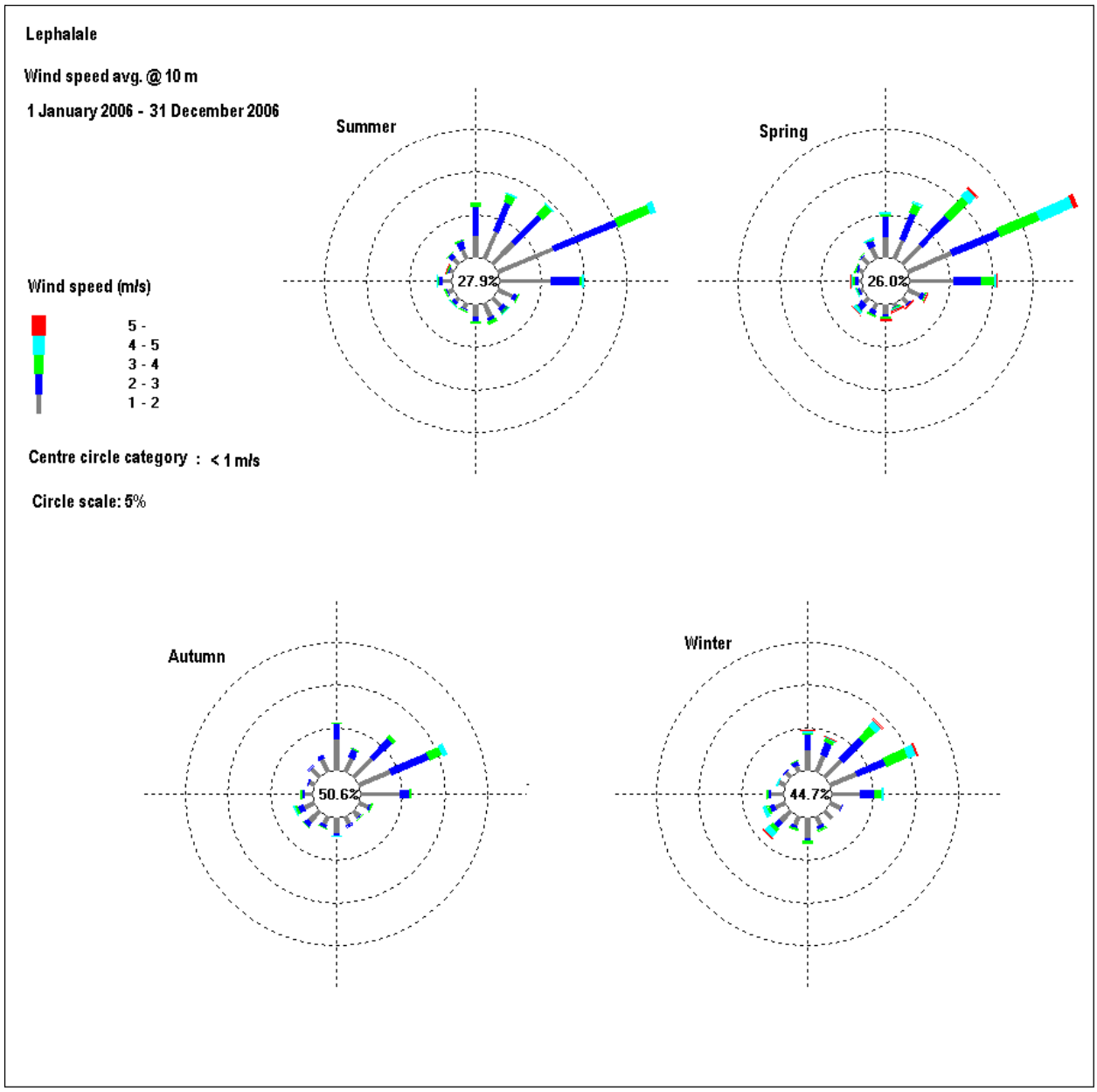


Figure 4.8: Seasonal Wind Roses for Lephalale (Ellisras) Weather Station (2006) (Airshed, 2012).

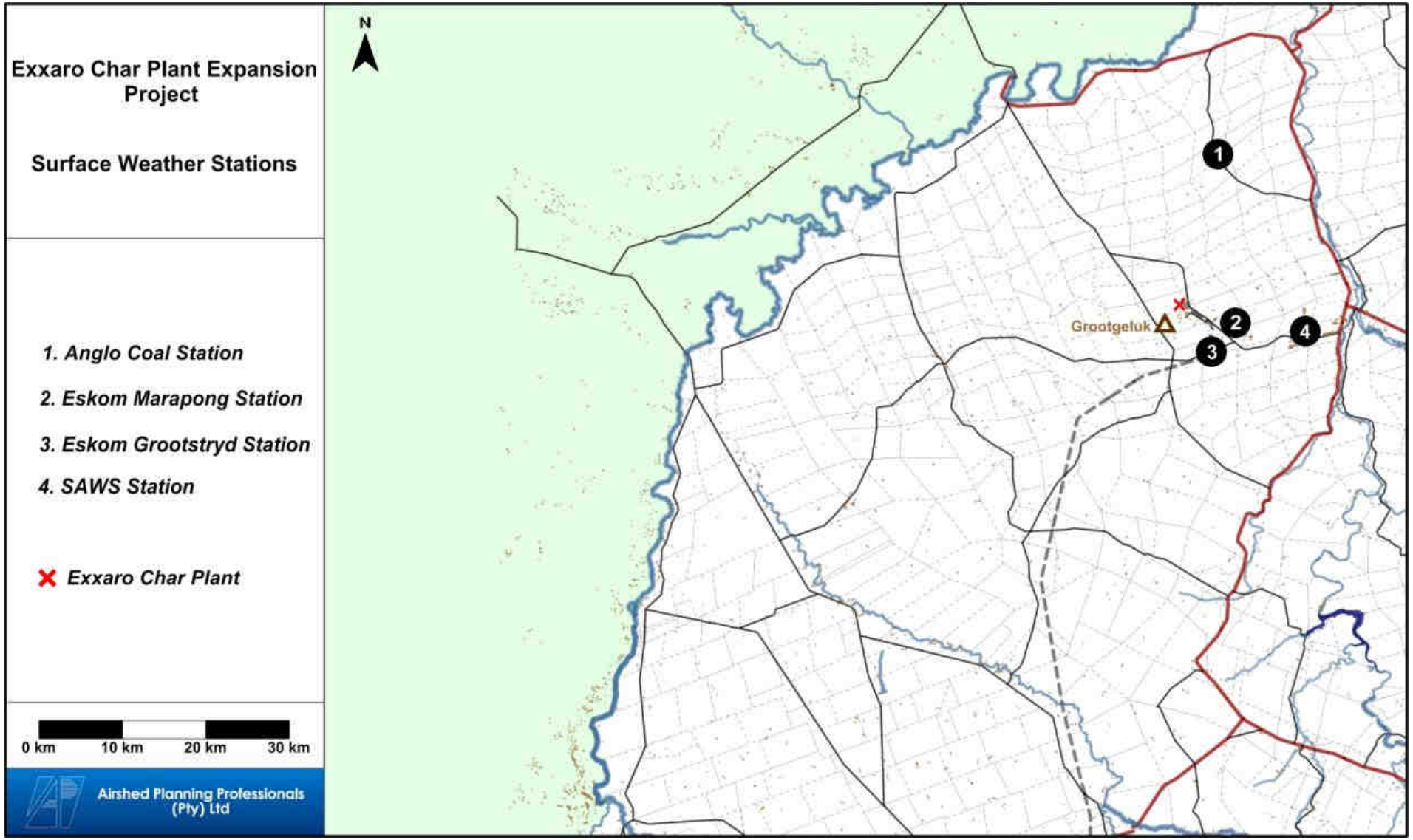


Figure 4.9: Relative locations of regional meteorological stations (Airshed, 2012).

4.1.1.4 Atmospheric Stability

Atmospheric stability relates to the amount of turbulence and mixing in the first few hundred meters of the atmosphere and has a major effect on the movement and dispersion of air pollution. Generally, more turbulent conditions increases the mixing of unpolluted air into a polluted plume and thereby acts to reduce the concentration of pollutants in the plume (i.e. enhances the plume dispersion). Daytime is usually characterised by unstable and turbulent conditions due to convection currents generated by heating. Vertical mixing of the atmosphere is therefore more prolific during the day (Airshed, 2012). Conversely, night times are characterised by weak vertical mixing and the predominance of a stable layer. These conditions are normally associated with low wind speeds. Atmospheric stability is frequently categorised into one of six stability classes. These are briefly described in Table 4.2.

Table 4.2: Atmospheric Stability Classes (Airshed, 2012)

A	very unstable	calm wind, clear skies, hot daytime conditions
B	moderately unstable	clear skies, daytime conditions
C	unstable	moderate wind, slightly overcast daytime conditions
D	neutral	high winds or cloudy days and nights
E	stable	moderate wind, slightly overcast night-time conditions
F	very stable	low winds, clear skies, cold night-time conditions

Figure 4.10 shows the stability class occurrence for the Waterberg region for the period January to December 2006. From the figure it can be seen that very stable atmospheric conditions are the most common, occurring on average 42% of the time. This implies that the dispersion of pollutants at the Char site will likely be minimal for a large percentage of the time.

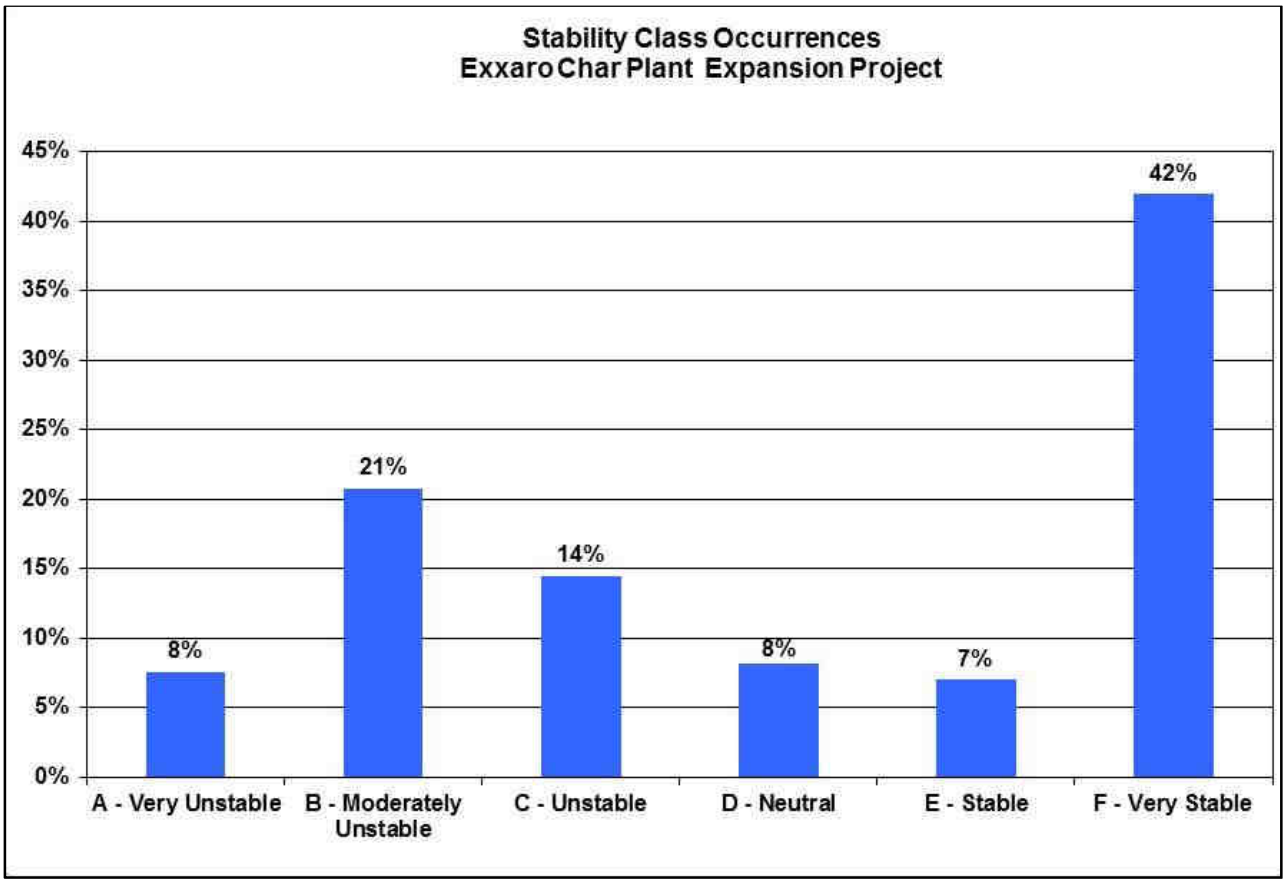


Figure 4.10: Atmospheric Stability Class Occurrence for the Waterberg Region (Airshed, 2012).

4.1.2 Topography

The elevation of Grootegeluk Mine varies from 900 to 922 m above sea level (Figure 4.11). The area is generally flat and featureless, with the exception of Nelsonskop to the north and the Waterberg range to the south, which have elevations of 922 m and 3600 m above sea level respectively.
Mining activities at Grootegeluk Mine have influenced the topography of the area in terms of the following created surface features:

- The open pit, which is approximately 135 m deep and 560 ha in extent and advancing at a rate of 80 m to 100 m per year;
- The various discard dumps, which cover approximately 1 000 ha at heights varying between 40 m and 60 m;
- Run of mine (ROM) stockpiles;
- Infrastructure such as the plant, offices, and workshops which are as high as approximately 50 m and occupy approximately 10 ha; and
- The slimes dam which covers approximately 100 ha with a height of about 25 m.

The development of the existing Char Manufacturing Plant changed the topography of the site, which was previously a large coal stockpile area. The stockpile and top layer of soil containing coal were removed from the site when it was leveled for the construction of the existing Char plant. For the construction of the proposed Market Coke and Co-generation Plant, some additional remaining coal and soil may need to be removed to level the site (refer to Figure 4.11).

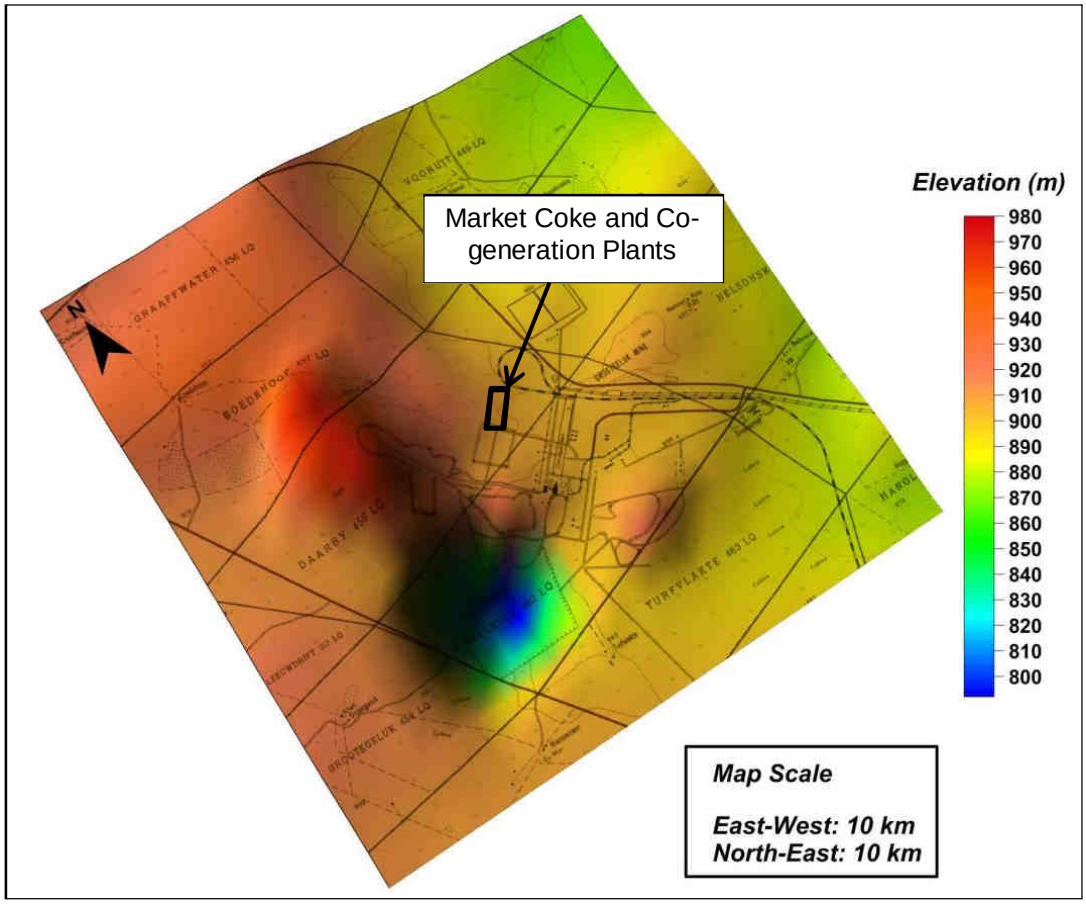


Figure 4.11: Topography of the proposed site (Airshed, 2012)

4.1.3 Soils

The Soils Assessment Report with the detailed description of the baseline soils on the site is included in

Appendix 2. The variations in soil form are characterised by differences in the texture (grain size), colour, soil structure, and the effective rooting depths that result from the depth to bedrock and or inhibiting layers that occur. The soils in the area are the Hutton type (Hu35). They are sandy, with 70 to 90 % of sand in the top layer and 50 to 90 % in the sub layer. The clay content ranges from 5 to 25 % in the top layer and 5 to 45 % in the sub layer. This content puts the top layer in the sandy to sandy-clay-loam texture and the sub layer in the sandy to sandy-clay texture. Silt content is low in all the soil types.

A mixture of yellow-brown and red apedal soils characterise the area around Grootegeluk Mine (Clean Stream, 2005). These soils are highly permeable. Water filters through the soil very fast, washing out nutrients and making these soil types unsuitable for cultivation. The yellow-brown apedal soils are well to moderately drained and shallow to very deep (0.4 m to >1.8m). They are the most dominant soil type area and generally occur in flat to gently sloping midslope to crest positions. The red apedal soils are relatively well drained soils with intermediate to very deep depths (0.3 m to >1.8 majority).

The soils in the study area have been heavily impacted by the mining activities that have been occurring on the site for approximately 29 years. The existing Char Manufacturing Plant is built on an area that was previously used for coal stockpiling. As such, the 5 to 10 cm of top soil over most of the surrounding area is impacted by coal contamination (Golder, 2011). Activities at the existing Char Manufacturing Plant have also led to the contamination of soils in the area by wastes generated at the plant, which include tar, liquor, char fines and fine coal and tar sludge (Golder, 2011). A large amount of infill material has also been imported during the construction of the existing Char Manufacturing Plant (Golder, 2011).

Soil sampling and analysis was conducted at potentially contaminated areas (i.e. where visual signs of contamination were evident) in and around the existing Char and proposed Market Coke and Co-generation Plant site to establish the amount of contamination that has taken place (Figure 4.13). Results of this analysis revealed the presence of potentially hazardous substances in the soils, which included:

- Inorganic Chemicals Of Concern (COC's), e.g. Arsenic (As) and Lead (Pb);
- Polycyclic Aromatic Hydrocarbons (e.g. Pyrene), (PAH); and
- Petroleum Hydrocarbons (TPH), a constituent of coal.

The results were compared to the Soil Screening Values (SSV) detailed in the Framework for the Management of Contaminated Land in South Africa (Department of Environmental Affairs, 2010). SSVs are a conservative measure used to assess whether compounds present in soils are at concentrations high enough to pose a potential risk to the receiving environment. The main findings indicate that:

- Concentrations of COCs (i.e. arsenic, lead etc.) in the TP samples were below SSV1 values.
- Samples in areas where visual contamination was evident had concentrations of the metals arsenic (As), lead (Pb), and vanadium (V), which exceeded the SSV1 values.
- PAHs pyrene, benzo(a)pyrene and TPH (C12-C16) in sample HA01 exceeded SSV1 values.

It was established that the elevated levels of As, Pb and V concentrations are not a result of the spillage of wastes as the levels of these COC's in samples taken from waste samples were low. Instead, the elevated As, Pb and V concentrations are associated with the infill material that was used during the construction of the existing Char Manufacturing Plant (Golder, 2011). Furthermore, these elevated COC's are unlikely to contribute to groundwater contamination as all these COC's are absorbed by clay particles and only move under acidic conditions (Golder, 2011).

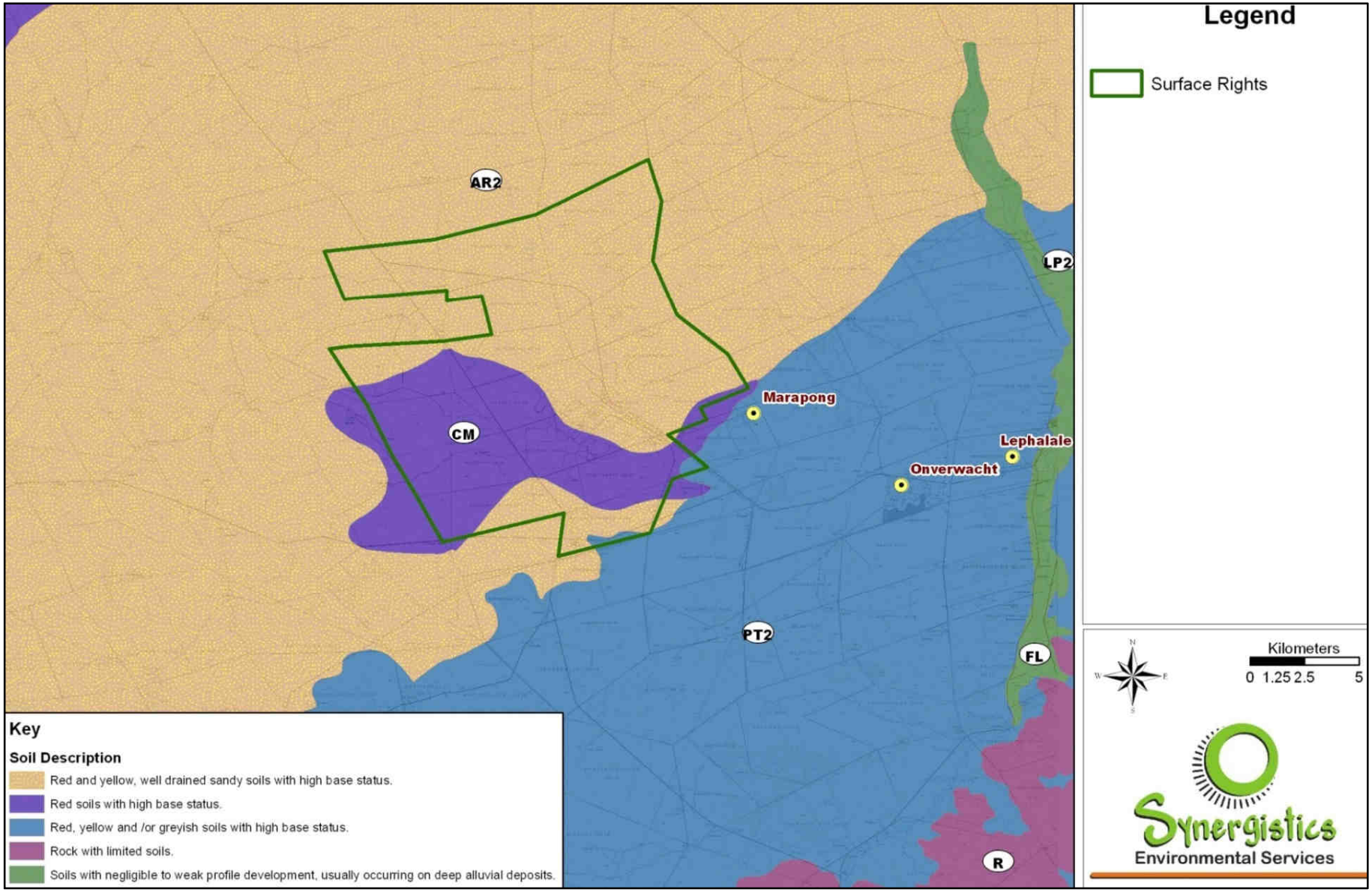


Figure 4.12: Soil types in the study area (the green polygon is the Grootegeluk Mine area)

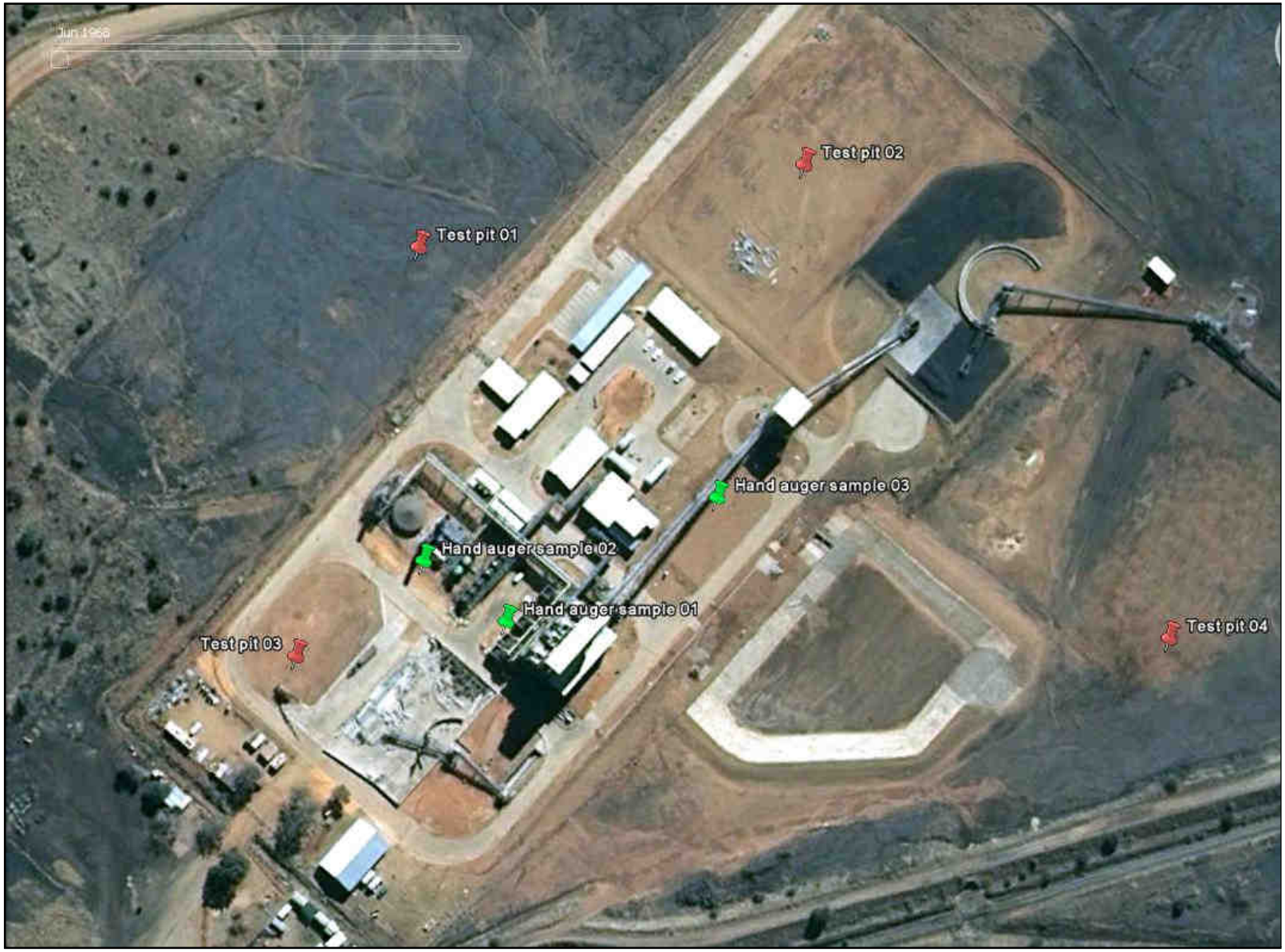


Figure 4.13: Location of soil sampling points (Golder, 2011).

4.1.4 Geology

The proposed site is located in the Waterberg Coal field. The coal field extends westward into Botswana and covers an area of approximately 88 km (east to west) and 40 km north-south (ERM, 2012). The coal field is bounded by the Zoetfontein fault in the north and the Eenzaamheid fault in the south (ERM, 2012). The Daarby fault subdivided the coal field in a northwest, then northeast direction (ERM, 2012).

Figure 4.15 illustrates the surface geology of the Waterberg coalfield. The formations directly underlying the Market Coke and Co-generation Plant sites are the Letaba Basalt and the Clarens Sandstone formations. A description of each follows:

- The Letaba Formation is preserved as a small wedge of Drakensberg basalt just north of and touching the Daarby fault (see Figure 4.15). The formation is comprised of successive lava flows, appearing as distinct beds of dark grey to black (ERM, 2012). Thin layers of sandstone similar to the Clarens Formation occur between the lava flows, especially near the base. The basalts are fractured and weathering is found between successive lava flows. The fractures and weathering present in the Letaba formation make it an aquifer that can produce relatively high groundwater yields in the order of 2 litres/s (ERM, 2012).

- The Clarens Formation is comprised of creamy white to yellowish to reddish brown, fine grained, well sorted sandstone with a high content of calcareous material (ERM, 2012). The average thickness of the formation is in the order of approximately 80 m and is overlain by the Drakensberg Basalt or the Letaba Formation (ERM, 2012).

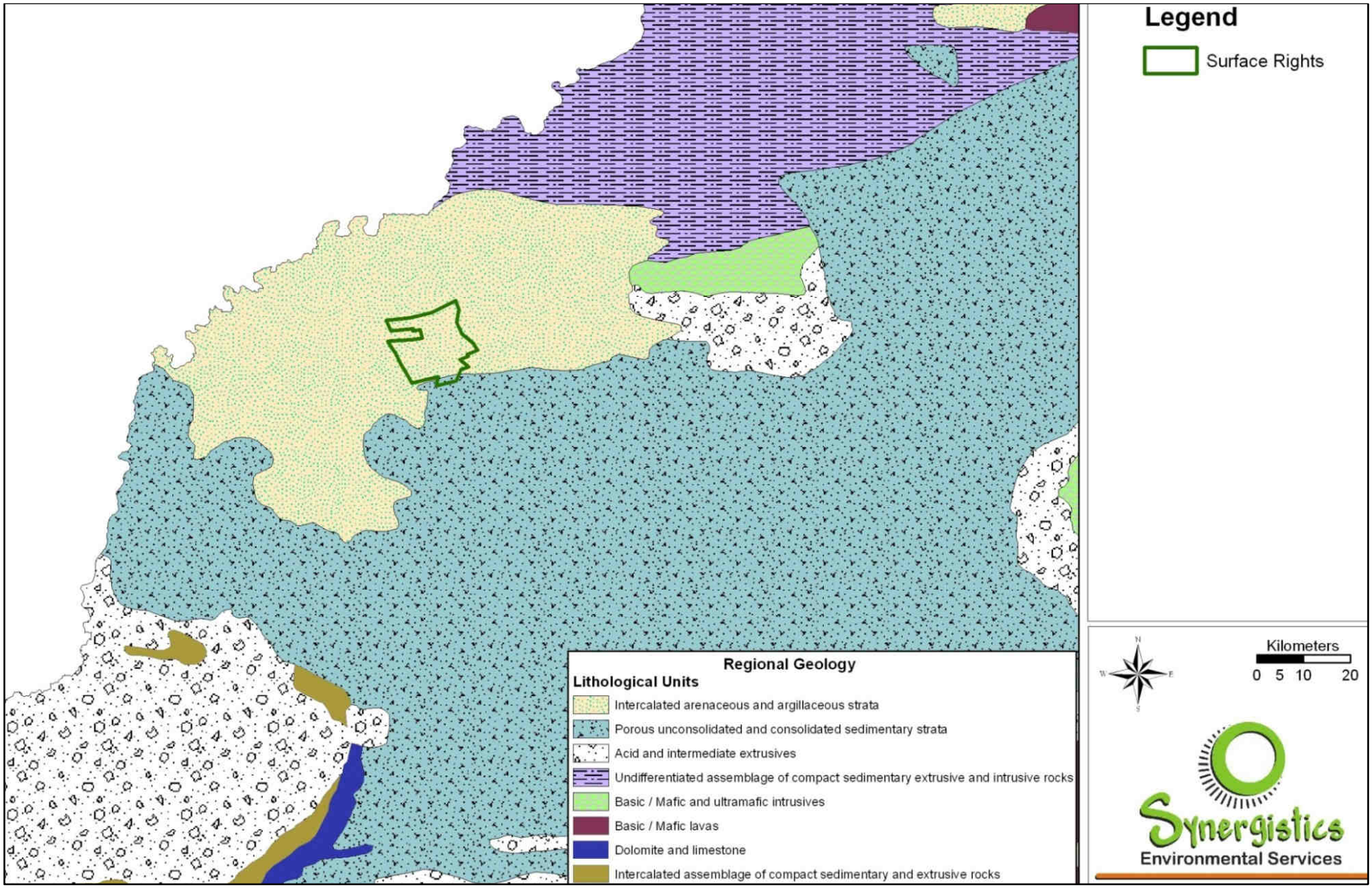


Figure 4.14: Geology in the study area (the green polygon is the Grootegeluk Mine area)

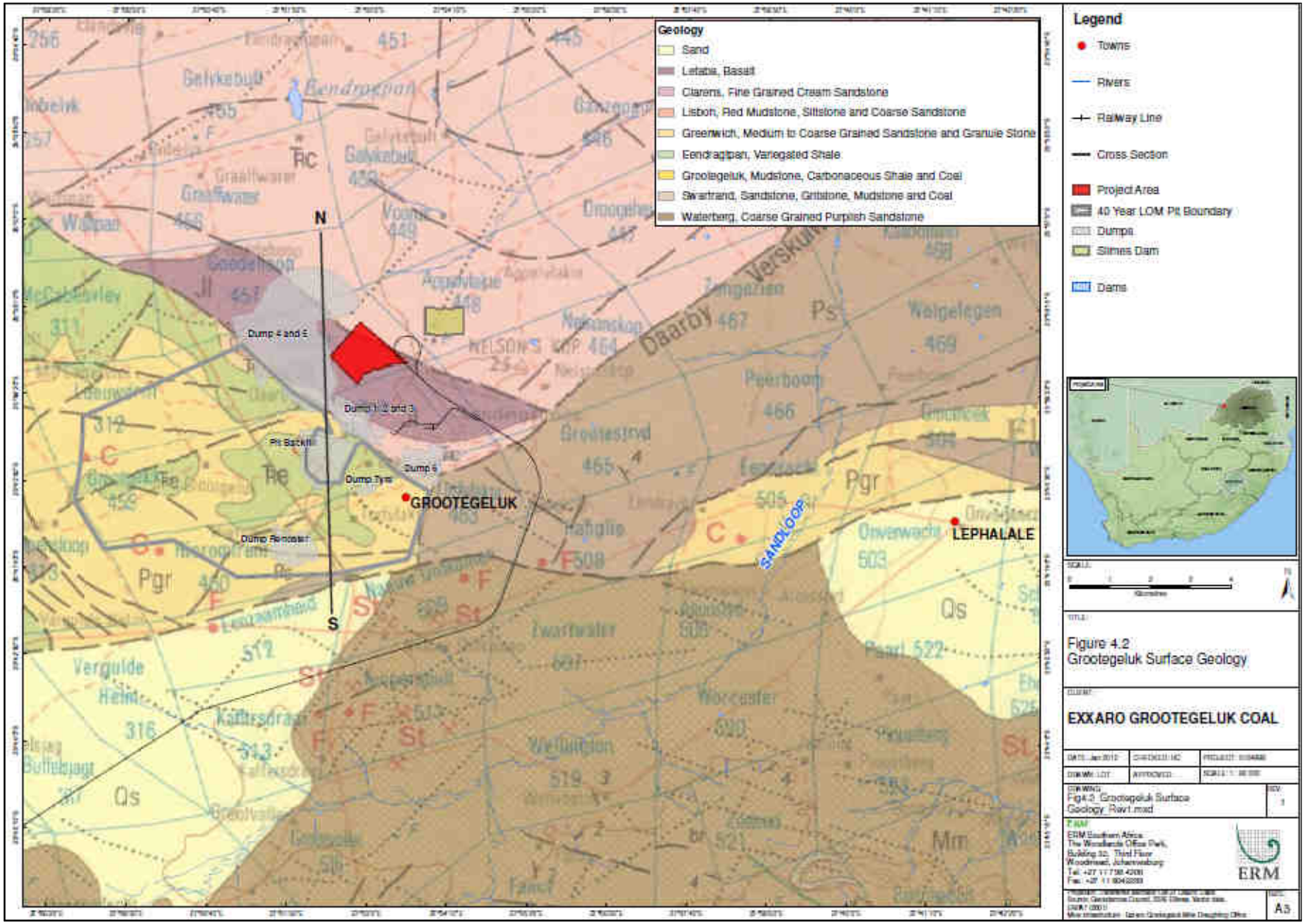


Figure 4.15: Surface geology of the greater Study Area (ERM, 2012)

4.1.5 Air Quality

The Waterberg District Municipality area has been declared as a Priority Area in Terms of Section 18(1) of NEMAQA (GN 495 of 15 June 2012). This declaration has been made because ambient air quality within the area may exceed the national ambient air quality standards in the near future. The minister has thus determined that the area requires specific national air quality management action to ensure that air pollution levels remain within the national ambient air quality standards. The implication of this is that the air quality officers for the area are required to prepare air quality management plans to manage air quality and address any issues. The air quality management plans will include:

- Emissions inventories for main air pollution sources and for each local municipality,
- Predicted air quality, and
- Emission reduction interventions.

The full Air Quality Impact Assessment Report with the detailed description of the existing air quality in the area is included in Appendix 3. Potential air pollution sources in the Waterberg District (from the EMF, 2011 and the AQMP, 2009) have been identified as:

- Power generation – Matimba Power Station is the main source of sulphur dioxide (SO_2) emissions in Lephalale. The new Medupi Power Station will also be a significant source of SO_2 emissions.
- Mining – mainly fugitive dust emissions from mining activities.
- Industrial emissions – mainly emissions from small boiler sources and brickworks in the District. These sources contribute to PM10 and SO_2 concentrations.

The Waterberg EMF (2011) adds that these developments have the potential to create a hazardous air pollution problem in the Lephalale area and thus it was agreed by the authorities that the National Standard should be maintained and considered the “cap” or “ceiling” for air quality. The National Air Quality Standards should not be surpassed. Once the air quality has reached National Standards, no further air polluting activity should be allowed, unless compensation, with pollution reduction in existing activities takes place. For these reasons an air quality study was done for the Market Coke and Co-generation Plant to quantify the emissions which will be produced and to determine their impact on air quality.

The Waterberg AQMP (2009) states that power generation was identified to be the main contributing source to PM_{10} emissions (68%) in the District, although this is likely to have been overestimated as many mines did not provide their emissions data, and therefore, were not possible to quantify. With the quantification of all mines in the District, mining sources are likely to be the main contributor to PM_{10} emissions in the District. The Waterberg AQMP also adds that power generation from the existing ESKOM Matimba power station is the main contributing source to SO_2 and NO_2 emissions in the District, contributing to 95% and 93% respectively.

Air quality management tools for the district are limited to the maintenance of a complaints response database in the Waterberg District as limited knowledge and software exists for dispersion modelling in the District (Waterberg AQMP, 2009). Ambient air quality monitoring is not undertaken by Government in the District, although Waterberg District has plans to install an air quality monitoring station in the near future (Waterberg AQMP, 2009).

4.1.5.1 Market Coke and Co-generation Plant Site

The air quality at the proposed Market Coke and Co-generation Plant site has been impacted by the previous mining and coal stockpiling activities. The top soil of the site is covered with a layer of coal of

varying depth (refer to Figure 4.16). The air quality of the Market Coke and Co-generation Plant site is therefore also impacted as a result of the coal dust emanating from the site. The site is located in close proximity to the Grootegeluk Mine coal discard dumps, gravel roads, rail loops, plant and coal stockpiling areas. Activities associated with these areas would also impact the air quality of the site in terms of dust, coal dust and vehicle emissions. Emissions from the spontaneous combustion of the coal discard dumps would also impact on the air quality of the area.

One of the major sources of baseline air pollution within the area of the proposed Market Coke and Co-generation Plant is from the adjacent, existing Char Manufacturing Plant. The existing plant produces emissions from the two excess gas flare stacks, two liquor destructor stacks and the boiler stacks (Figure 4.16). There is a vent pipe for each retort, but it is only used intermittently, e.g. during start-up or shut-down operations.

The emissions from the two existing flare stacks at the Char Manufacturing Plant (according to the *design criteria* of the plant) include:

- 66 kg/h CO_2
- 233 kg/h H_2O
- 60 kg/h SO_2
- 25 kg/h NO_x
- 16 kg/h NH_3
- 15 kg/h Hydrocarbons

The latest report from Airshed Planning Professionals, who have completed an Air Quality Assessment for the Char Plant Expansion, indicate significantly lower levels of emission concentrations from the flare stacks, based on the monitoring data (as undertaken by Gondwana Environmental Solutions):

- 7.1 kg/h CO
- 27 kg/h SO_2
- 1.3 kg/h NO_x
- Negligible PM_{10} is emitted by the flares

It is estimated (according to the design criteria of the plant) that the following amounts of gas are emitted to the atmosphere via the existing liquor destructors:

- 162 kg/h CO_2
- 312 kg/h H_2O
- 10 kg/h SO_2
- 15 kg/h SO_X (This may also represent H_2S)
- 44 kg/h NO_X
- 30 kg/h NH_3
- <15 kg/h H-H Hex
- 10 kg/h H-C
- 15 kg/h O_2

However, the Gondwana report indicated higher emissions for the liquor destructors with the following estimated release rates for the existing Char plant:

- 1738 kg/h CO
- 138 kg/h SO_2
- 28 kg/h NO_x
- 2 kg/h PM_{10}

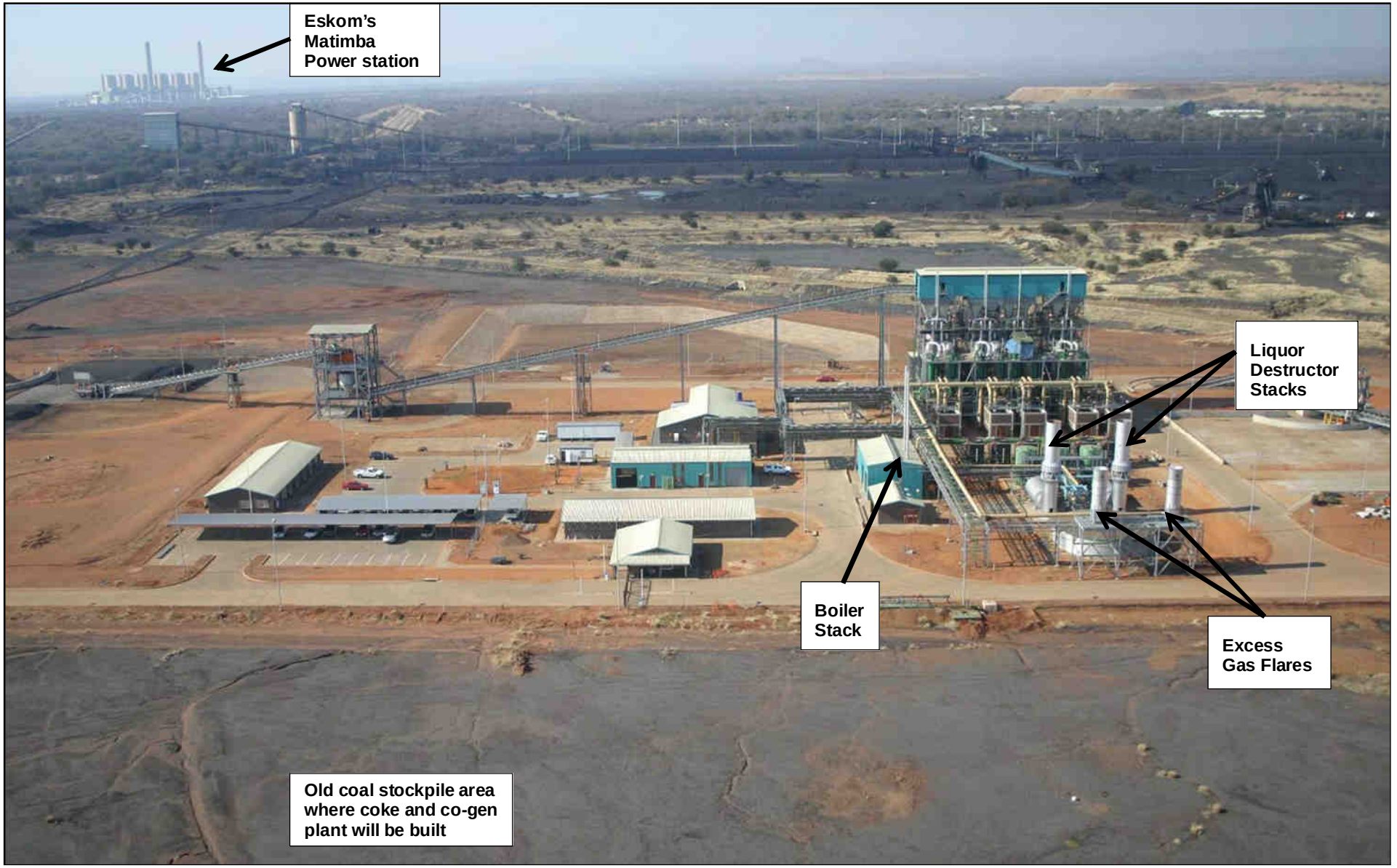


Figure 4.16: Location of Gas Emissions Stacks at the Existing Char Manufacturing Plant

4.1.5.2 Air Quality in the Surrounding Area

Other air quality impacts in the area arise from the Grootegeluk Mine and the Matimba (existing) and Medupi (under construction) Power Stations and their associated ash dumps. The main sensitive receptors identified are the Marapong, Onverwacht and Lephalale residential areas located approximately 6 km, 15 km and 20 km south east, respectively, of the proposed Market Coke and Co-generation Plant.

Grootegeluk Mine contributes to air pollution at the Market Coke and Co-generation Plant in terms of the following:

- Discard dumps - spontaneous combustion from burning dumps releasing SO_2 and fugitive dust emissions;
- Untarred roads - dust emissions from untarred roads;
- Slimes dam;
- Product Stockpiles – fugitive dust emissions; and
- Offloading activities – fugitive dust emissions.

Other sources of air pollution in the vicinity (other than the power stations mentioned above) are:

- The brickworks operating at the farm Hanglip (south east of the mine);
- Household fuel combustion from the residential areas;
- Infrequent veld fires;
- Sewage works on the farm Nelsonskop, east of the site;
- Vehicle exhausts from the nearby roads; and
- Windblown dust from agricultural activities and bare land.

4.1.5.3 Lephalale and Surrounding Areas Ambient Air Quality

The National Ambient Air Quality Standards (NAAQS) (GN 1210, 24 December 2009) sets limit values on the concentration (in µg/Nm^3) of a number of priority pollutants that are potentially harmful to human health and the environment (Table 4.3). Limit values are average values determined over certain time periods termed “averaging periods” and are fixed on the basis of scientific knowledge with an aim of reducing harmful effects on human health or the environment (or both) (NEMAQA, 2004). However, limit values are often exceeded due to the variability of pollutant concentrations encountered during monitoring. The NAAQS allows for these exceedances by incorporating “frequency of exceedance’ values (see Table 4.3) which allows for a certain number of exceedances as averaged over a calendar year. Therefore, if the number of exceedances are within the tolerances set by the NAAQS (e.g. < 88 exceedances in a year for CO), then there is still compliance with the NAAQS.

Table 4.3: National Ambient Air Quality Standards

Pollutant	Averaging Period	Limit Value (ug/m3)	Limit Value (ppb)	Frequency of Exceedance	Compliance Date
Benzene (C_6H_6)	1 year	10	3.2	0	Immediate – 31 Dec 2014
	1 year	5	1.6	0	1 Jan 2015
Carbon Monoxide (CO)	1 hour	30000	26000	88	Immediate
	8 hour(a)	10000	8700	11	Immediate
Lead (Pb)	1 year	0.5	-	0	Immediate
Nitrogen dioxide (NO_2)	1 hour	200	106	88	Immediate
	1 year	40	21	0	Immediate

Ozone (O_3)	8 hour(b)	120	61	11	Immediate
PM10	24 hour	120	-	4	Immediate – 31 Dec 2014
	24 hour	75	-	4	1 Jan 2015
	1 year	50	-	0	Immediate – 31 Dec 2014
	1 year	40	-	0	1 Jan 2015
Sulphur Dioxide (SO_2)	10 minutes	500	191	526	Immediate
	1 hour	350	134	88	Immediate
	24 hour	125	48	4	Immediate
	1 year	50	19	0	Immediate

Ambient air quality data for the period 2005 to 2007 was obtained from Eskom, who conducted ambient air quality monitoring from their ambient station located at Grootestryd for the period January 2005 to August 2006. The station was later relocated to Marapong in September 2006. The Grootestryd station is located approximately 2km south-west of the Matimba power station and the Marapong station approximately 2km to the north-west. The following air quality parameters were monitored between 2005 and 2007 (Airshed, 2012):

- Ozone (O_3);
- Sulphur dioxide (SO_2);
- Nitrous oxides (NO_x); and
- Particulates with a diameter less than 10 microns (PM_{10}).

Hourly SO_2 concentrations measured at the Grootestryd station for the period January 2005 to August 2006 showed exceedance of 350 µg/m³ (see Figure 4.17), but did not exceed the maximum allowable 88 exceedances of 350 µg/m³ per year (Airshed, 2012). Daily and annual averages complied with the corresponding standards. Similar SO_2 concentrations were measured at the Marapong station for the period September 2006 to December 2007, with fewer exceedances of the hourly standard (see Figure 4.18). It is therefore unlikely that the hourly SO_2 standard of 88 exceedances of 350 µg/m³ will be exceeded at the Market Coke and Co-generation Plant Site (Airshed, 2012).

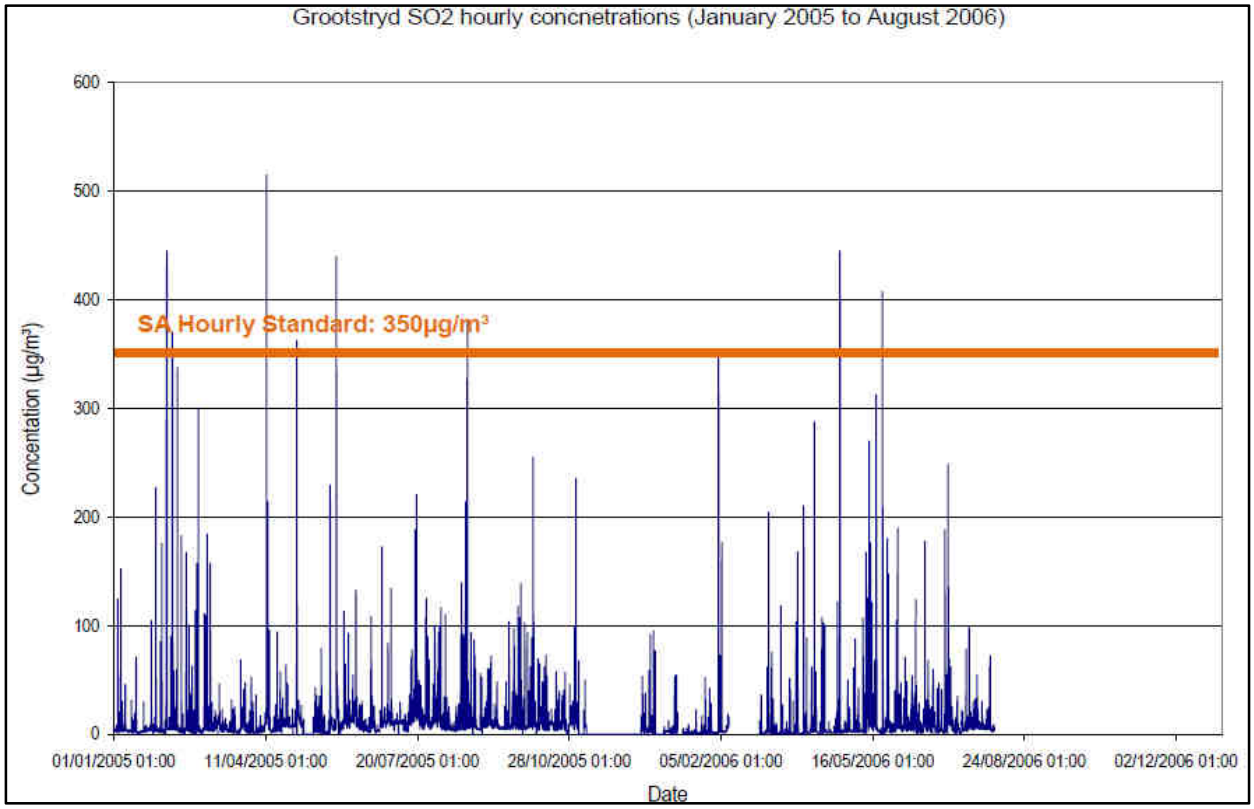


Figure 4.17: Grootestryd SO_2 hourly concentrations (µg/m³) for the period January 2005 to August 2006 (Airshed, 2012).

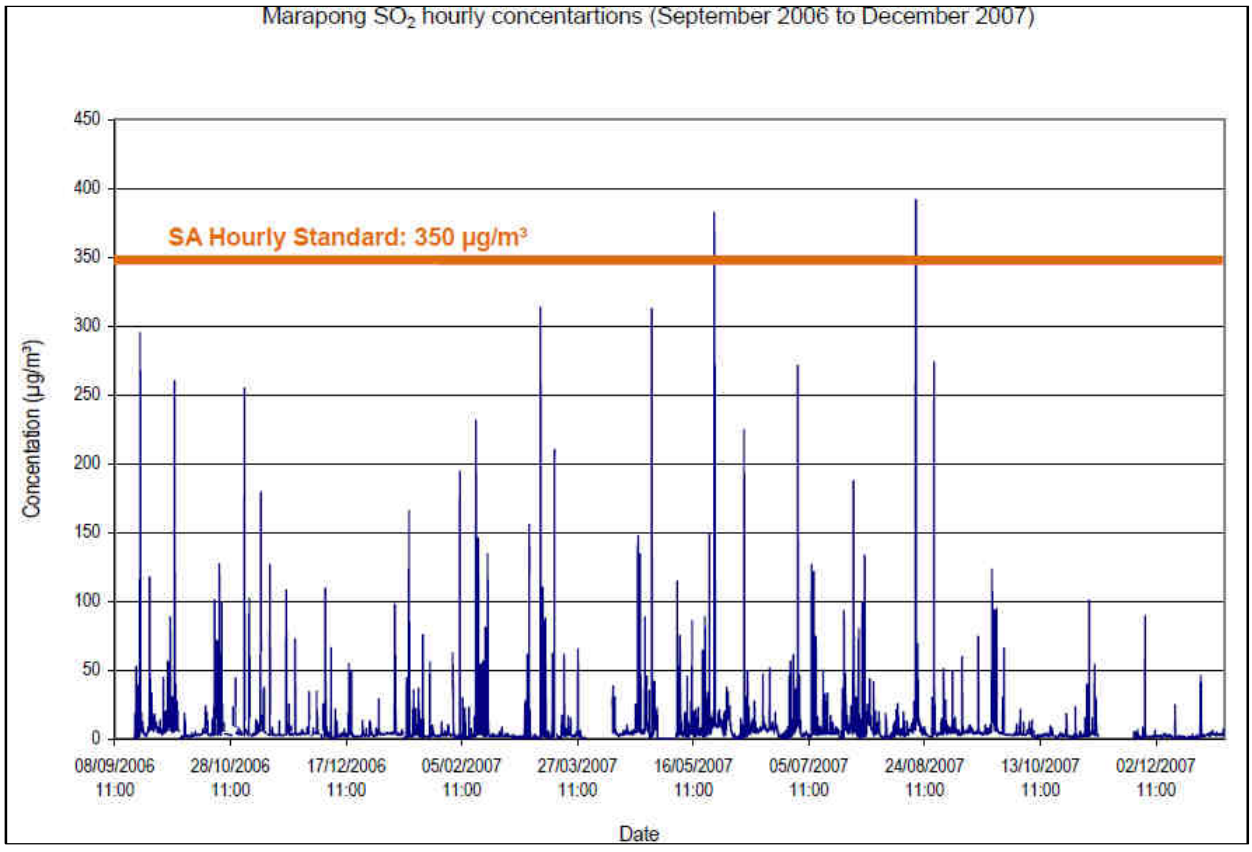


Figure 4.18: Marapong SO_2 hourly concentrations (µg/Nm³) for the period September 2006 to December 2007 (Airshed, 2012)

NO_x hourly concentrations as recorded at Marapong did not exceed the NAAQS standard of 88 hours of 200 µg/m³ per year (see Figure 4.19) (Airshed, 2012).

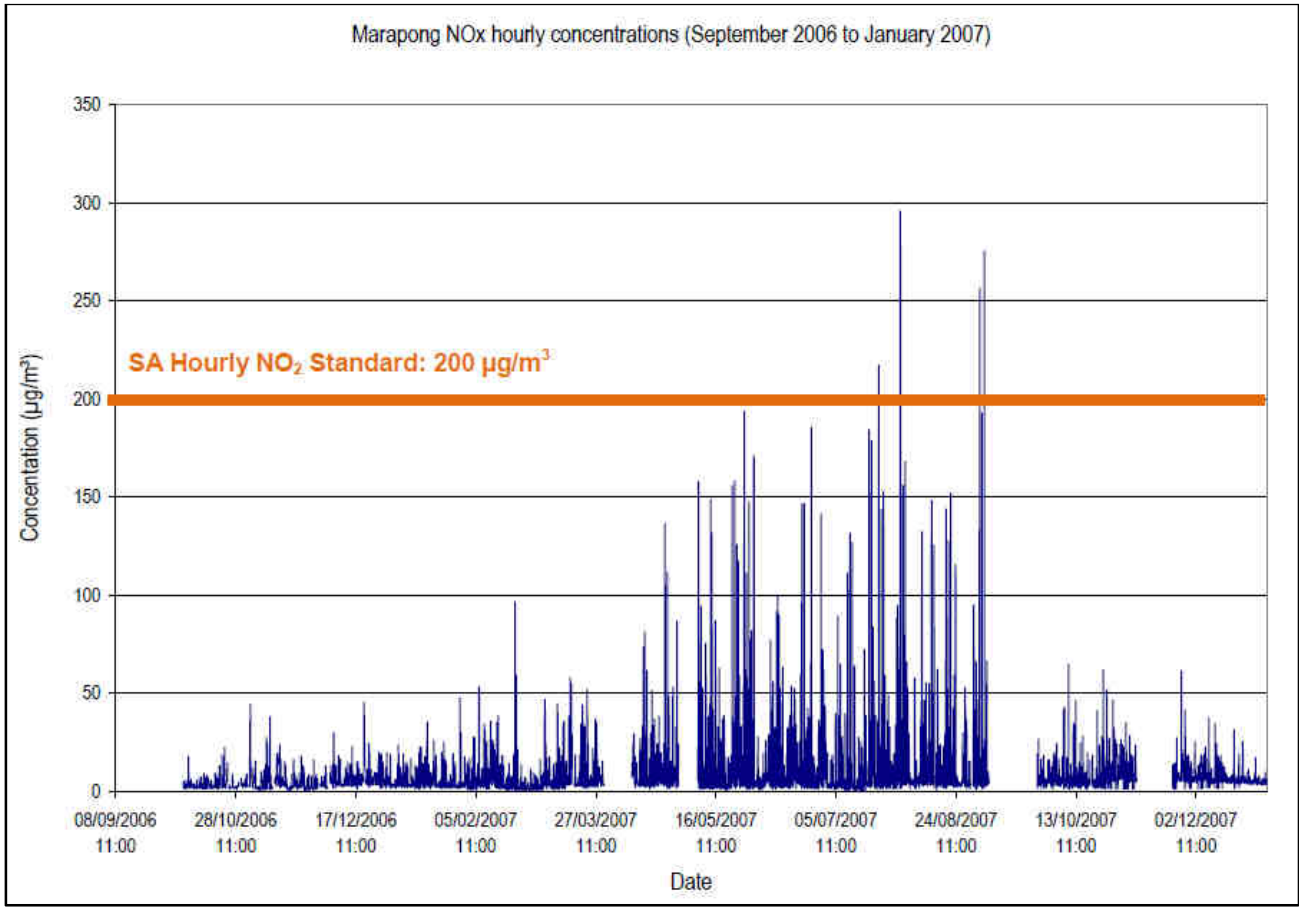


Figure 4.19: Marapong NO_x hourly concentrations (µg/m³) for the period September 2006 to December 2007 (Airshed, 2012)

Exceedances of the standards for daily PM_{10} ambient concentrations were recorded at both the Grootestryd station and Marapong station (see Figure 4.20 and Figure 4.21). The high PM_{10} levels experienced in the area are due to the many air pollution sources in the area, including the current Char Manufacturing Plant. The main sources include the Grootegeluk Mine and the Matimba (existing) and Medupi (under construction) Power Stations and their associated ash dumps (Airshed 2008). Other minor sources of PM_{10} pollution in the vicinity are (Airshed, 2008; Airshed, 2012):

- The brickworks operating at the farm Hangklip (south east of the mine);
- Household fuel combustion from the residential areas;
- Infrequent veld fires;
- Sewage works on the farm Nelsonskop, east of the site;
- Vehicle travel on unpaved roads,
- Vehicle exhausts from the nearby roads; and
- Windblown dust from agricultural activities and bare land.

The main sensitive receptors identified are the Marapong, Onverwacht and Lephalale residential areas located approximately 6 km, 15 km and 20 km south east, respectively, of the proposed Market Coke and Co-generation Plant. Other sensitive receptors include farm households that are scattered through the area (Refer to Figure 4.22).

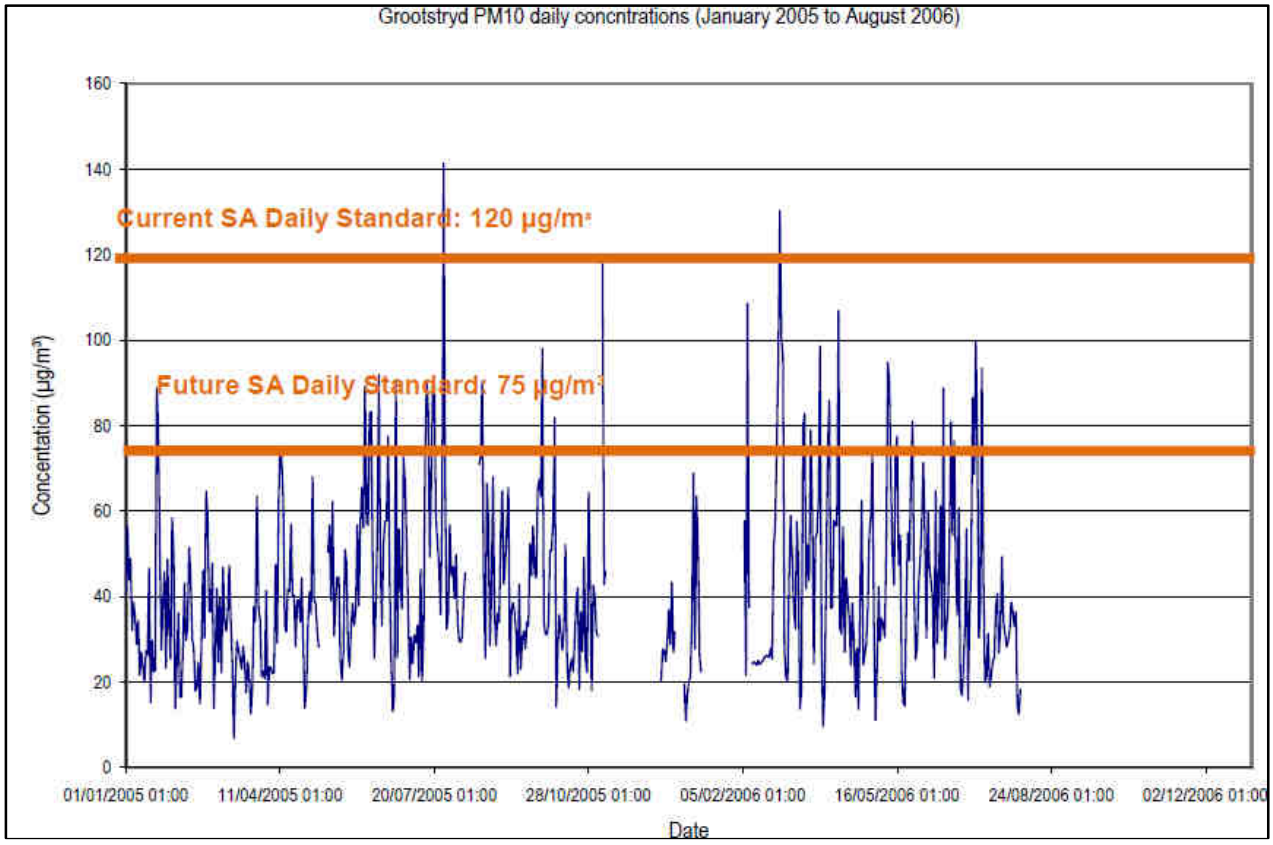


Figure 4.20: Grootestryd PM_{10} daily concentrations (µg/m³) for the period January 2005 to August 2006 (Airshed, 2012)

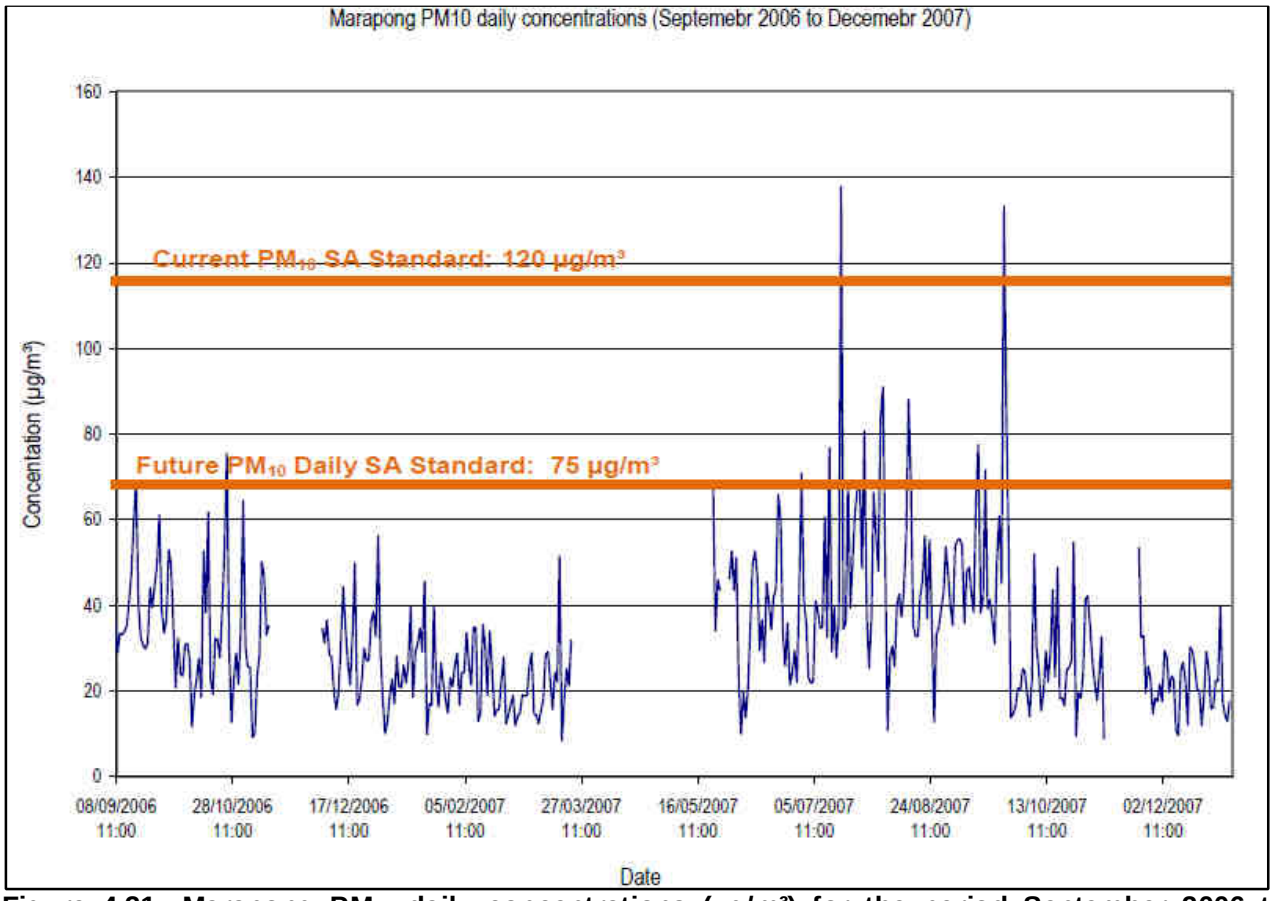


Figure 4.21: Marapong PM_{10} daily concentrations (µg/m³) for the period September 2006 to December 2007 (Airshed, 2012)

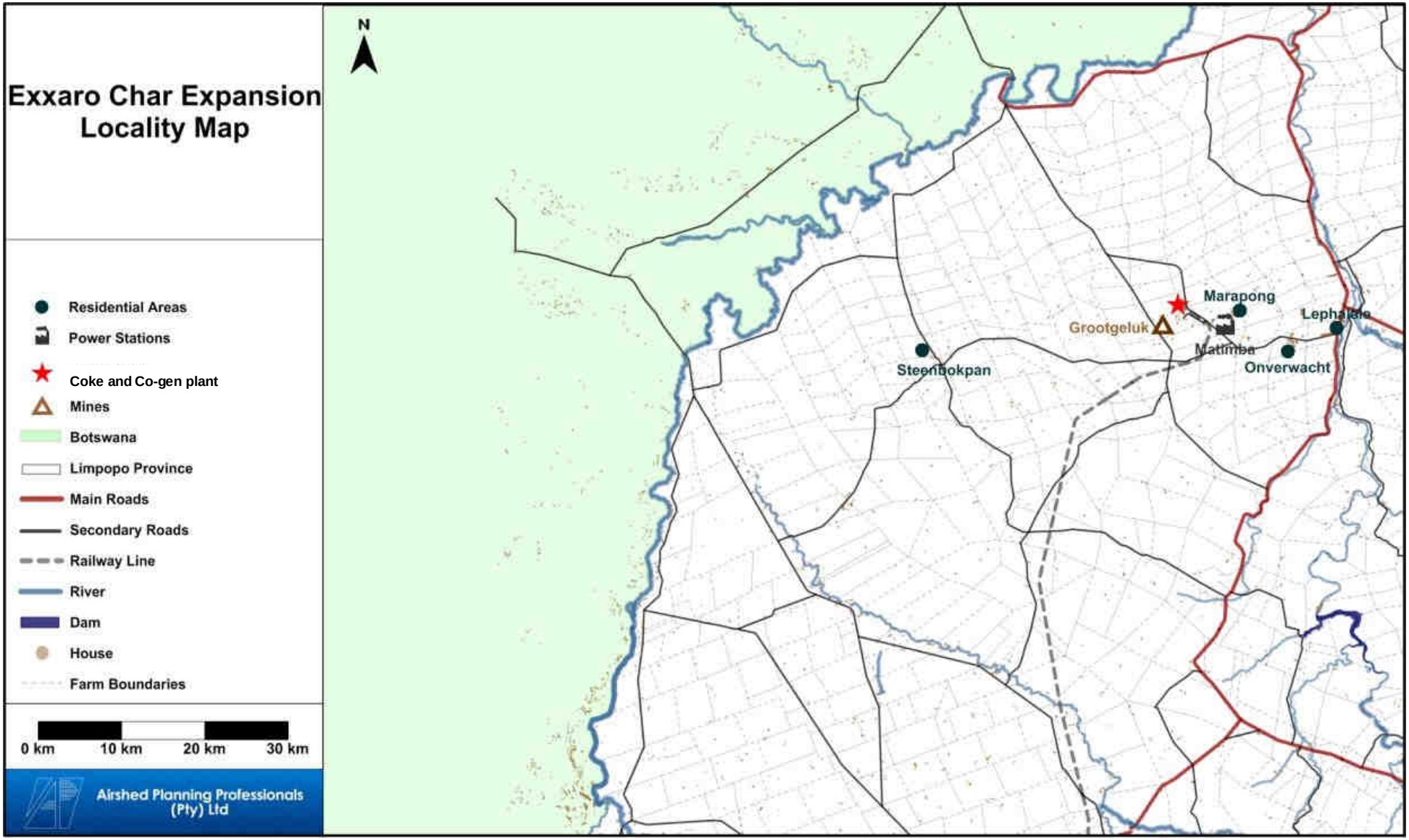


Figure 4.22: Locality Map showing the main sensitive receptors identified in terms of air quality at the Market Coke and Co-generation Plant (Airshed, 2012)

4.1.5.4 Current and Future Baseline Modelling

The current baseline was simulated for the determination of cumulative impacts with the proposed Market Coke and Co-generation Plant operations (Airshed, 2012). The model took into account emissions from the Matimba Power Station and the Grootegeluk mine and ambient data from the Grootestryd (relocated to Marapong in September 2006) monitoring station. For the future baseline (2013-2015), atmospheric dispersion modelling was undertaken which included the following significant sources (Airshed, 2012):

- expanded Grootegeluk operations required to accommodate the future Medupi station;
- existing Matimba Power Station;
- future Medupi Power Station and associated ash dumps;
- future vehicle tailpipe emissions due to additional power stations;
- future expanded char plant.

The baseline model indicates that SO_2 concentrations exceed the hourly and daily NAAQS limit value of 350 µg/m^3 and 125 µg/m^3 respectively (Figure 4.23). However, the number of hourly exceedances annually is below the NAAQS tolerance value of 88, which indicates that ambient SO_2 levels are in compliance.

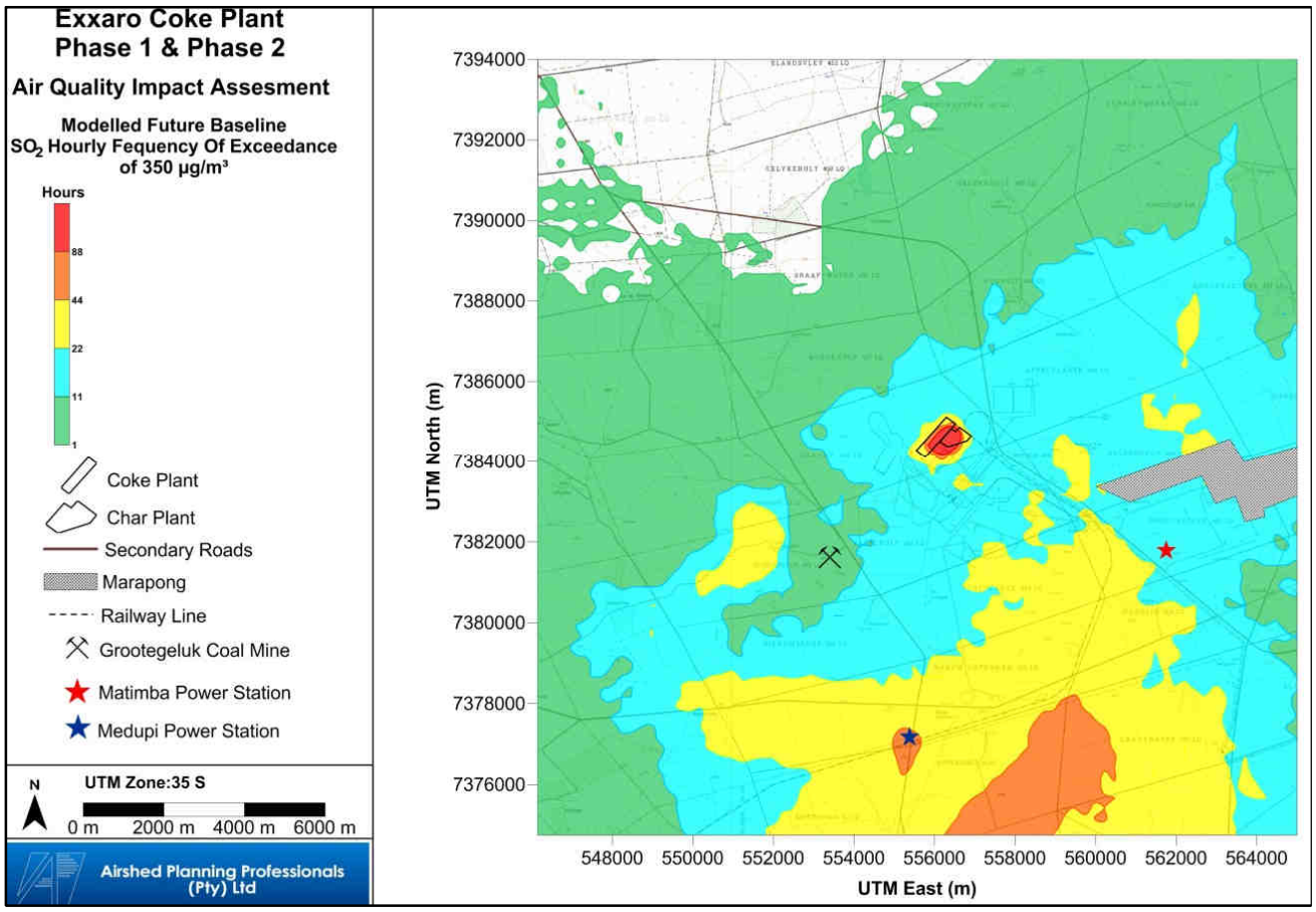


Figure 4.23: Predicted future baseline hourly exceedances of SO_2 concentration (350 µg/m^3) (Airshed, 2012)

Future baseline predictions for SO_2 concentrations are similar to the current predicted baseline, exceeding the hourly NAAQS of 350 µg/m^3 at identified sensitive receptors Onverwacht, Marapong and Grootestryd (Table 4.4). However, the highest number of hourly exceedances predicted (22 at Grootestryd) does not exceed the SA Standard of 88 per year.

Table 4.4: Predicted SO_2 future baseline concentrations due to all sources within the region (exceedances of air quality limits are highlighted) (Airshed, 2012)

Receptor	Highest hourly average (µg/m3)	Number of hourly exceedances per year	Highest daily average (µg/m3)	Number of daily exceedances per year
Onverwacht	**463**	8	63	none
Marapong	**835**	22	**130**	none
Lephalale	322	none	52	none
Grootestryd	**891**	28	109	none
NAAQS hourly concentration limit value: 350 µg/³m with 88 allowable exceedances per year NAAQS daily concentration limit value: 125 µg/³m with 4 allowable exceedances per year				

Predicted future baseline cumulative NO_x concentrations are low and do not exceed the NAAQS of 200 µg/m^3 more than 88 hours per year (Airshed, 2012). Future baseline concentrations are also all below NAAQS limit values (Table 4.5).

Table 4.5: Predicted NO_2 future baseline concentrations due to all sources within the region (Airshed, 2011)

Receptor	Highest hourly average (µg/m^3) (a)	Number of hourly exceedances per year
Onverwacht	105	none
Marapong	119	none
Lephalale	61	none
Grootestryd	119	none
75% of total NOx modelled were taken to convert to NO_2 NAAQS hourly concentration limit value: 200 µg/³m with 88 allowable exceedances per year		

Due to the proximity of operations at the Grootegeluk mine, as well as other sources as discussed in the previous section, predicted current and future baseline particulate (PM_{10}) concentrations are very high and do not comply with NAAQS in some areas (Airshed, 2012). Figure 4.24 summarises the future baseline prediction results based on average and maximum hourly concentrations of PM_{10}. Predicted current baseline PM_{10} concentrations exceed the daily and annual average values of 75 µg/m^3 and 40 µg/m^3 respectively, mostly to the east of the Market Coke and Co-generation Plant site. Predicted future baseline concentrations (Table 4.6) are not in compliance with NAAQS at Grootestryd, where daily average exceedances are predicted to be in excess of the tolerance value of 4 per year.

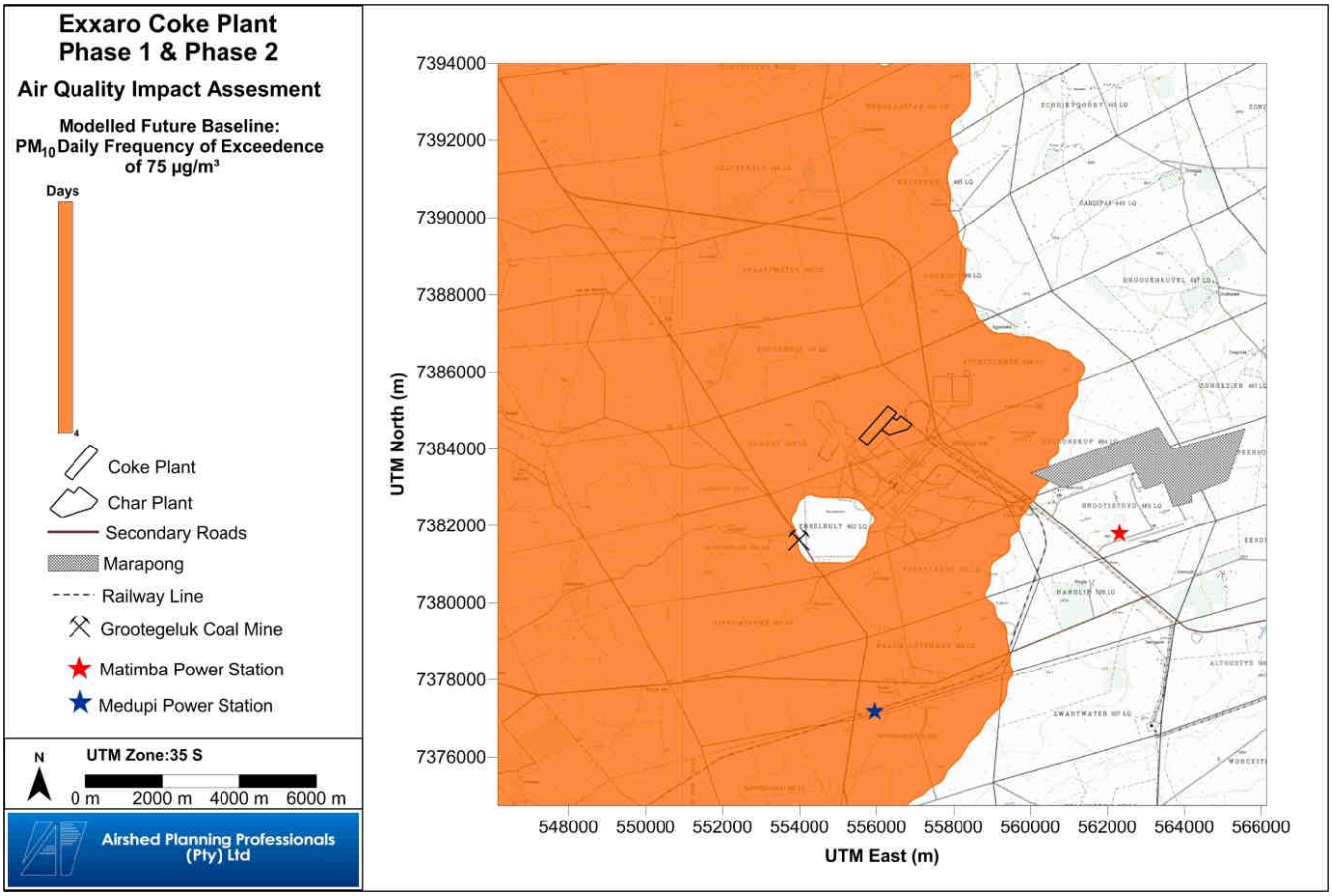


Figure 4.24: Predicted highest daily baseline PM_{10} concentrations (Airshed, 2012)

Table 4.6: Predicted PM_{10} future baseline concentrations due to all sources within the region (exceedances of air quality limits are highlighted) (Airshed, 2012)

Receptor	Highest daily average (µg/m³)	Number of daily exceedances per year
Onverwacht	6	none
Marapong	**77**	3
Lephalale	16	none
Grootestryd	**105**	**7**
(a) NAAQS daily concentration limit value: 75 µg/³m was utilised (immediate compliance) with 4 allowable exceedances per year		

4.1.6 Surface Water

4.1.6.1 Surface Water Features

The overall pattern of surface water drainage in the area is north east towards the Mokolo River, which then drains northwards to the Limpopo River. The site drains via a tributary of the Sandloop, which runs in an easterly direction, discharging into the Mokolo River approximately 20 km east of the site (Jones & Wagener, 2012b) (refer to Figure 4.25).

The site is located in quaternary catchment A42J and the Sandloop and Mokolo Rivers which fall within this catchment are considered to be critically endangered river ecosystems (refer to Figure 4.26). The Mokolo River is approximately 810 m above sea level, while the mine is approximately 900 m above mean sea level. This results in an almost negligible gradient of 90:21000 m or 0.0043% (Bohlweki Environmental, 2006) and thus there is no fast flowing water and drainage from the area is slow.

Surface water is found only after a rainfall event, and due to the relatively flat topography and sandy soil cover, most of the rainwater seeps into the groundwater aquifer. Small shallow pans or depressions occur in the veld where runoff may temporarily collect. There are no wetlands or dams located near the site. The nearest large dam is the Mokolo Dam located 41 km to the south east of the site.

The receiving water body, that is the point below which the project's impact on the catchment is considered to be negligible, is the Mokolo River at the confluence with the Sandloop tributary which drains the site (Jones & Wagener, 2012). The receiving water body is an important concept as it implies that aspects related to surface water, e.g. surface water users, need only be defined down to that point. The use of the aforementioned location as the receiving water body is motivated on the following basis (Jones & Wagener, 2012):

- By the time the water reaches the Mokolo River, it is required to be suitable for use for all of the expected uses (drinking water, agricultural, industrial and aquatic ecosystems). Thus, by achieving compliance in terms of these, no additional impacts are expected downstream of the Mokolo River.
- Beyond the confluence with the Mokolo River, the potential impact of the plant becomes small due to the water volumes in the catchment and the dilution effects.
- The total site which includes the Char Plant Expansion, Market Coke and Co-generation Plant covers an area of of approximately 0.555km² compared to a catchment of just under 8400 km² for the Mokolo River (the site covers only 0.001% of the Mokolo catchment) (Jones and Wagener, 2012b). The Net MAR for this drainage region is 4.2 x 10^6 m³ (*WR90*).

The Market Coke and Co-generation Plant will be located within the greater Grootegeluk Colliery dirty water area. The water quality of runoff and effluent water from the Market Coke and Co-generation Plant differs from that of the dirty water on the surrounding mine, where it is potentially contaminated with organic hydrocarbons. These contaminants cannot be accommodated in the mine's dirty (process) water system and must therefore be contained on site. All runoff from the Market Coke and Co-generation Plant terrace will therefore be directed via a piped storm water system, through a silt trap to the existing Char Plant PCD and the expansion to the PCD. The water will then be pumped to the Market Coke and Co-generation Plant for use in the process. Since the existing Char Plant PCD will not have sufficient storage capacity to accommodate the runoff expected during extreme rainfall events, an additional PCD will be constructed adjacent to the existing dam to provide the required dirty water storage capacity. Any spillage of contaminated water from the site is collected in Grootegeluk Colliery's Bosbok Dam and a PCD (Jones & Wagener, 2012a and b).

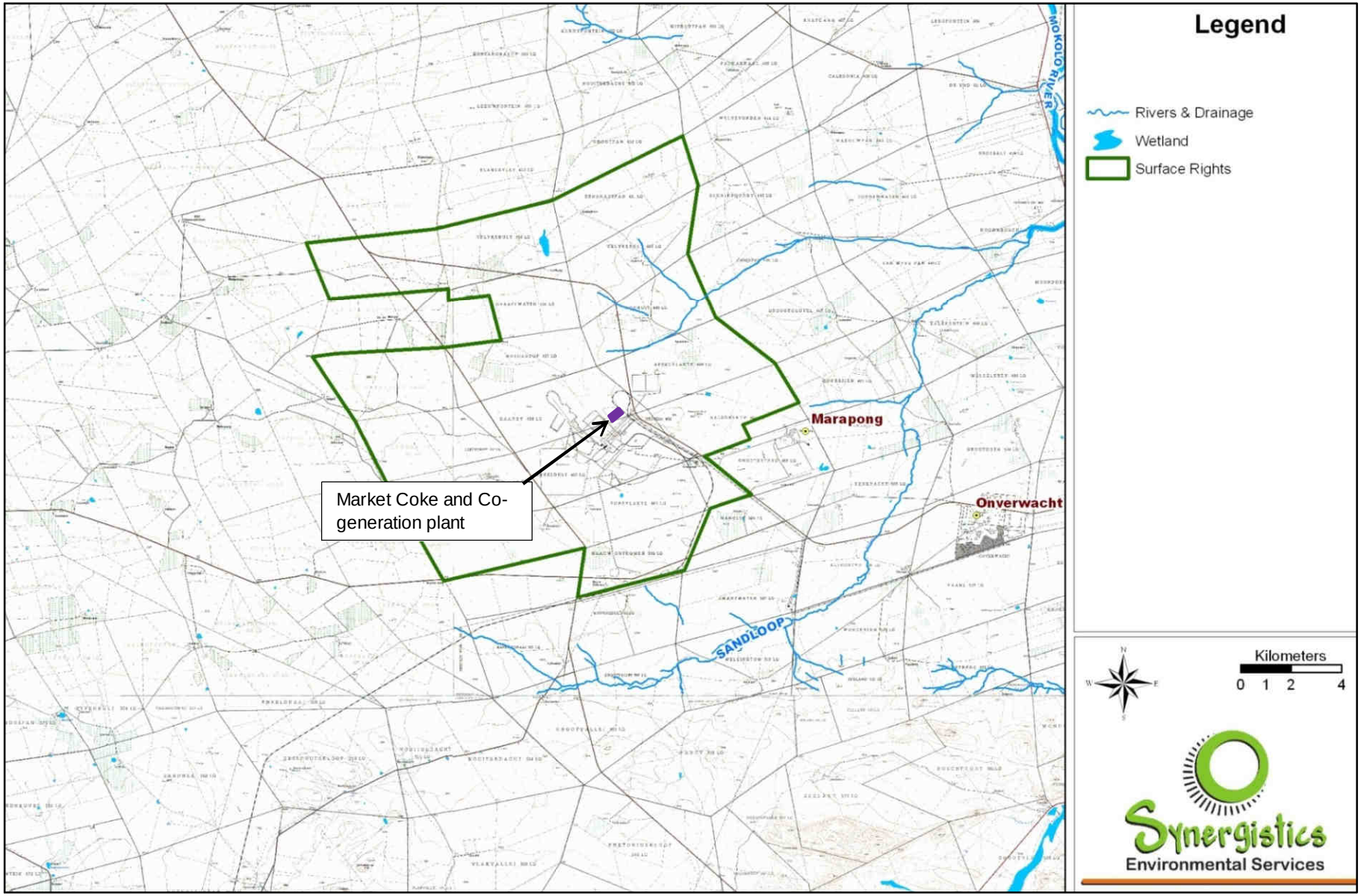


Figure 4.25: Surface Water Features in the Study Area

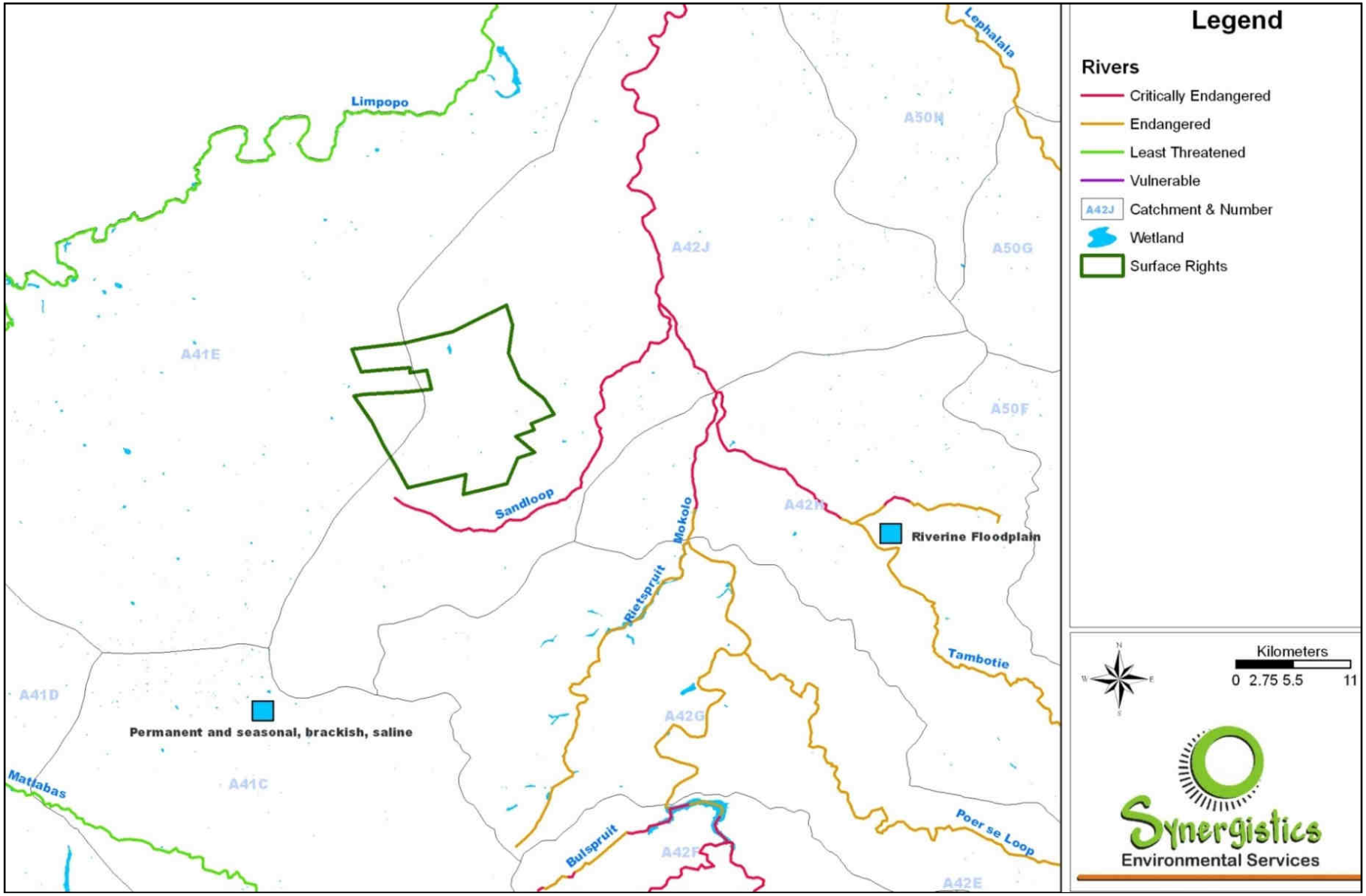


Figure 4.26: Quaternary Catchments and Conservation Status of River Ecosystems

4.1.6.2 Surface water quality

No natural drainage channels occur within the mine area. Due to the flat topography, highly permeable sands and the absence of any nearby surface water drainage courses, the mine has no direct impact on the surface water quality in the rivers.

The Market Coke and Co-generation Plant site, still has areas that are covered by a layer of coal of varying depth. Surface water runoff on the site is polluted due to the presence of this coal.

Sampling was carried out by Gondwana Environmental Solutions on 11 October 2010 and 16 March 2011, with analysis carried out for selected inorganics and total hydrocarbons. A single water quality sampling run was also undertaken on 14 October 2011, when grab samples were taken from the existing Char Plant Pollution Control Dam (PCD) and Bosbok Dam (Figure 4.27). These were analysed for both inorganics and hydrocarbons.

Figure 4.27: Water Quality Monitoring Sample Locations.

The results of the water quality monitoring conducted by Gondwana Environmental Solutions are detailed in Table 4.7 below.

Table 4.7: Surface water quality for the Grootegeluk Market Coke and Co-generation Plant area, sampled by Gondwana

Parameter	SANS 241:2006			Char Plant area			
	Class I	Class II		11 October 2010		16 March 2011	
Sample location				Bosbok Dam	PCD	Bosbok Dam	PCD
pH	5.0-9.5	4.0-10.0	>10.0	6.56	6.59	7.22	7.17
Conductivity (mS/m)	<150	150-370	>370	207.1	206	260.7	261.4
Total Dissolved Solids	<1000	1000-2400	>2400	1652	2190	2553	2224
Chloride	<200	200-600	>600	22.6	26.2	49.1	47.3

Parameter	SANS 241:2006			Char Plant area			
	Class I	Class II		11 October 2010		16 March 2011	
Nitrate	<10	Oct-20	>20	5.66	5.86	5.49	3.36
Sulphate	<400	400-600	>600	1115	1112	1904	1956
Al	<300	300-500	>500	<0.031	<0.031	<0.031	<0.031
Mg	<70	70-100	>100	106.69	110.04	68.62	66.09

Key: Unless otherwise indicated, all values are in mg/l
Class I (Clear); Class II (Yellow); Exceeding Class II (Red)
Class I and Class II are as defined in SANS 241:2006 – Drinking Water.

Levels of sulphate and magnesium were significantly above the upper limit prescribed for drinking water in SANS 241:2006 and thus posed a health risk. Levels of conductivity and total dissolved solids were elevated and classified as Class II according to SANS 241:2006.

Hydrocarbons were also tested and were all less than 1 µg/ℓ, with the exception of the concentration of toluene at the PCD, which was measured at 134 ppb. No petroleum hydrocarbons were detected within the Bosbok Dam, indicating that there is no overflow from Char Plant PCD into this dam. In addition, a low concentration of dichloromethane was detected within the Char Plant PCD sample.

The grab samples taken by Jones and Wagener on the 14th October 2011 were sent to Analytico in the Netherlands for analysis. The complete list, including the detection limits and the results of the analysis, including screening guidelines are included in Appendix 4 and summarised in Table 4.8 and Table 4.9.

Table 4.8: Inorganics: Surface water quality for the Grootegeluk Reductant Manufacturing Complex, sampled by Jones & Wagener

Parameter	SANS 241:2006			Char Plant PCD	Bosbok Dam
	Class I	Class II			
Sample Code					
pH	5.0-9.5	4.0-10.0	>10.0	8.7	8.1
Conductivity (mS/m)	<150	150-370	>370	350	290
As	0.010	0.050	>0.050	0.0038	
Ba	NG	NG		120	26
Co	0.50	1.0	>1.0	0.0026	0.0028
Mo			0.300	0.012	0.0042
Ni	0.15	0.35	>0.35	0.0079	0.0072
Se	0.020	0.050	>0.050	0.0092	0.012
V	0.20	0.50	>0.50	0.0021	

Key: Unless otherwise indicated, all values are in mg/l
Class I (Clear); Class II (Yellow); Exceeding Class II (Red)
Class I and Class II are as defined in SANS 241:2006 – Drinking Water.

Table 4.9: Organics: Surface water quality for the Grootegeluk Reductant Manufacturing Complex, sampled by Jones & Wagener

Parameter	Screening Guideline	Char Plant PCD
Volatile Chlorinated Hydrocarbons		
Dichloromethane	1000	0.8
Total Petroleum Hydrocarbons		
TPH C10-C12	15	13

Parameter	Screening Guideline	Char Plant PCD
TPH C12-C16	15	**57**
TPH C16-C21	15	**54**
TPH C21-C30	15	**38**
TPH (sum C10-C40)	**600**	180

Key: Unless otherwise indicated, all values are in µg/l
Screening Guidelines are according to the Dutch Intervention Limits.

Organic Constituents

An initial assessment of potential risk is often required for contaminated site investigations, irrespective of whether exposure could occur or not. As South Africa does not have health risk based screening guidelines for organic constituents, the Dutch Intervention Limits were used for screening purposes (Jones and Wagener, 2012b).

The screening guidelines have been included with the data in Appendix 4, as well as in Table 4.9. The Total Petroleum Hydrocarbons were detected within the Char Plant PCD, although at a concentration below the screening guideline of 600 µg/ml (TPH Sum). There were No Petroleum Hydrocarbons detected within the Bosbok Dam, which indicates that there is no overflow from Char Plant PCD reporting to this dam. There was a low concentration of dichloromethane detected within the Char Plant PCD sample. However, the concentration is well below the screening guideline (Jones and Wagener, 2012b).

4.1.6.3 Surface water quantity

As illustrated in the figure below, the Mean Annual Runoff (MAR) in the study area is approximately 4.1 mm per year (AGIS, 2004) (refer to Figure 4.28). The expected MAR for the site, the Sandloop tributary into which water from the study site drains, and the Mokolo River is presented in Table 4.10.

Table 4.10: MAR for catchments relevant to the Grootegeluk Market Coke and Co-generation Plant (Jones & Wagener, 2012)

Description	Catchment area (km^2)	MAR ($m^3 \times 10^6$)	% of MAR at receiving water body
Char, Coke and Co-generation Plants Catchment	0.555	0.004	0.001
Sandloop tributary at confluence with Mokolo River	70.78	0.52	0.17
Mokolo River at Limpopo River	8 395	312.3	100

Because of the dry climate, the dry weather flow (flow that is equalled or exceeded 70% of the time) is expected to be zero.

4.1.7 Flood peaks and volumes

The site is not located on or in close proximity to a watercourse. It is, however, located in the upper catchment of the Sandloop tributary and there is a small catchment that drains towards the plant and needs to be diverted around. The peak flow was calculated at the point just below the PCD. The catchment characteristics were determined from a contour plan provided by the client, and are detailed in Table 4.11.

Table 4.11: Catchment characteristics

Parameter	Value
Catchment area (km^2)	0.593
Length of longest watercourse (km)	1.478
Slope of watercourse	<0.7%
Average catchment slope	≈1.4
Time of concentration (minutes)	35.5

There are a multitude of methods for the determination of peak flows, with the applicability of each method depending largely on catchment area, but also the region in which the peak flow is being determined. On catchments as small as this, the Rational Method is most applicable, and was employed in this case. The peak flows determined by the Rational Method are presented in Table 4.12.

Peak flows were calculated based on the parameters of the upper catchment of the Sandloop tributary where the Market Coke and Co-generation Plant is located. The catchment is small, with an area of 0.555 km^2 (Jones & Wagener, 2012). Table 4.12 presents the calculated peak flows for the catchment.

Table 4.12: Peak flows determined for the catchment draining past the Market Coke and Co-generation Plant

Recurrence Interval	Peak flow (m^3/s)
1:2 year	1.7
1:5 year	2.5
1:10 year	3.4
1:20 year	4.4
1:50 year	6.0
1:100 year	7.8

Flood lines

There are no watercourses on or in close proximity to the Site; therefore no flood lines have been determined for the Market Coke and Co-generation Plant project.

Watercourse alterations

There will be no watercourse alterations since there are no rivers or watercourses flow through the Site.

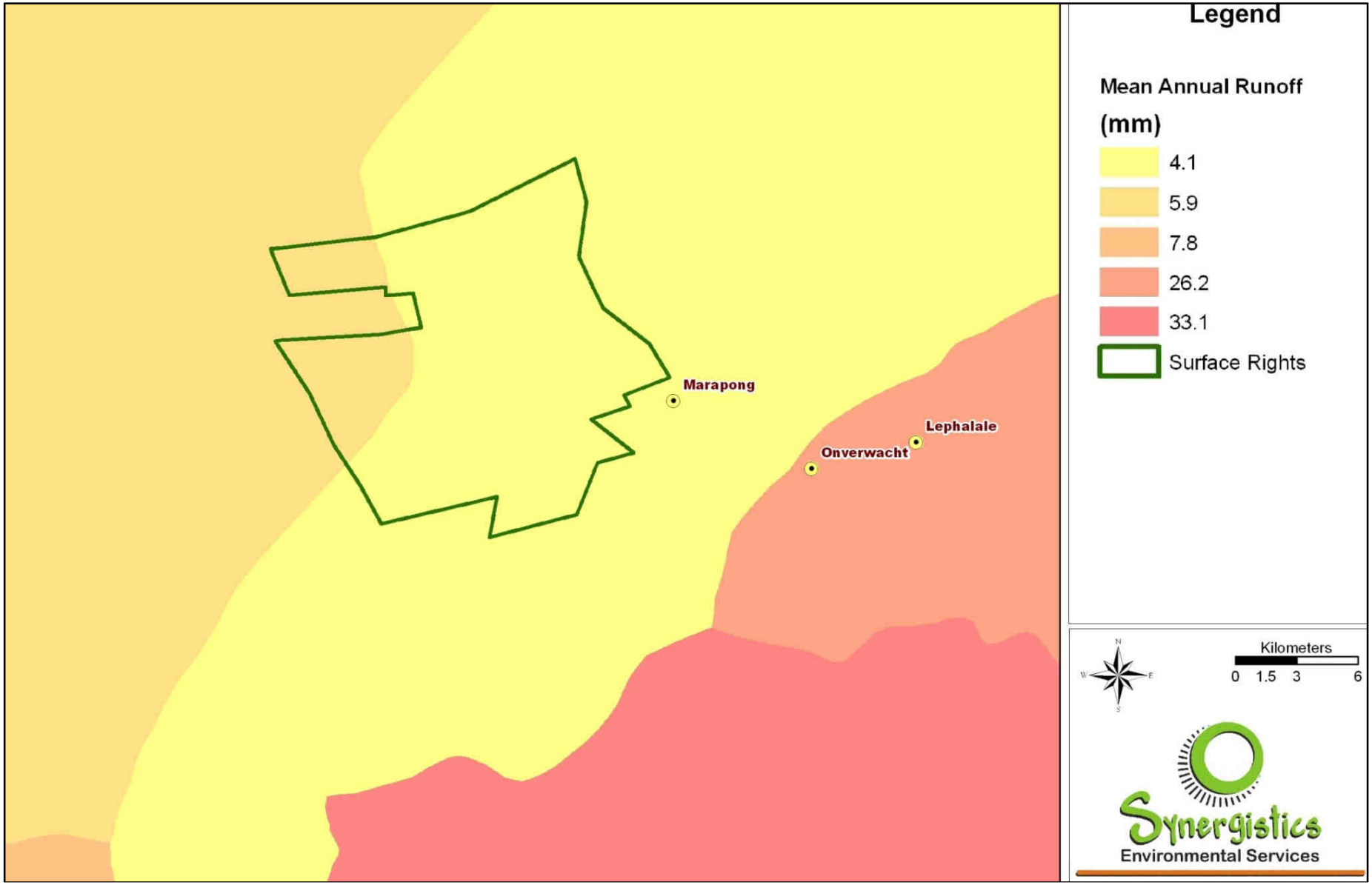


Figure 4.28: Mean Annual Runoff in the Study Area (AGIS Database, 2004)

4.1.7.1 Surface water use

The majority of the area surrounding Grootegeluk Mine is utilised for cattle and game farming. No crop cultivation (either dryland or irrigation) occurs due to the sandy soils and relatively low rainfall. The surrounding landowners are heavily reliant on groundwater (boreholes) since surface water is only available for a short period after rainfall events. Some of the surrounding landowners are supplied with water piped from the Mokolo Dam. It is expected that there will be little or no regular use of surface water in this catchment, with groundwater being the most common source for water in the area.

4.1.7.2 Water authority

The water authority responsible for the study area is the Department of Water Affairs, Limpopo Regional Office.

4.1.8 Groundwater

4.1.8.1 Groundwater features

Groundwater potential in the area is generally limited due to low permeability, storage and transmissivity. Boreholes tend to have low sustainable yields and borehole depths are variable, with levels that do not necessarily mimic the flat topography as a result of different piezometeric pressures, confined aquifers, artificial recharge and geological structures (Bohlweki, 2006).

The geological faults, including Daarby and Eenzaamheid, act as barriers for groundwater flow and divide the groundwater resource into separate compartments. Groundwater levels on either side of the Daarby fault differ markedly and groundwater contamination is also retarded from moving through the fault. Indications are that the faults act as preferential flow paths for groundwater within the compartments and thus also for potential contaminants.

Several boreholes have been drilled at Grootegeluk Mine. Some of these are equipped with pumps for extraction of groundwater to lower the elevated water table found to the north of the Daarby fault. This has been done to protect infrastructure, to prevent the spreading of the pollution plume, to optimise re-use of affected water and thus to reduce the volume of intake water from the Mokolo Dam.

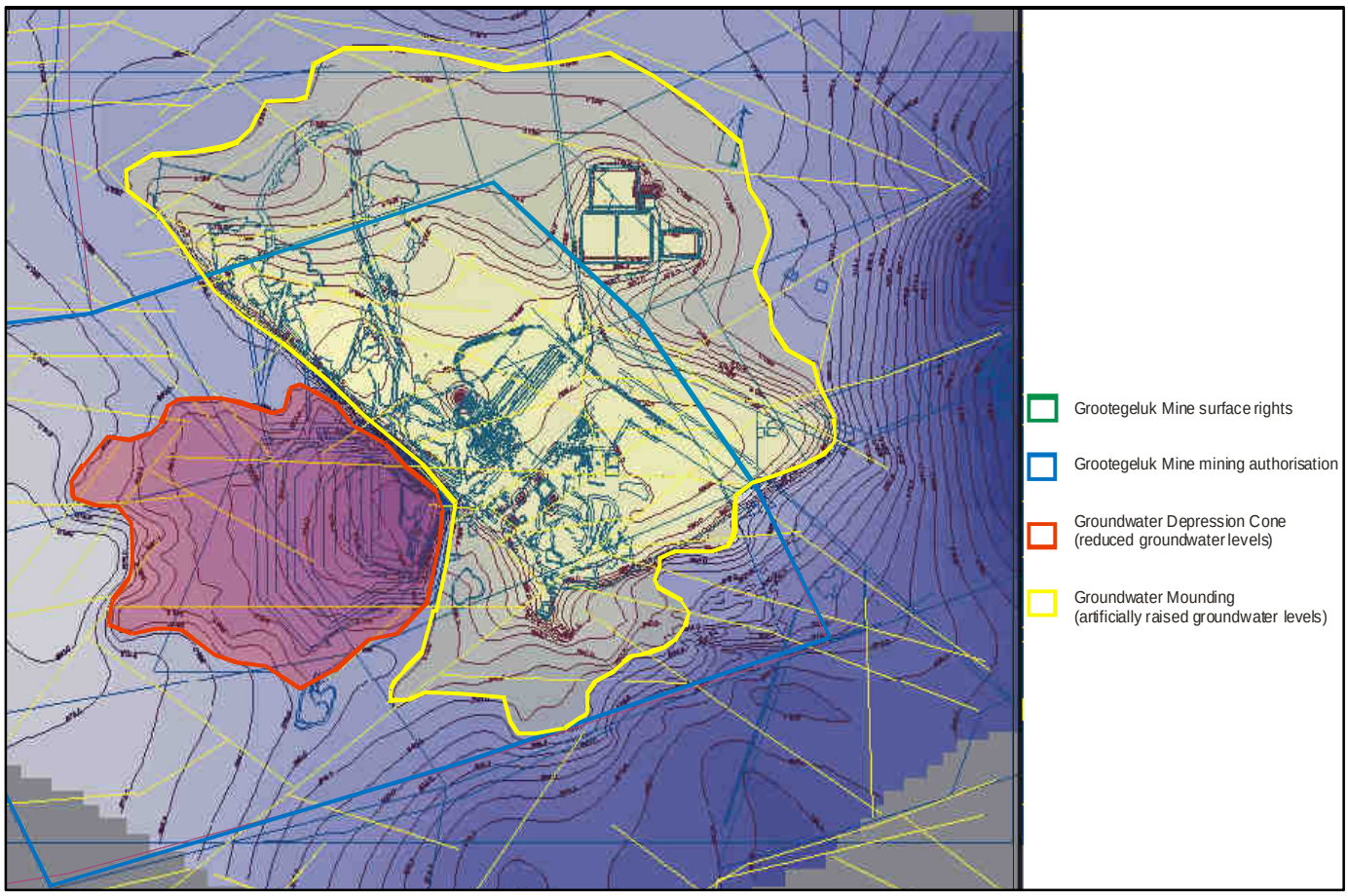


Figure 4.29: Groundwater Levels Around Grootegeluk Mine (June 2003)

4.1.8.2 Groundwater Levels

Groundwater monitoring conducted at Grootegeluk Mine has revealed that groundwater levels in the underlying aquifer vary between 1.98 meters below ground level (mbgl) and 33.12 mbgl with 80% of boreholes sampled having a water level shallower than 20 mbgl (ERM, 2012). The groundwater level at the current Char Manufacturing Plant site is more than 14 mbgl with an average depth of approximately 20 mbgl (ERM, 2012)

A cone of ground water depression has formed around the mining pit due to abstraction of water to keep the pit dry (Figure 4.29). The cone extends for approximately 8.0 km from the exposed pit faces because of groundwater seepage towards the pit and the subsequent abstraction from the pit to enable dry mining conditions.

In the area to the north of the Daarby fault where the Market Coke and Co-generation Plant will be constructed, it is estimated that the average pre-mining groundwater table was approximately 20 to 30 m below surface. Artificial recharge by imported water from outside sources has caused groundwater levels to increase from approximately 30 m below the surface to one or two metres below the surface. Groundwater mounding has occurred because of artificial recharge from unlined water storage dams, slimes dams, water spills in and around the processing complex, as well as from stormwater ponding around the mining waste and process discard facilities. The natural drainage direction of groundwater from this area is in a south-eastern direction, which has further promoted the migration of the mounding to the south.

Groundwater levels for 2003 are depicted in Figure 4.29. Figure 4.29 shows that, based on existing

groundwater modelling, the areas of groundwater depression (south) and mounding (north) do not extend outside land owned by Exxaro Coal.

4.1.8.3 Groundwater Receptors

Groundwater in the Lower Mokolo catchment area (catchment A42J), is used mainly for domestic supply, limited watering of gardens and livestock watering (ERM, 2012). Groundwater use in the catchment is relatively low due to the low aquifer yields as well as the abundant surface water available in the region. The low population density and low aquifer yields limit large-scale abstraction for irrigation and/ or other uses. As a result, the groundwater resources in the region are fairly underutilised (ERM, 2012).

The main receptor in the immediate vicinity of the Market Coke and Co-Generation Plant is the Grootegeluk Mine, which extracts groundwater through dewatering boreholes in the Letaba Basalt for use in dust suppression and the mine's processing plants (ERM, 2012).

Groundwater contribution to streams in Lower Mokolo catchment area (catchment A42J) is zero (DWAF, 2009). This implies that contaminants in the groundwater are highly unlikely to impact on streams in the area.

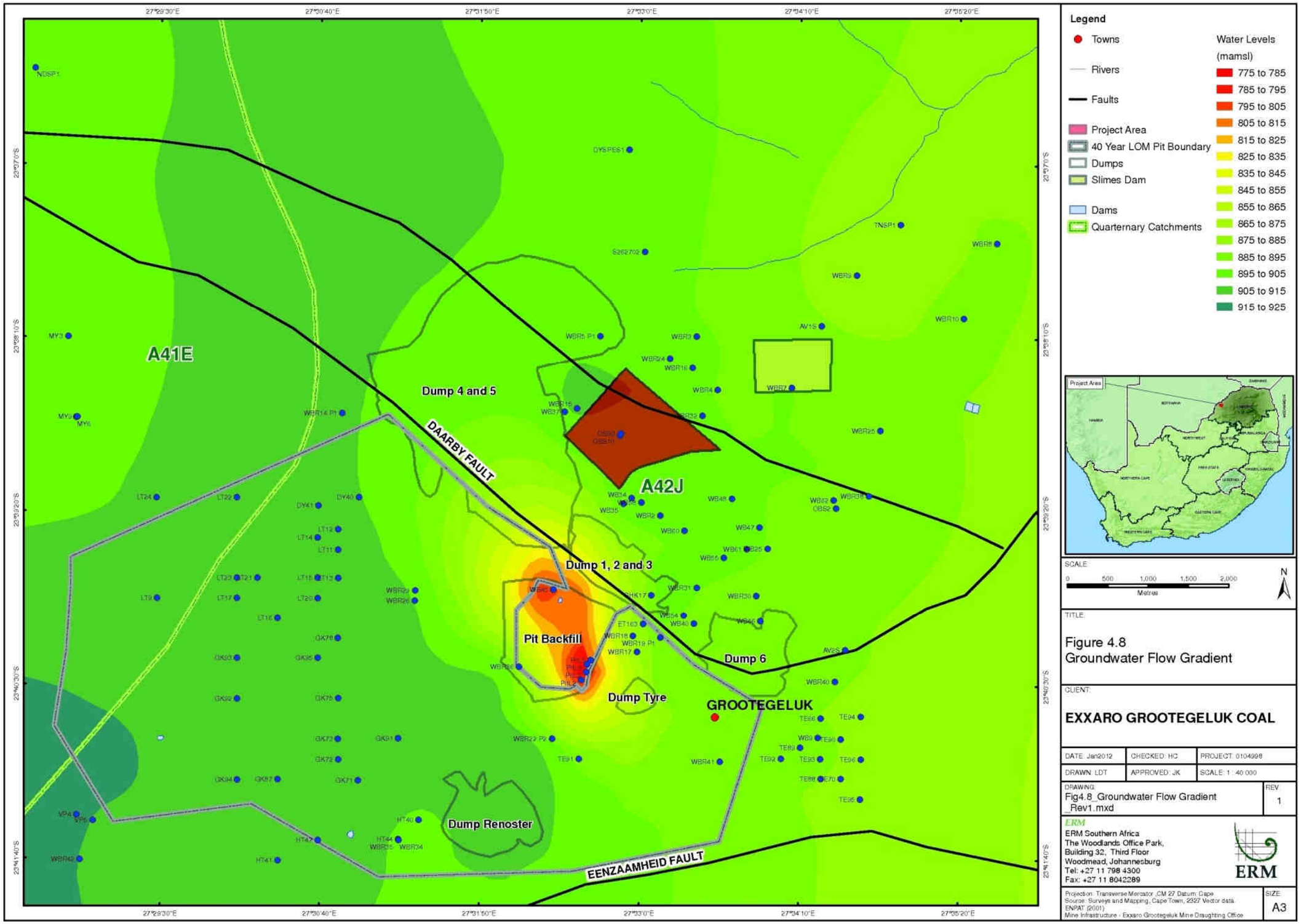


Figure 4.30: Groundwater Levels Around the proposed Market Coke and Co-generation Plant (ERM, 2012)

4.1.8.4 Groundwater Quality

Contaminant Sources

The major sources of potential groundwater pollution associated with the proposed Market Coke and Co-generation Plant include (ERM, 2012):

- contaminated storm water runoff;
- process or quenching water contained within the dirty water containment facility (silt traps and PCDs); and
- recharge of groundwater with contaminated water by means of seepage from the PCDs and any unlined storm water channels.

In addition, there are other potential surface pollution sources in the vicinity of the proposed Market Coke and Co-generation Plant which are summarised in Table 4.13. The locations of the potential sources are shown in Figure 4.31. The summary includes the hydrochemistry of the water contained in/ at these facilities and highlights their most likely contaminants of concern.

Table 4.13: Source Areas and Contaminants of Concern (ERM, 2012)

Source Areas	Facilities	Contaminants of Concern
Hydrometallurgical plants	Existing Char Manufacturing Plant PCD	Volatiles and hydrocarbon contaminants
Pollution control Dams	Bosbok dam, Olifants dam, dam 20 000	Macro elements i.e. Ca, Mg, Na, SO_4, NO_3, Cl, Metals i.e. Sb, Cd, Fe, Pb, Mn, Se
Contaminated water, hydrocarbons from Diesel, oil and lubricants used in machinery	Mine workshop areas, plant areas	Macro elements i.e. Ca, Mg, Na, SO_4, NO_3, Cl, Metals i.e. Sb, Cd, Fe, Pb, Mn, Se Hydrocarbons & Organic compounds
Fine residue	Slimes dam	Macro elements i.e. Ca, Mg, Na, SO_4, NO_3, Cl, Metals i.e. Sb, Cd, Fe, Pb, Mn, Se
Course residue	Waste rock dumps 1 – 6, Coal stockpile area	Macro elements i.e. Ca, Mg, Na, SO_4, NO_3, Cl, Metals i.e. Sb, Cd, Fe, Pb, Mn, Se
Stockpiles	Char feed and Char product	Macro elements i.e. Ca, Mg, Na, SO_4, NO_3, Cl, Metals i.e. Sb, Cd, Fe, Pb, Mn, Se

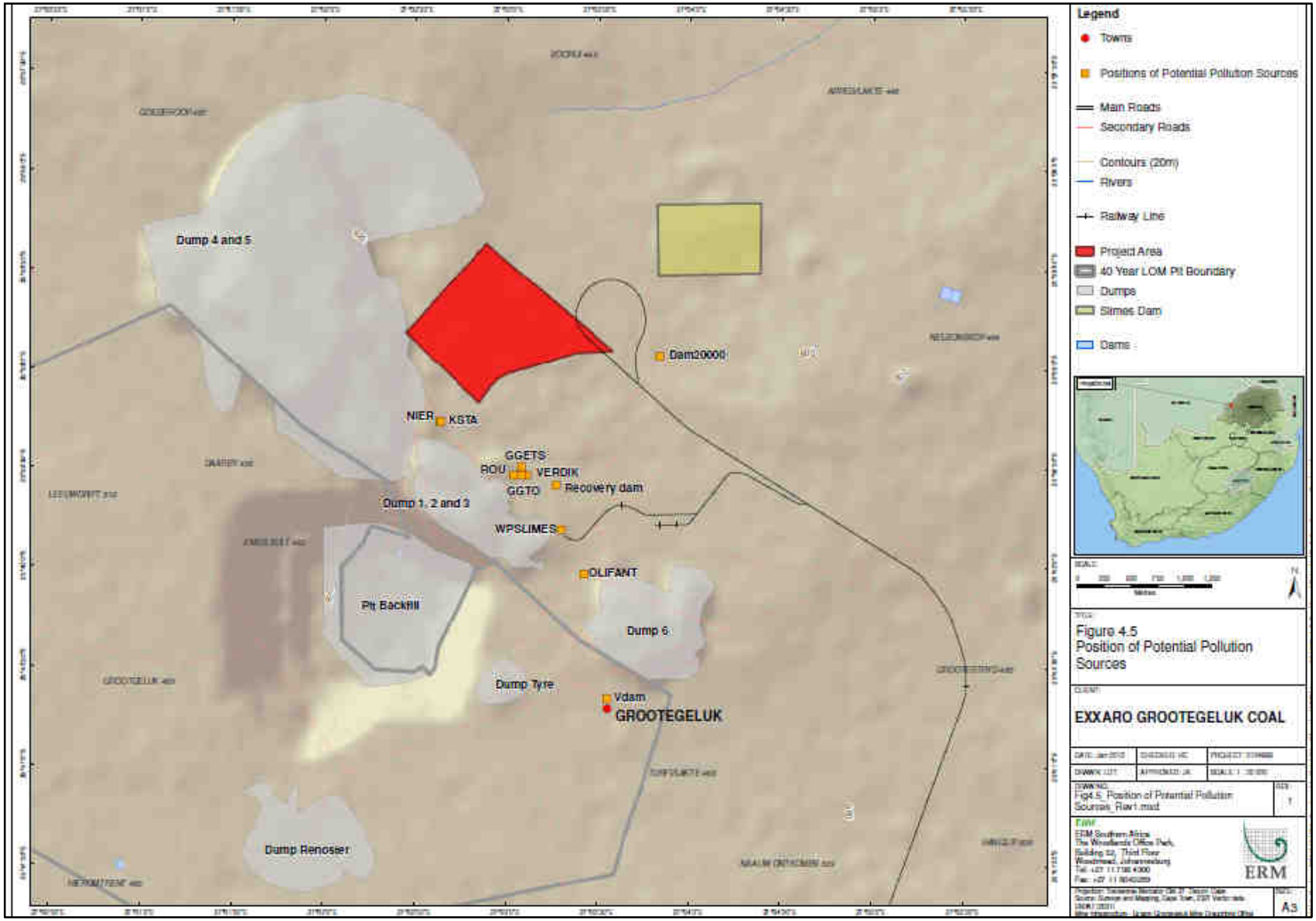


Figure 4.31: Position of Potential Groundwater Pollution Sources (ERM, 2012)

Historical Data

A large water quality database for Grootegeluk and surrounding areas exists from sampling conducted as part of Grootegeluk Mine's EMP. Due to the large database, ERM (2012) screened the data set to highlight water quality issues both from the site and the surrounding borehole users. Figure 4.32 depicts the boreholes that have been monitored for Grootegeluk and surrounding areas.

The groundwater quality results have been compared to the South African National Standards (SANS) 241 for drinking water (2011). This SANS standard is representative of water that is deemed to present an acceptable health risk for lifetime consumption (this implies an average consumption of 2 litres of water per day for 70 years by a person that weighs 60 kg) (SANS 241-1, 2011).

pH and Alkalinity

The pH measured in all but two boreholes in November 2008 falls within the SANS drinking water standards and varies between pH 6 and pH 8 with an average pH of 7.4 (ERM, 2012). Boreholes WBR9 and WBR24 are situated directly west of Waste Dump No 4 and the Slimes dam respectively and had values of 3.2 and 3.4 in November 2008. Overall, a declining trend in pH has been noted in the two samples (Figure 4.33).

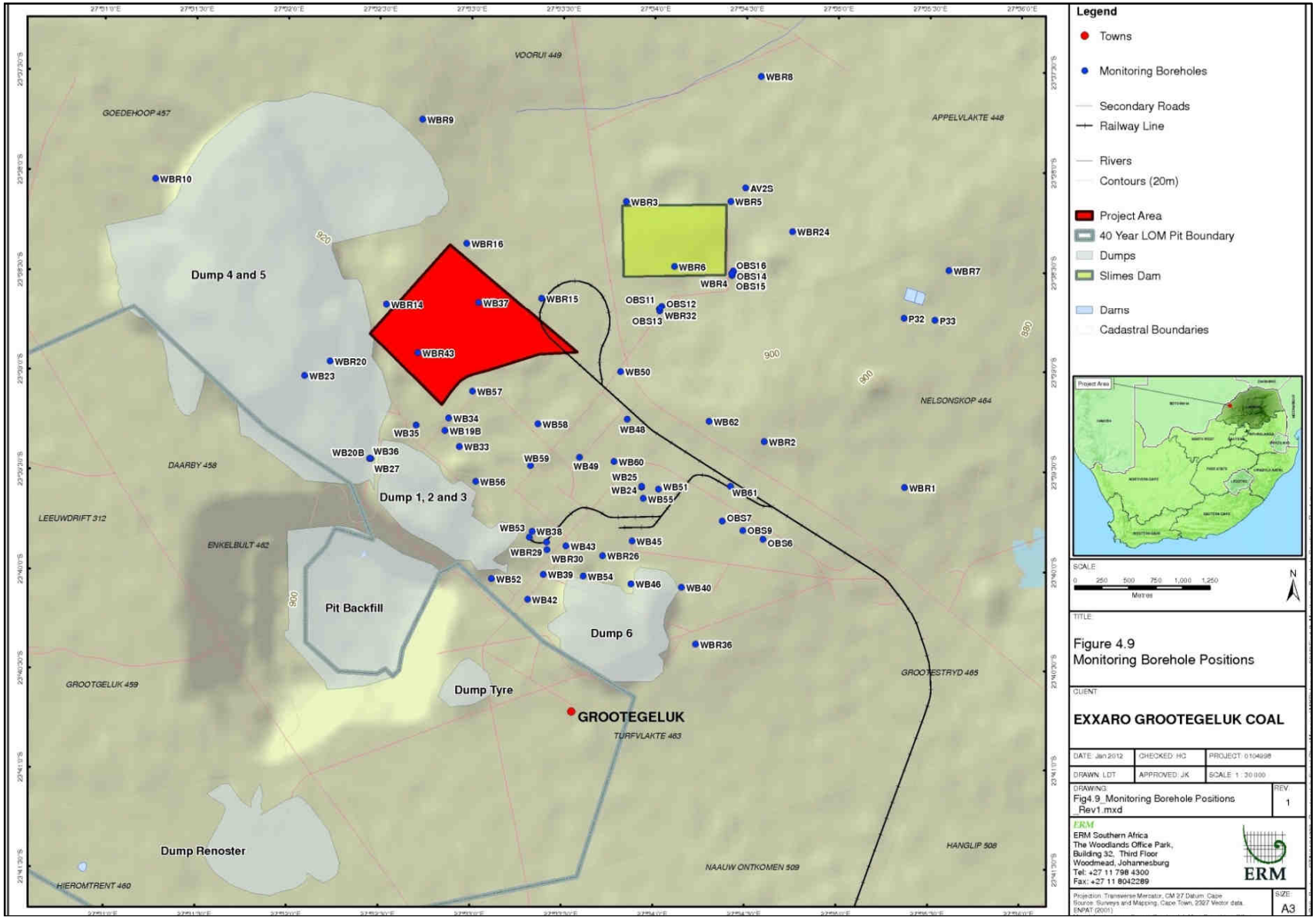


Figure 4.32: Monitoring Boreholes in the Greater Study Area (EMR, 2012).

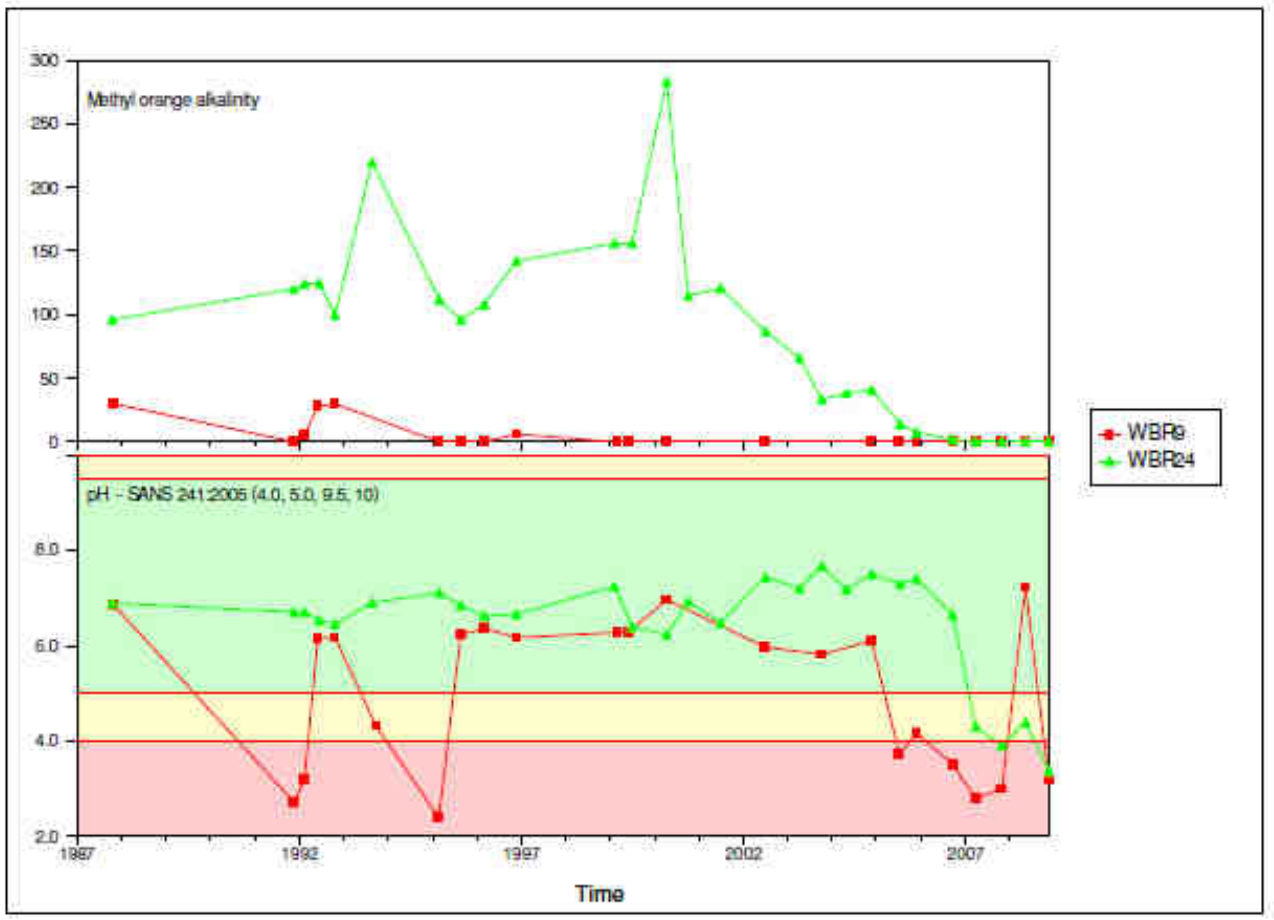


Figure 4.33: pH and Alkalinity in Samples WBR9 and WBR24 (ERM, 2012)

Cations and Anions

The Total Dissolved Solids (TDS) values as measured in November 2008 exceed the SANS Drinking water standards in the majority of the samples taken (ERM, 2012). The observed TDS values are due to the presence of Ca, Mg, NO_3 and SO_4 in concentrations above recommended SANS Drinking water standards (ERM, 2012). A possible reason for this is leaching of these constituents from the waste rock dumps (Dump 1 – 6), the Kidney Discard stacker area, the Old Middling stockpile area and the current stockpile areas adjacent to the railway lines, to the shallow groundwater table present below these areas (ERM, 2012).

Table 4.14 lists the borehole water samples that exceed the SANS Drinking water standards in terms of cations and anions.

Table 4.14: Samples exceeding the SANS Drinking Water Standard (Anions and Cations)

Parameter	Samples exceeding SANS Standard Limit
Total dissolved solids (TDS)	WBR 8, WB 60, WBR 2, 3, 7, 9, 10, 15, 16, 26, 29, 30, 32, 36, 24, 43 WBR 4, 30,WB 29, 36, 48, 49, 58, 60
Sodium (Na)	P 32, WBR 8
Chloride (Cl)	WBR 3, 9, P 33, WBR 8, P 32
Nitrate (NO_3)	WBR 2, 10, 15, WB 19, 62, WBR 16, 36, WB 35, 58, P 32
Sulphate (SO_4)	WB 38, WBR 4, 29, 30, 43, WB 19B, 34, 35, 36, 39, 42, 45, 46, 48, 50, 54, 57, 58, 60

Metals

The concentration of metals such as Al, Cr, Co, Cu, F, Ni, V, and Zinc were all within the SANS drinking water guidelines. Conversely, concentrations of metals such as As, Sb, Cd, Pb, Mn and Se were elevated and exceeded the SANS drinking water guidelines in a large number of samples during the November 2008 sampling run (ERM, 2012).

Table 4.15 lists the samples that exceed the SANS Drinking water standards in terms of metals.

Table 4.15: Samples exceeding the SANS Drinking Water Standard (Metals)

Parameter	Samples exceeding SANS Standard Limit
Antimony (Sb)	WBR 8, WB 60, WBR 2, 3, 7, 9, 10, 15, 16, 26, 29, 30, 32, 36, 24, 43 WB 25,33, 34, 35, 36, 39, 40, 48, 58, 60, 61, 62, 19B
Arsenic (As)	WB 25, WBR 2, 4, 7, 8, 9, 10, 15, 16, 24, 26, 29, 30, 32, 36, 43 WB 19B, 33, 34, 35, 36, 39, 40, 48, 58, 90, 61, 62
Cadmium (Cd)	WBR 15, 43, WB 25, 48, WBR 2, 7, 9, 10, 16, 24, 26 WB 34, 35, 40
Iron (Fe)	WBR 9, 24
Lead (Pb)	WBR 2, 4, 26, 32, WBR 3, 7, 8, 9, 10, 15, 16, 24 WB 25, 34, 35, 62
Manganese (Mn)	WBR 3, 8, WB 25, WBR 4, 9, 24, 29, 30 WB 19B, 48
Selenium (Se)	WBR 2, 8, 9, 26, 32 WB 25, 35, 62

Current Investigation

Another sampling round was conducted in 2011 as part of the groundwater impact assessment for the Char Manufacturing Plant and is presented in Table 4.16 (ERM, 2012). Samples were taken from three boreholes, one up gradient (WBR15), one inside (WB58) and one down gradient of the Char Manufacturing Plant site (WBR43).

Table 4.16: 2011 Groundwater Quality Results (numbers in red indicate exceedance of the SANS 2011 Drinking Water Standard)

Parameter	SANS 241-1: 2011 Standard	WB58	WBR43	WBR15
pH	5 ≥ pH ≤ 9.7	6.1	6.6	6.7
EC (mS/m)	≤170	**330**	**220**	**220**
Antimony (mg/L)	≤ 0.02	-	-	
Arsenic (mg/L)	≤ 0.01	-	-	
Barium (mg/L)	NS	0.028	0.033	0.066
Cadmium (mg/L)	≤ 0.003	-	-	-
Chromium (mg/L)	≤ 0.05	0.008	-	-
Cobalt ((mg/L)	≤ 0.5	-	0.0014	0.0071
Copper (mg/L)	≤ 2	0.0053	0.009	0.0054
Lead (mg/L)	≤ 0.01	-	**0.036**	0.0049
Mercury (mg/L)	≤ 0.006	-	-	-
Nickel (mg/L)	≤ 0.07	-	0.0026	0.0186

Selenium (mg/L)	≤ 0.01	**0.012**	-	-
Uranium (mg/L)	≤ 0.015	-	-	-
Vanadium (mg/L)	≤ 0.2	0.097	0.02	-
Zinc (mg/L)	≤ 5	0.0076	0.047	0.04
Phenols (mg/L)	≤ 0.01	-	-	0.0006
2,3/3,5 –Dimethylphenol+ Ethylphenol (mg/L)	NS	-	0.00005	-
Phenanthrene (mg/L)	NS	-	0.00005	0.00003
2,4/2,5 Dichlorophenol (mg/ℓ)	NS	-	0.00003	-

The EC levels in the all the samples exceeded the SANS 241-2011 standard limits for drinking water (SANS 241, 2011). Most metal concentrations are below the standard limits with the exception of lead (WBR43), selenium (WB58) and vanadium (WB58), which marginally exceed the standard limits.

A few organic compounds were detected namely phenols, chlorinated phenols and phenanthrene, a polycyclic aromatic hydrocarbon (PAH). However the concentrations of these compounds are at least two orders of magnitude below the SANS 241 standards. As the hydrocarbons were detected both up gradient and down gradient of the current Char Manufacturing Plant, the results indicate a regional impact to groundwater possibly related to current and historical stockpiling of coal in the area (ERM, 2012).

4.2 Noise

The ambient noise level at the Market Coke and Co-generation Plant expansion site is influenced by activities associated with mining at the Grootegeluk Coal Mine. Blasting and earthworks as well as the use of heavy vehicles for coal and discard haulage at Grootegeluk Mine impact on the noise level of the Market Coke and Co-generation Plant site. Operational noises from the adjacent Char Manufacturing Plant will also have an impact on the noise level at the site of the proposed Market Coke and Co-generation Plant. The potential sensitive receptors for noise will be the same as those for the potential air quality impacts.

4.3 Biological Environment

The proposed site for the Market Coke and Co-generation Plant has been previously disturbed by coal stockpiling and the biological environment of the site is completely transformed. The possibility of species or habitats of significance being found at the site is therefore considered to be negligible. The full Biodiversity Assessment Report with the detailed description of the baseline ecological conditions is included in Appendix 6.

4.3.1 Flora

4.3.1.1 Regional Vegetation

The proposed site is in the Savanna Biome and falls entirely within the Limpopo Sweet Bushveld vegetation type (SVcb 19), as described by Mucina and Rutherford (2006) (refer to Figure 4.34). This Bushveld type is widely distributed in the region and is characterised by a grassy ground layer and an upper layer of woody plants (Mucina and Rutherford, 2006). In disturbed areas thickets of *Acacia erubescens, Acacia mellifera* and *Dichrostachys cinerea* are almost impenetrable (NSS, 2010). Important plant species of the Limpopo Sweet Bushveld vegetation type are presented in Table 4.17.

Table 4.17: Important Plant Species in the Sweet Limpopo Bushveld.

Species Group	Important Taxa
Tall Trees	***Acacia robusta***(d), ***Acacia burkei***
Small Trees	***Acacia erubescens***(d),***A. fleckii***(d), *A. nilotica* (d), *A. Senegal var rostrata* (d), *Albizia anthelmintica* (d**), *Boscia albitrunca***(d), ***Combretum apiculatum***(d),***Terminalia sericea***
Tall Shrubs	*Catophractes alexandri (d**), Dichrostachys cinerea** (d), Phaeoptilum spinosum (d), Rhigozum obovatum (d), **Cadaba aphylla, Combretum hereroense**, **Commiphora pyracanthoides, Ehretia rigida subsp. rigida, Euclea undulate, Grewia flava, Gymnosporia senegalensis.*
Low Shrubs	*Acacia tenuispina* (d),***Commiphora africana**, **Felicia muricate**, Gossypium herbaceum subsp. africanum, Leucospaera bainesii.*
Gramminoids	***Digitaria erianthia subsp. erianthia***(d), *Enneapogon cenchroides* (d), *Eragrostis lehmanniana* (d),***Panicium coloratum***(d),***Schmidtia pappophoroides***(d**), Aristida congesta**, Cymbopogon nardus, Eragrostis pallens, E. rigidior, E. trichophora, Ischaemum afrum**, Panicum maximum**, Setaria verticillata, Stipagrostis uniplumis, **Urochloa mosambicensis**.*
Herbs	*Acanthosicyos naudinianus, **Commelina benghalensis**, Harpagophytum procumbens subsp. transvaalense, Hemizygia elliotii, Hermbstaedtia odorata, Indigofera daleoides.*
Succulent Herbs	*Kleinia fulgens, Plectranthus neochilus*

Source: Mucina & Rutherford (2006).

Key: (d)= dominant species; Species in bold indicate those identified in the study area

The conservation status of the Limpopo Sweet Bushveld is classified as Least Threatened. About 5% of the vegetation type has been transformed, mainly by cultivation. The area is good for game and cattle farming due to the high grazing capacity of sweet veld.

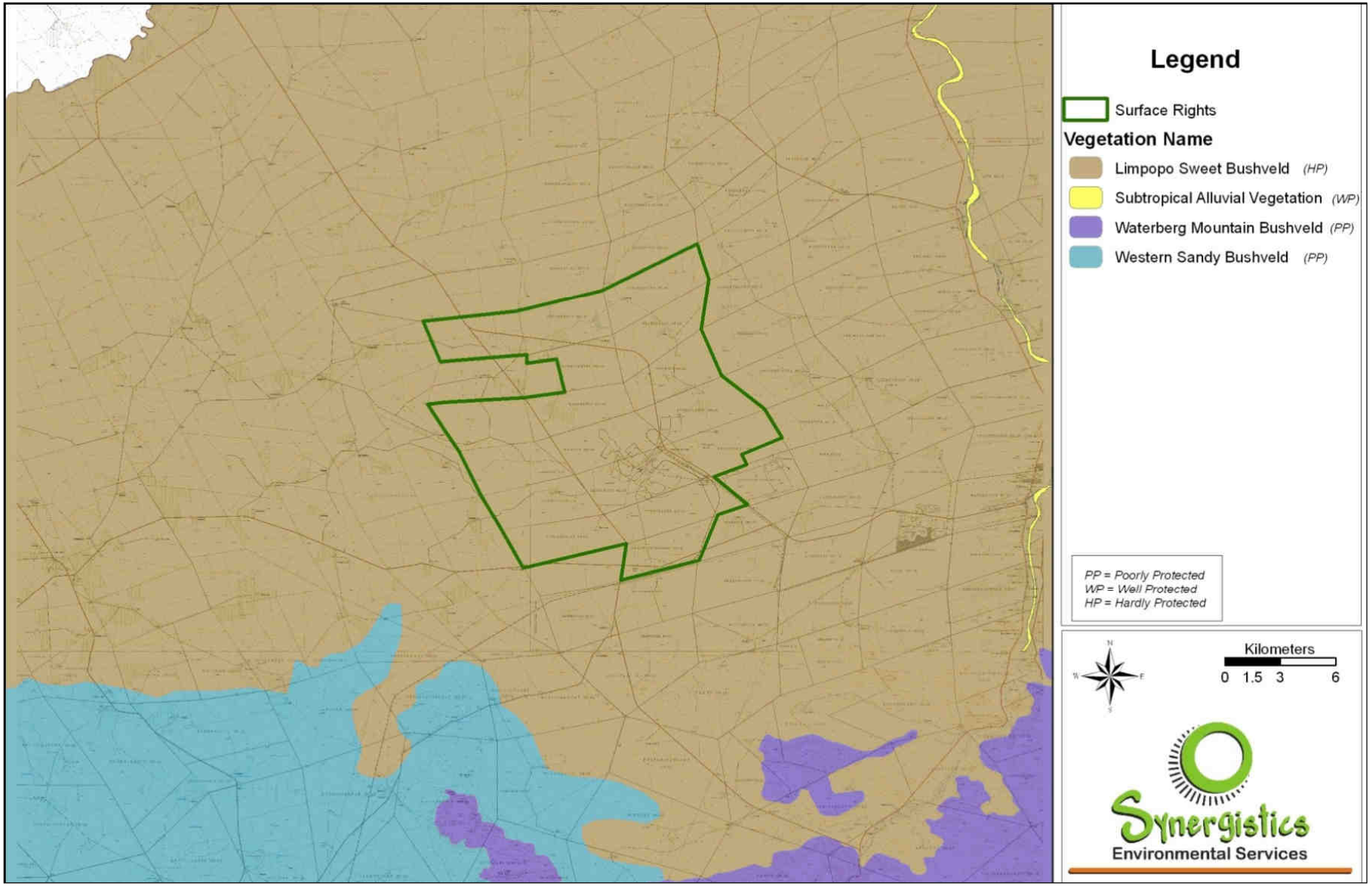
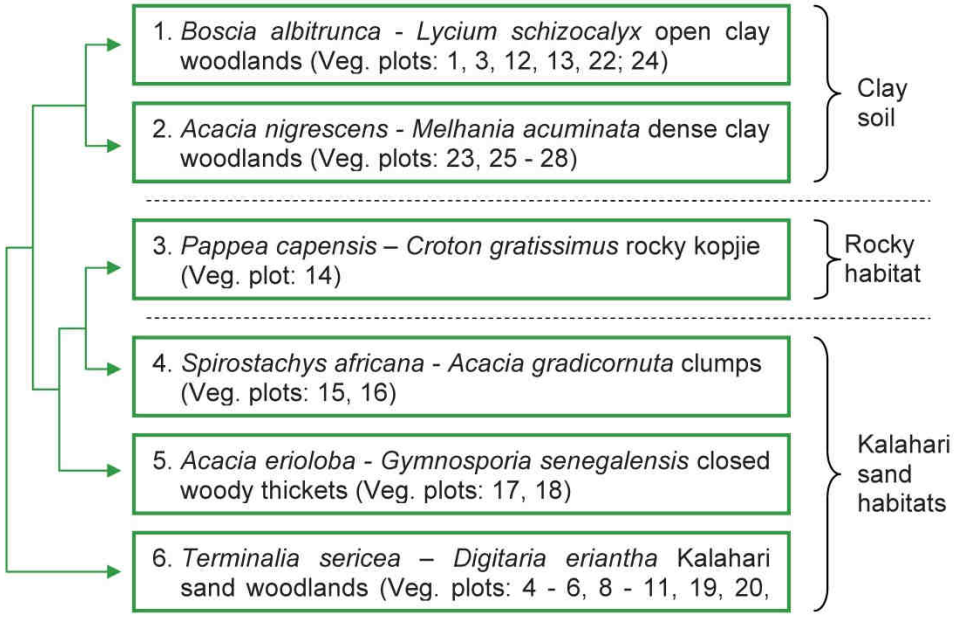


Figure 4.34: Boundaries of Regional Vegetation Types in the Study Area (AGIS, 2004)

4.3.1.2 Vegetation Units

Natural Scientific Services conducted a vegetation survey (NSS, 2010) of Grootegeluk Mine as part of an ecological impact assessment completed in 2010. Their results indicate that the greater Grootegeluk Mine study area is divided into six vegetation units, which include:



The vegetation varies from dense, short bushveld to open tree savannah (NSS, 2010). Variation in species composition is influenced by topography, soil depth and soil structure while the vegetation structure is determined by the fire and grazing regime (NSS, 2010).

Sclerocarya birrea (Marula tree) is the only species found in the greater Grootegeluk study area that is listed as protected under the Limpopo Environmental Management Act, 1998. SANBI lists five plant species with a Red Data status as occurring in vegetation units identified in the greater study area. However, only one species, *Acacia erioloba* (Camel thorn tree), was identified in the greater Grootegeluk study area with the other four unlikely to occur there (NSS, 2010).

The proposed Market Coke and Co-generation Plant falls entirely within the *Terminalia sericea – Digitaria eriantha* Kalahari sands woodlands vegetation unit which is the most widespread in the greater Grootegeluk study area (Figure 4.35) (NSS, 2010). *Terminalia sericea* is the dominant woody species occurring in this vegetation unit while the grass layer is strongly dominated by *Digitaria eriantha* (NSS, 2010).

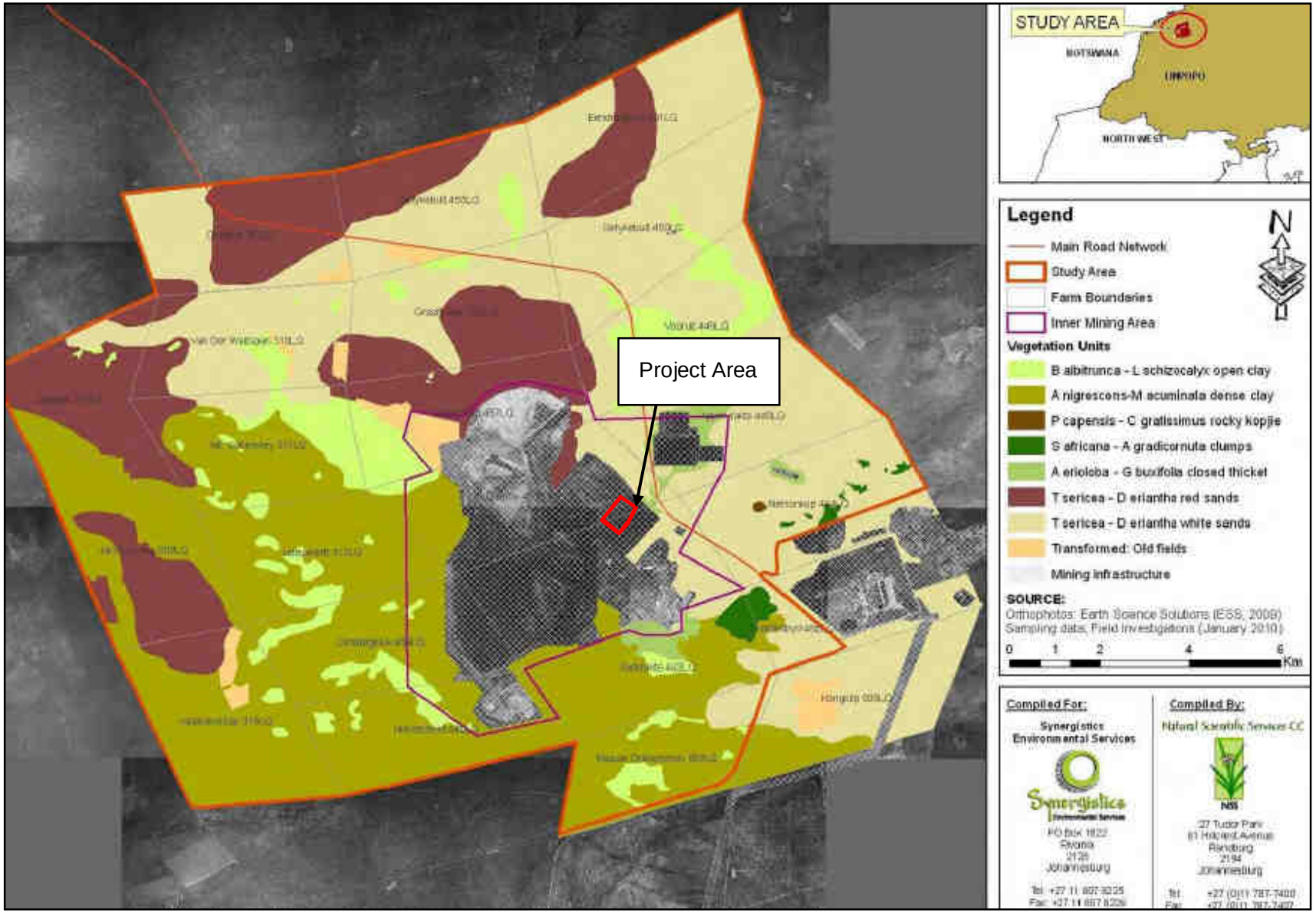


Figure 4.35: Boundaries of Vegetation Units in the greater Grootegeluk Mine Study Area (NSS, 2010)

4.3.2 Fauna

As already indicated, the proposed Market Coke and Co-generation Plant site has been disturbed due to previous coal stockpiling activities. The site of the Market Coke and Co-generation Plant is still partially covered with a coal layer, which does not provide a suitable habitat for animal species. In addition, the location of the site adjacent to the existing Char Manufacturing Plant Expansion and close to other infrastructure, is also not suitable habitat for animals.

However, faunal surveys conducted by NSS in 2008 and 2010 confirmed that a large diversity of faunal species occur in the surrounding area. Numbers of faunal species identified during the survey of the greater Grootegeluk Study Area and surrounding areas is presented in Table 4.18.

Table 4.18: Numbers of faunal species (families for invertebrates) identified in the greater Grootegeluk Study Area (NSS, 2012).

Animal Group	Total for Study Area	Species Nearby (NSS, 2008)	Total Diversity
Mammals	43	6	49
Avifauna	94	65	159
Reptiles	18	10	28
Amphibians	10	3	13
Macro-invertebrates	41	7	48

4.3.2.1 Mammals

The study area supports a rich diversity of mammals. A large area of the greater Grootegeluk Study Area is managed as a nature reserve and has been stocked with a variety of large antelope and rhino species (NSS, 2010). The sex ratios and sizes of these populations are managed intensively to maintain a diversity of species and optimise the economic performance from the area (NSS, 2010). An impressive diversity of smaller mammals survives alongside the managed populations of larger mammals (NSS, 2010). These include carnivores, some of which thrive due to the significant conservation area with limited fragmentation by fences, roads and mining development (NSS, 2010).

A desktop study conducted by NSS (2010) identified 106 mammal species that can possibly be present in the region, of which 30 are Red Data species (Friedmann & Daly, 2004; NSS, 2010). The total mammal species identified represents a very large 63% of the provincial diversity of mammals (NSS, 2010). During their field survey, NSS (2010) identified 48 mammal species in the greater Grootegeluk study area, of which eight were red data species (Table 4.19). Sixteen of the 48 mammal species identified are considered to occur as managed or introduced populations.

Table 4.19: Red Data species identified in the Greater Study Area (NSS, 2012).

Species	Common Name	Red Data Status
Tatera leucogaster	Bushveld gerbil	data deficient species
Pipistrellus rusticus	Rusty pipistrelle	near threatened
Manis temminckii	Ground pangolin	vulnerable
Parahyaena brunnea	Brown hyaena	near threatened
Acinonyx jubatus	Cheetah	vulnerable
Diceros bicornis	Black rhinoceros (northeastern race)	vulnerable
Damaliscus lunatus	Tsessebe	endangered
Hippotragus niger	Sable	vulnerable

4.3.2.2 Birds

A potential of 394 bird species can possibly be present in the proposed areas of the development (Robert's, 2003 in Synergistics, 2006). Of the 394 birds recorded in the region, one is listed as endangered, namely the Saddle-billed Stork (*Ephippiorhynchus senegalensis*), 11 are listed as not threatened, 14 are listed as vulnerable species and 49 are listed as endemic species. A total of 27 Red Data species and 47 endemic species are listed by Robert's, 2003 in Synergistics, 2006 and can possibly be present at any given time.

During two field visits conducted by NSS in 2010, 94 bird species were identified (NSS, 2010). However, a combined list of birds including species from an adjacent area identified in a previous survey (NSS, 2008) has generated a list of 159 bird species for the greater study area. NSS confirmed the presence of three Red Data species in the greater study area, which include the White-backed Vulture (*Gyps africanus*) listed as vulnerable, the Kori Bustard (*Ardeotis kori*) also listed as vulnerable, and the Red-billed Oxpecker (*Buphagus erythrorhynchus*), listed as near threatened (Barnes, 2000; NSS, 2010).

4.3.2.3 Reptiles and Amphibians

The Limpopo Province supports at least 148 reptile species and 46 amphibian species with 11 being endemic to the province (SOER Limpopo, 2003). Potential species occurring in the greater study versus those identified during a survey conducted by NSS (2010) is listed in Table 4.20.

Table 4.20: Numbers of faunal species (families for invertebrates) identified in the greater Grootegeluk Study Area (NSS, 2012).

Animal Group	Potential Species	Species Recorded	Percentage Representation
Snakes	33	9	27%
Agamas, chameleons & lizards	37	12	32%
Geckos	10	4	40%
Crocodile	1	0	0%
Terrapins and tortoises	5	3	60%
Frogs	23	13	57%
Total	109	41	38%

The greater study area was found to be particularly rich in reptile species, with 28 species or 33% of the potential diversity has been shown to be present in the area during three field surveys. One reptile species identified in the area, namely the Southern African python (*Python natalensis*), is listed as vulnerable in the IUCN list of threatened species (Friedmann & Daly, 2004; NSS, 2010)

In all, 13 amphibian species, representing a 57% of the potential amphibian fauna, was confirmed as being present in the greater study area. Two conservation important amphibian species – *Pyxiecephalus adspesus* (Giant bullfrog) and *P. edulis* (African bullfrog), have been reported to occur in the clay pans in the west and south regions of the greater study area (Peter Scott *pers. comm.* in NSS, 2010). The Giant Bullfrog is listed as near threatened while the African Bullfrog is listed as a species of least concern in the IUCN Red Data species list.

4.4 Land Capability and Land Use

4.4.1 Land capability

Land capability is determined by the combination of soil capability and climate factors. A land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. The majority of the land in the Grootegeluk Mining area (and hence the Market Coke and Co-generation Plant area) falls within land capability classes V and VI (see Figure 4.36). Land in these classes has very limited potential for use as

arable landand is generally used as grazing landor wildlife habitat.

According to the IAPs, the area was cultivated in the past, but that this activity no longer takes place, mainly due to decreased rainfall. A vast area (approximately 16 000 ha) is managed as a game farm by Ferroland, a division of Exxaro Coal.

4.5 Land use

As illustrated in Figure 4.37 below, the entire Grootegeluk Mine area is classified as grazing land. These soils are thus generally capable of sustaining palatable plant species on a sustainable basis. In addition, there should be no rocks in the upper horizons of any of the soil groups. If present, these would limit the land capability to wilderness land.

Figure 4.38, shows land cover in the study area which provides some more details regarding land use, as the land subject to mining and quarrying is indicated. This map also shows the very small portion of land which is being cultivated in the region.

Section 2.12 of the Waterberg District Municipality's EMF (2011) states that due to the low rainfall in the area the main land use conflicts in the area are considered to be between low intensity land uses (game farming, agronomy, conservation) and high intensity land uses (urban development and mining).

4.6 Land Tenure

The map below shows the farm names and locations of the farm boundaries. The Grootegeluk mining authorisation area is indicated with pink crosshatch. The proposed Char Manufacturing Plant Expansion will take place on the farm Daarby 456LQ, entirely within the existing Grootegeluk mining area. Thus, no other landowners will be directly affected by the development.

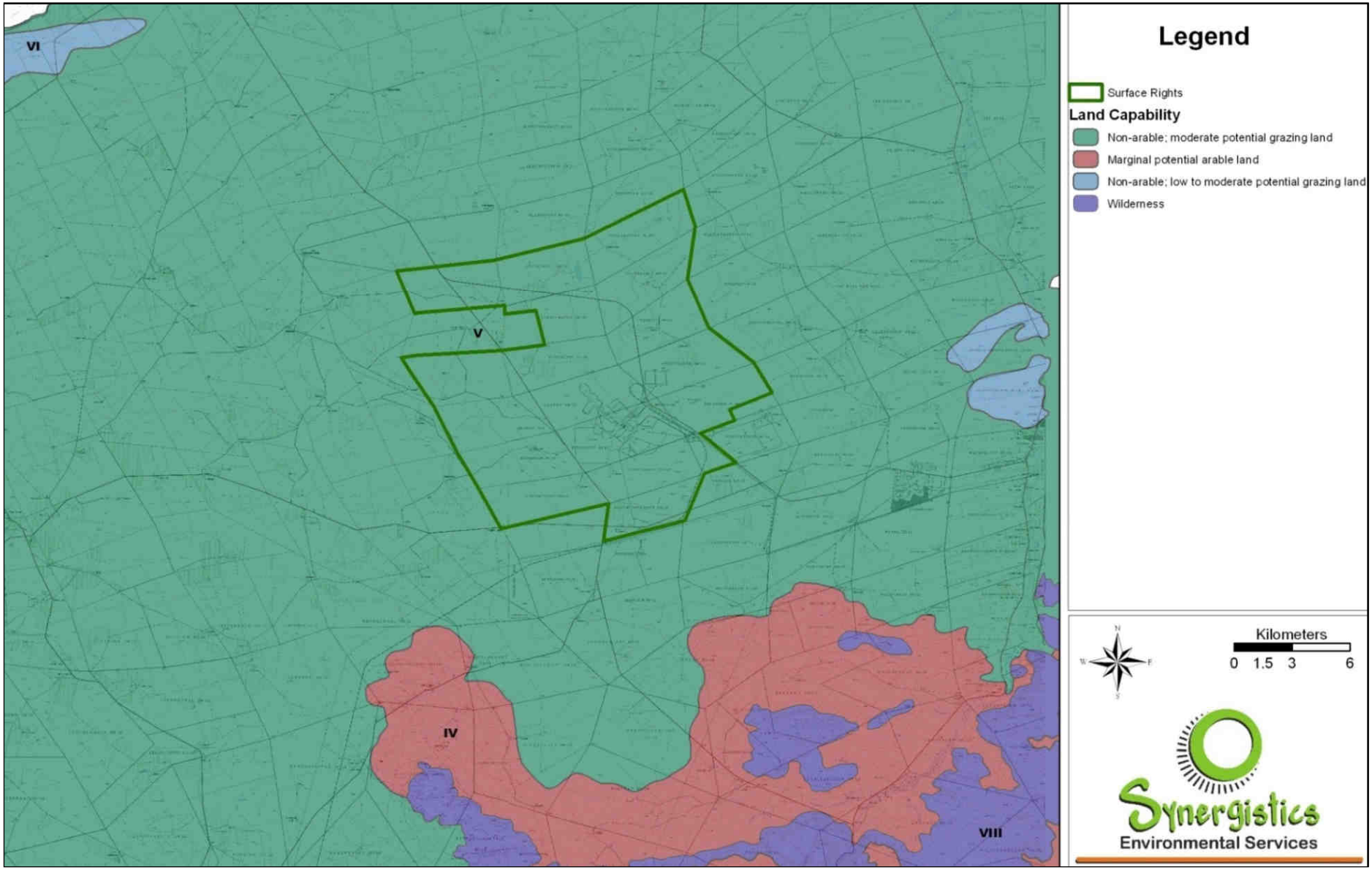


Figure 4.36: Land Capability in the Study Area

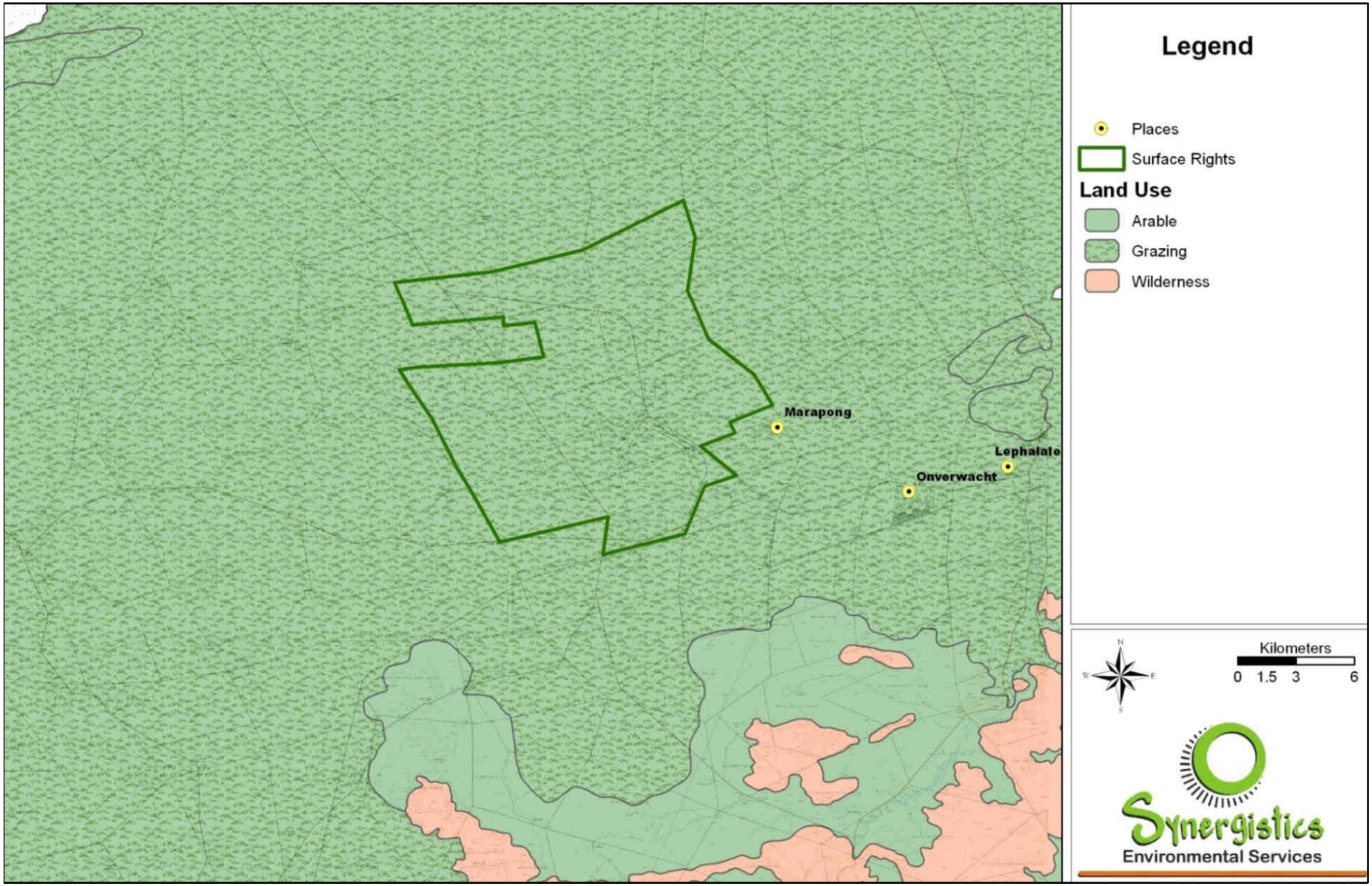


Figure 4.37: Land Use in the Study Area

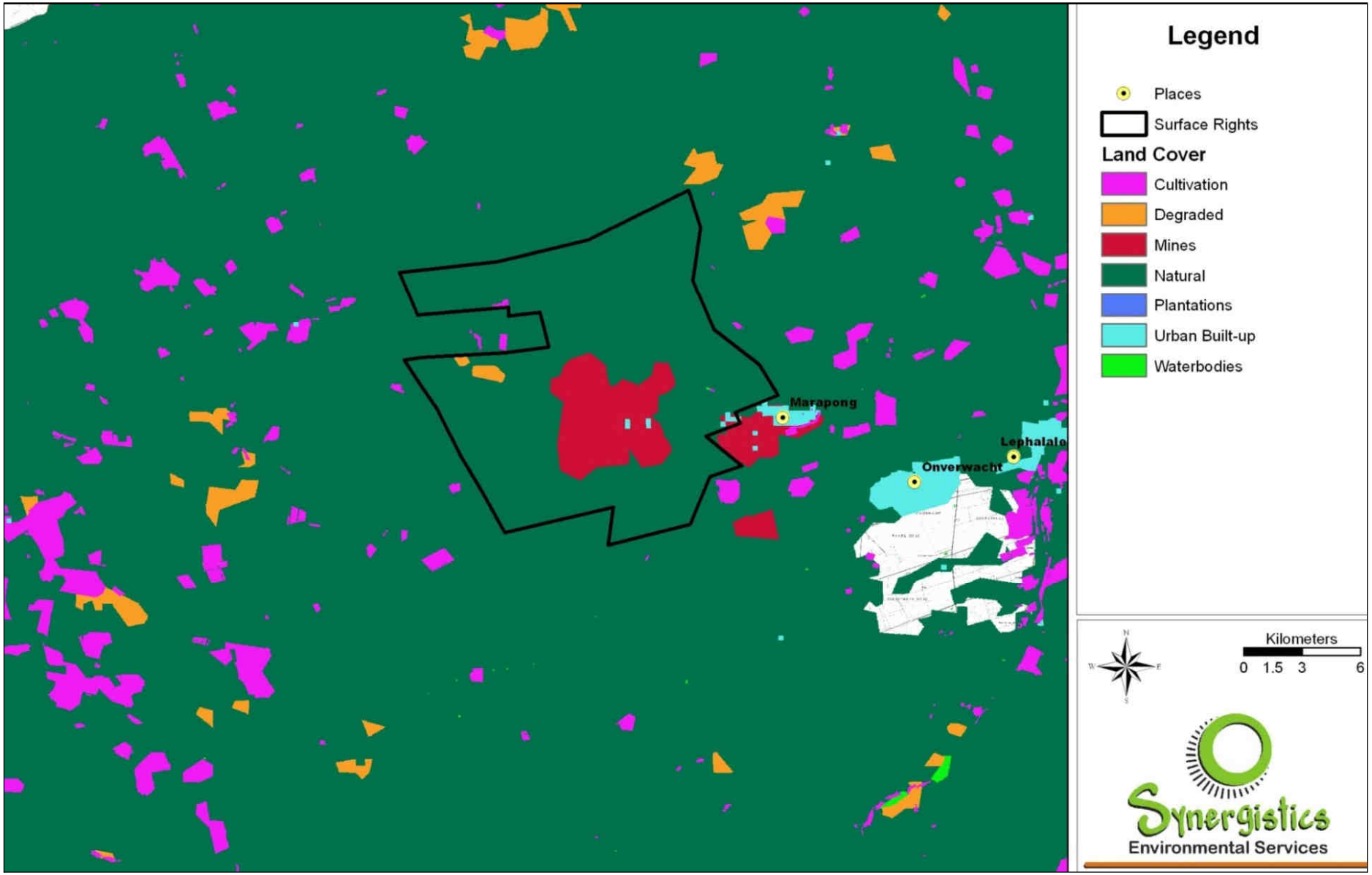


Figure 4.38: Land Cover Types in the Study Area (source Natural Scientific Services, 2010).

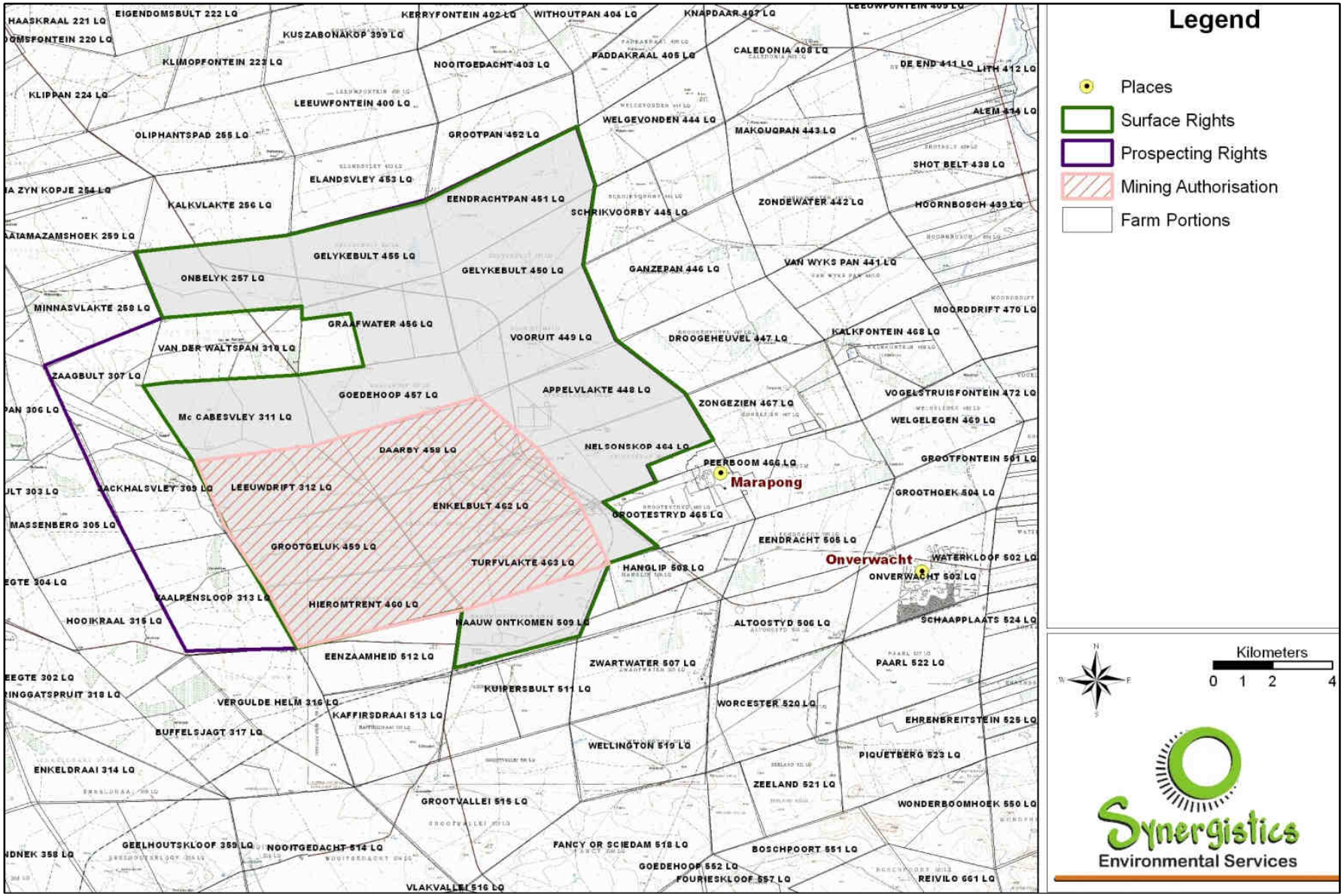


Figure 4.39: Farm Portions in the Study Area

4.7 Cultural and Heritage Resources

The footprint of the proposed Market Coke and Co-generation Plant will be approximately 49.4 ha. However, the proposed site has been previously disturbed by coal stockpiling undertaken for many years. The possibility of artefacts of cultural or heritage significance being located at the site is therefore considered to be negligible. The full Phase 1 Heritage Assessment Report with the detailed description of the baseline cultural and heritage resources is included in Appendix 7.

The Waterberg EMF (2011) states that various development activities can affect (damage, destroy, alter, remove) heritage resources and that many such activities in the Waterberg area should be accompanied by a Phase I Heritage Impact Assessment (HIA) study. For this reason, a phase one Heritage Impact Assessment was conducted for the entire mining rights area for the Exxaro Grootegeluk Mine, which includes the proposed site of the Market Coke and Co-generation Plant (refer to Appendix 7). This report stated that due to the somewhat inhospitable environment, being hot and dry and with few sources of surface water, people did not settle in large numbers in the area in the past (National Cultural History Museum, 2005). As a result, only a few sites of cultural significance were identified in the study area (Figure 4.40). The results of this report indicate that the closest archaeological site to the proposed developments is on the farm Nelsonskop 3.16 km away. This unique site is however considered to be of high archaeological significance, possibly religious significance and it has several engravings and artefacts (National Cultural History Museum, 2005).

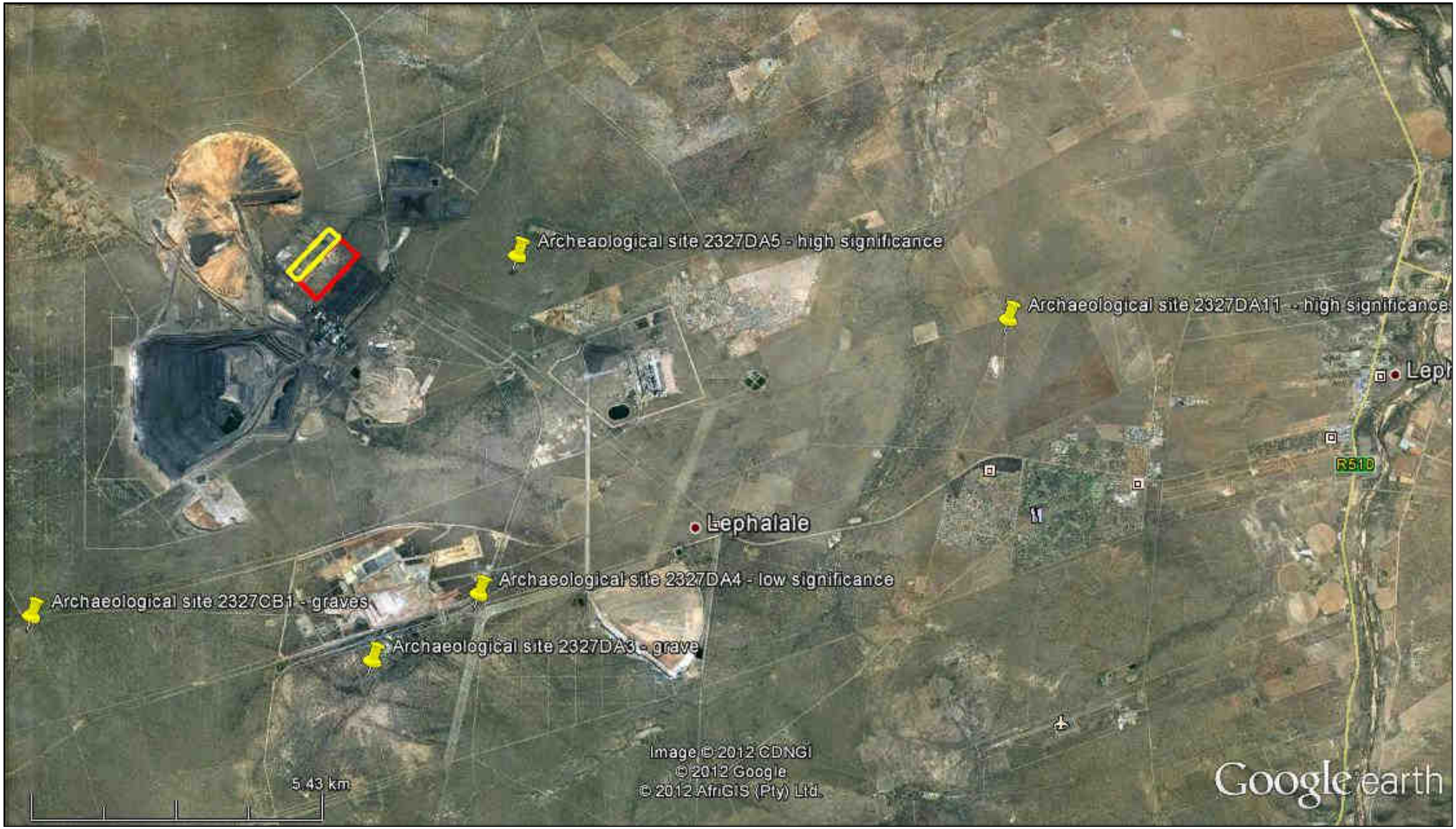


Figure 4.40: Archaeological sites in the vicinity of the Study Area (Market Coke and Co-generation Plant is highlighted in yellow)

4.8 Traffic

The main access (M1) to Grootegeluk mine and the Market Coke and Co-generation Plant is off Nelson Mandela Avenue (D2001), which links directly with Lephalale town (Figure 4.41). The main routes linking Lephalale to these destinations are the R510 (R511) to Brits, the R33 to eNtokozweni and the R518 to Burgersfort, as shown in Figure 4.41. Other roads currently used for product transport are the D1675, R517, R516 and R555.

It is likely that the construction vehicles and additional product transport trucks will increase the current levels of congestion. The loading of the coke product will take place primarily during night-time and the trucks will utilise the same roads as they currently use for product transport: D2001, D1675, R510 or R33, R517, R33, R516 and R555. Product vehicles will be limited on the mine site i.e. they will queue outside the mine gate on road D2001.

Full-time and shift personnel will be transported by minibus from the Grootegeluk Mine main gate to the plant. As the number of employees will increase by 275 people for the Market Coke and Co-generation Plant project, there is expected to be an impact on public transport and the number of employee's vehicles travelling from Lephalale to the mine.

As part of their Traffic Impact Assessment conducted in November 2011 and September 2012, WSP SA Civil and Structural Engineers (Pty) Ltd conducted a visual survey of roads used for transporting coke products. The haul roads (D2001, R510, and R33) are all tarred and in good condition.

Electronic traffic counts, comprising 24-hour, classified (light and heavy) counts of vehicles in each direction, were carried out from Thursday 5 May 2011 to Wednesday 11 May 2011 at the intersections indicated in Figure 4.42. The seven-day average traffic volumes over 24 hours are summarised in Table 4.21 below.

Table 4.21: Seven-day Average Traffic Volumes (24 hours).

Station	Vehicles Classification	Counts (both directions)
E-1	Light	8607
	Heavy	1516
	All	10123
E-2	Light	6008
	Heavy	1848
	All	7856
E-3	Light	2329
	Heavy	587
	All	2916
E-4	Light	5101
	Heavy	557
	All	5658

Figure 4.41: Main Access Routes to Market Coke and Co-generation Plant Site.

Figure 4.42: Electronic Survey Locations.

4.9 Visual Impacts

The proposed site for the Market Coke and Co-generation Plant is located adjacent to the existing Char Manufacturing Plant and in close proximity to surrounding infrastructure, such as the rail loops, slimes dams and internal mine roads. The plant would be visible from various points within the Grootegeluk Coal Mine area. It would not be visible from the nearest residential area (Maropong) which is 6 km away. The site may however be visible from the nearest road, the D2001 (a tarred provincial road) which is approximately 850 m from the site.

4.10 Sense of Place

The proposed site is located within the boundaries of the Grootegeluk Coal Mine and adjacent to the Char Manufacturing Plant. The land uses of the directly adjacent areas are related to mining and industrial activities. The site already has an industrial feel and the construction of the Market Coke and Co-generation Plant would not change the sense of place. The close proximity of the Matimba and Medupi Power Stations also results in the area having a somewhat industrial feel.

A vast area spanning 16 000 ha, surrounding and including the Grootegeluk Coal Mine is managed as a game farm (Clean Stream, 2005). Property in private ownership within a 5 km radius of the mine is mainly utilised for cattle and game farming and no cultivation of crops (dryland or irrigated) takes place (Clean Stream, 2005).

4.11 Social and Economic Environment

The Waterberg District Municipality is a well-known tourist destination with an internationally recognised Biosphere Reserve and the Nylsvley Nature Reserve that has been accorded Ramsar Wetland status. The district is one of the major mining regions within South Africa and has a population of approximately 596 092 (Statistics South Africa, 2007). The Waterberg district has a high proportion of people employed in the mining and agricultural sectors (Waterberg District Municipality: LED).

The Grootegeluk Mine is located in the Lephalale Local Municipality, within the Waterberg District Municipality. The Lephalale Local Municipality has a population of 80 141 (Statistics South Africa, 2007). The local population resides in the towns of Lephalale, Marapong and Onverwacht, and on farms in the area. Lephalale has approximately 49 proclaimed townships, 38 villages, and a number of service points and farm areas. All the townships are located around Lephalale town with the exception of Thabo-Mbeki, which is about 85km away in the north-eastern site in the location of the rural villages.

Lephalale has been identified by Limpopo Employment Growth and Development Plan as a petrochemical cluster and has attained the status of national development node. More than 40% of the total coal reserve in South Africa is in the Waterberg coalfields.

The Market Coke and Co-generation Plant Project area is adjacent to the Grootegeluk Coal Mine. There is likely to be a spurt of economic development in Lephalale Local Municipality related to mining and energy generation due to the expansion of coal mining activities.

4.11.1 Economic Drivers

Economically, Lephalale is one of the fastest growing centres in South Africa. The main economic drivers of the local municipal area include (Lephalale Local Municipality, 2008):

- The Grootegeluk Mine;
- The Eskom Matimba and Medupi power stations;
- Agriculture;
- Livestock farming;
- The D'Nyala Nature Reserve; and
- Hunting and eco-tourism.

Lephalale has an unemployment level of 15.5%. This low unemployment rate needs to be balanced against the relatively high percentage (42.5%) of the municipality's population that is not economically active. Just over 45% of the households in the Lephalale local municipal area have an income of less than R9 600 per annum; however, the situation in the various wards differs considerably with those wards close to the Grootegeluk Mine, Eskom power stations and town of Lephalale.

The majority of people that are employed are in elementary occupations (48%). The second major occupation category is agricultural workers (38%). This structure shows that there is vulnerability of the workforce in the context of expanding medium to high technology industrial activities in the local economy. Most of the Gross Domestic Product (GDP) comes from mining (59%) (Environomics & NRM Consulting, 2010). The area also has extensive hunting and eco-tourism sectors, however these are very small in comparison. Table 4.22 below summarises the contribution of economic sectors in terms of GDP and employment for Lephalale local municipality.

Table 4.22: GDP contribution per sector of Lephalale, 2005 (NRM Consulting, 2010)

Sectors	GDP%	Sectoral Employment %
Agriculture	3.33	38.85
Mining	59.21	7.89
Manufacturing	4.08	6.75
Electricity	11.33	2.14
Construction	0.54	2.94
Wholesale	2.09	7.76
Transport	7.36	2.08
Finance	6.80	6.60
Community services	2.04	15.71
Government services	3.23	9.29
Total	100	100

4.11.2 Economic Potential

The Lephalale Local Municipality is seen as an area with high economic growth potential, due mainly to the positive outlook for mining and electricity generation around Lephalale (Lephalale Local Municipality, 2012). The Waterberg Coal Field in Lephalale is the biggest coal field in South Arica in terms of *in situ* reserves, and with the Grootegeluk Mine planning to expand its coal mining operations, mining is likely to play an ever more important role in the area's future economic development. In terms of power generation, a second power station (Medupi) is currently being constructed at a cost of R26 billion near Lephalale, with a third one being considered due to the large coal reserves in the area. The area is also seen as having considerable agricultural potential (Lephalale Local Municipality, 2012).

Other major projects anticipated for the Lephalale Local Municipality area include:

- A projected Sasol Plant;
- Upgrading of the Matimba Power Station;
- Completion of the Medupi Power Station;
- Further exploration of the other mineral rich areas; and
- The proposed privatisation of the D'Nyala and the Mokolo Dam Nature Reserve - in order to utilise the reserves more economically and to be able to provide better services to tourists.

4.11.3 Population and Social Environment

The local population has increased considerably since the early 1980s due largely to the strong economic growth of the area in that time. The population of the then Ellisras (now Lephalale) stood at 500, however with development of the Grootegeluk Mine and Matimba and Medupi Power Stations, the population in Lephalale (including Marapong and its Extensions) grew to some 18000 to 19000 people (Lephalale Local Municipality, 2012).

With this increase in population, significant development of social infrastructure has occurred. A number of schools (primary and secondary), recreational facilities (golf course, tennis court, soccer, athletics, and rugby sports field) as well as a hospital have been established (Environomics & NRM Consulting, 2010). There is also a high demand for housing in the local area. It is estimated that within the next 5 years, 5000 additional residential units will have to be built in Lephalale and Marapong to ensure that the demand for housing is met. However, the municipality have indicated that they do not have the land available for further expansion.

Table 4.23 presents the population of Lephalale Local Municipality, divided by age and gender for 2001 and 2007. According to census figures, a 20% decline in population has occurred from 2001 to 2007. However, this decline is due mainly to a shift in municipal boundaries, which has resulted in a smaller population for the Lephalale local municipality (Environomics & NRM Consulting, 2010). A high proportion (55%) of individuals in the population is younger than 25 years of age. This is typical for South Africa and indicates a high birth rate in the area.

Table 4.23: Lephalale Local Municipality Population – Age and gender (NRM Consulting, 2010)

	2001			2007		
Age	Male	Female	Total	Male	Female	Total
0-4	5490	5345	10835	4535	4688	9223
5-9	5638	5520	11153	4809	4726	9535
10-14	5679	5644	11323	4512	4747	9259
15-19	5302	6527	10729	4138	4717	8855
20-24	4631	4881	9512	3873	3461	7334
25-29	4106	4390	8496	3222	2797	6073
30-34	3445	3518	6963	3529	2764	6293
35-39	3099	3403	6502	2260	1963	4223
40-44	2579	2495	5074	1795	2474	4369
45-49	1918	2245	4163	1639	1424	3063
50-54	1461	1637	3098	1298	1722	3020
55-59	1012	1052	2064	1135	1149	2286

	2001			2007		
Age	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**
60-64	923	1090	2013	665	1303	1968
65-69	568	930	1468	388	1251	1639
70-74	495	650	1145	384	907	1291
75-79	266	365	631	272	487	759
80-84	220	316	536	84	365	449
85+	150	216	366	217	340	557
Sub-total	**46982**	**49124**	**96106**	**38857**	**41285**	**80142**

The table below (Table 4.24) presents the annual household income for the Lephalale local municipality. The most striking feature is the exceptionally high unemployment figure, with 31% of households earning no formal income. Despite the high unemployment figures, approximately 80% of households live in formal dwellings, while roughly equal proportions of the remainder live either in traditional or informal dwellings (Lephalale Local Municipality, 2008).

Table 4.24: Annual household income for the Lephalale local municipality

INCOME LEVEL	HOUSEHOLD	
	NUMBER	PERCENTAGE
None	15 381	31,3%
R0-R2400	2 537	5,1%
R2401-R6000	3 604	7,3%
R6001-R12 000	4 060	8,2%
R12 001-R18 000	5 396	10,9%
R18 001-R30 000	4 534	9,2%
R30 001-R42 000	3 385	6,8%
R42 001-R54 000	2 253	4,5%
R54 001-R72 000	1 809	5,2%
R72 001-R96 000	1 554	3,6%
R96 001-R132 000	1 314	2,6%
R132 001-R192 000	1 169	2,3%
R192 001-R360 000	1 088	2,2%
R361 000+	1 064	2,1%
TOTAL	**49 148**	**100%**

Source: Global insight 2007

4.11.4 Social Infrastructure

4.11.4.1 Education

There are 66 primary and secondary schools in the Phaklala south and North circuit areas and there are a further 20 schools on various farms and in the Lephalale circuit area (Statistics South Africa, 2007). There are three secondary schools in Maropong and Lephalale. The population growth has resulted in the building of a fourth high school in Onverwacht Lephalale. There is also a FET college in Onverwacht which caters for training needs for the whole Waterberg District Municipality. Four secondary schools are located in Mogalakwena Municipality but fall within Lephalale circuit area.

High levels of illiteracy make it difficult for local communities to enter skilled and semi-skilled employment

markets. Most of the secondary schools do offer maths and science subjects which is a requirement for the entry into engineering careers. The lack of technical high schools limits career paths for students at an early age.

4.11.4.2 Housing

In Limpopo, the percentage of people living in informal dwellings is close to 6% - one of lowest in South Africa, with South Africa having 14.4%. Limpopo (and the Western Cape) has the highest percentage of municipalities having their households living in formal dwellings exceeding the national average of 70.6%. Limpopo also has the highest percentage of households owning their dwelling (69.2%) which exceeds the national average (61.6%) (Statistics South Africa, 2007). Lephalale Municipality has 80 141 people and 23 745 households which is likely to increase with the increase of work demand in the area.

4.11.4.3 Water and Sanitation

Mokolo dam is the main source of water in Lephalale. It delivers 16 cubic metres of water per annum to three major customers of which Lephalale Municipality receives 22%. In the Lephalale Local Municipality 32.8% of the households have flush toilets, 16.8% Ventilation Improved Pit latrines, 44.3% have Pit toilets, with 6.1% of households not having any toilets (Statistics South Africa, 2007). More than 50% of the households do not have hygienic toilets. Wastewater Treatment works needs an additional 10 ML/d capacity to meet current and future demands in the area.

27.5% of households have piped water in their dwelling, 14% have piped water in their yards, 22.6% have water less than 200m away from their dwelling and 20.5% have water more than 200m from their dwelling. 15% of the households have no formal piped water (Lephalale Integrated Development Plan for 2011/2012). The Department of Water Affairs has negotiated the upgrade of the Mokolo pipeline to meet the projected water needs with Exxaro, Eskom and the Lephalale Local Municipality.

The Waterberg District Municipality's IWMP (2009) indicates that the municipality is allocated the function of solid waste disposal sites. The municipality is required to develop a waste disposal strategy, regulate waste disposal and establish, operate and control waste disposal sites and bulk waste transfer facilities (Waterberg IWMP, 2009). Some of the waste related challenges faced by the Waterberg district which are described in the IWMP include:

- indigent households without the means to pay for services;
- waste collection service catering for urban areas and rural areas and resorts/farms are not catered for;
- lack of capacity to monitor or implement the minimum waste management standards as outlined by DWA; and
- no consideration given for waste minimisation and recycling.

4.11.4.4 Health Facilities

There are three hospitals (two public and one private) and six clinics in the Lephalale Municipal area and three mobile clinics. The Marapong clinic requires upgrading to provide adequate service for the population, which has grown threefold compared to when the clinic was originally built. The provision of health services in urban Lephalale is adequate. However, the health sector in Lephalale is faced with several problems, and these include:

- Poor clinic services
- Lack of medical specialists and qualified nurses
- No public clinic in Onverwacht

- Overnight facilities needed for patients that are referred to Lephalale hospital
- Problems with the transport of state patients from rural areas to specialist services in Polokwane
- Need for public participation in HIV/Aids and TB awareness programmes.

5 RESULTS OF CONSULTATION WITH INTERESTED AND AFFECTED PARTIES

A detailed public participation report is included in Appendix 1. As mentioned, the March and May 2011 meetings were combined for two projects: (1) the proposed Market Coke and Co-generation Plant, as well as a separate project – (2) the expansion of the existing Char Manufacturing Plant. Thus not all of the questions asked in the meetings were relevant to the Market Coke and Co-generation Plant project.

Table 5.1 and 5.2 below provide the issues raised by IAPs for the project and the project response to the comments. Tables 5.3 to 5.10 provide details on correspondence relating to report submissions to authorities. The minutes of the public meetings and attendance registers are attached in Appendix 1.

Table 5.1: Questions/Issues Raised at the Public Meeting on 17 March 2011

Question/Issue Raised:	Answer:	Section in EIA where further addressed.
Tendani Mufamadi of the Grootegeluk Mine (TM): Are you going to extend the capacity of the pollution control dam?	GS: Yes we are. Charles Linstrom of Exxaro (CL): It is currently under investigation by Jones and Wagener (surface water specialists). We will update the public on the results of the specialists' studies.	Section 3.2., Appendix 4
Elijah Mabogo (EM): How long will construction of the plant take?	Lomeus Conradie of Exxaro (LC): We use special materials, and thus it can take two years, up to the end of 2014.	Section 3.3
TM: Will you need a permit for emissions and electricity generation form the Department of Energy?	SH: We are applying for an Atmospheric Emissions License. With regard to the Department of Energy, I don't think a permit is needed, but we will confirm it.	A permit is not required from the Department of Energy
TM: With regard to water use licenses required, a Section 21 A license is missing. Are you making provision for it?	CL: No, section 21 A applies to the Mokolo and Crocodile Water Augmentation Project (MCWAP). We already have an allocation from MCWAP for the Grootegeluk Mine. We will use the allocated water for the Char, Coke and Co-gen Plants as well.	Section 1.5.4

No issues/questions were raised at the second public meeting held in May of 2011.

The minutes of the meetings and attendance registers are attached in Appendix 1. A summary of the questions and/or issues raised at the authorities meetings are included in Section 5.

Table 5.2: Questions/Issues Raised at the Meeting with the DMR held on 16 March 2011

Question/Issue Raised:	Answer:	Section in EIA where further addressed.
Azwi Malaudzi – DMR (AM): What do you produce?	Charles Linstrom – Exxaro (CL): Char. We want to expand our plant and add a coking process (explained process).	Section 3.2

Question/Issue Raised:	Answer:	Section in EIA where further addressed.
AM: Are you using waste coal?	CL: No, we are using coal product from bench 11 and 13 at Grootegeluk Mine which is ideal for process.	Section 3.2
AM: So the current plant is a Char Manufacturing Plant, and now you want to expand Char and construct Coke and Co-Generation plants?	Shelley Holt - Synergistics (SH) and CL: Yes, (explained process).	Section 3.2.
SH: We will do EMP amendment, update closure costing etc. This will be a separate document (from the current EMP update of the entire Grootegeluk Mine). This is due to different pollutants. Do you think this will be acceptable?	AM: For administrative purposes, we want one EMP and not several amendments to the EMP. CL: We will try to align the Char, Coke and Co-gen EMP with the whole Grootegeluk Mine EMP update.	Appendix 13, Appendix 14, Volume 2 – the EMP.
AM: DMR requires the a scoping report, then the EMP. When submitting reports, submit in parallel to DWA, DEA etc. so ensure that you meet all legislation.	SH: We will do this.	Section 2.7.8 and 2.7.9
AM: What is Coke? Whom are you selling it to?	CL: Coke is formed by compressing coal and then heating it to remove impurities. Coke is used to produce steel. CL: We sell it to many clients, such as chrome producers and smelters.	Section 3.2
AM: Will there be water pollution as a result of these plants?	CL: We are decreasing existing water pollution on the mine property. The groundwater pollution plume is being reduced. In our water use license there are stipulations to manage this. We have written a water and waste management plan. SH: The new construction is not likely to have a significant detrimental impact on ground water. CL: Construction is to take place on old coal stockpile site used in the 1970s. We have taken out all coal from the construction area, so no further pollution will leach from this coal to the groundwater.	Sections 4.1.6, 4.1.8, 7.1 and 7.2.

Table 5.3: Questions/Issues Raised at the Meeting with the LEDET held on 16 March 2011

Question/Issue Raised:	Answer:	Section in EIA where further addressed.
Victor Mongwe – LEDET (VM): Will you burn the coal?	Mike Plaskitt – Exxaro (MP): There are volatile gases in the coal. We heat the coal to remove volatiles to produce Char or Coke. The gas is then combusted and fed into a boiler, producing steam which drives a generator.	Section 3.2.
VM: How will you deal with the sulphur from the coal?	MP: 1% of the sulphur is released as SO_2. When tar is precipitated, SO_2 goes into the tar and later in the precipitated water called liquor.	Section 3.2. The tar and liquor refers to the separate char

Question/Issue Raised:	Answer:	Section in EIA where further addressed.
		plant expansion project.
Tinyiko Malungani – LEDET (TM): Are you doing separate applications?	SH: Yes, the applications are for the Char, Coke and Co-gen plants. We are also doing AEL applications and an air quality study. Once done we will engage with AEL officers at LEDET.	Appendix 1, Appendix 15.
VM: We must confirm whether the waste is hazardous waste or not. Waste management licensing is not the core of the project. If it is a by-product LEDET will deal with it.	MP: We think it is likely to be hazardous. We may add the tar to the gas for burning, to produce electricity. Tar is a by-product, not waste, as it can also be sold. We will also burn the liquor to produce heat and generate electricity. SH: We do have a waste specialist who is working on the project. MP: The specialist will classify the waste. All our "waste" will be converted to energy. The only "waste" will be atmospheric emissions. No solid or liquid waste will be left.	N/A. This applies to a separate project – the Char Plant Expansion
TM: With PPP, language gaps must be addressed. The dominant language of the area should be identified.	SH: We will do this.	Section 2.7 and Appendix 1
TM: Is it our competency to run with electricity production, or do we need to delegate to DEA?	VM: We must focus on the main process, in this case, to produce Char by erecting the facility.	N/A This applies to a separate project – the Char Plant Expansion
TM: If applications are submitted separately, the processes should be separate. If it is one process, applications should possibly be combined.	MP: Coke and Co-Gen are interdependent.	Coke and co-gen are being applied for together.
TM: How will you align the MPRDA and NEMA processes? If you submit the reports to the DMR and LEDET at the same time, and the report is inadequate, there could be issues.	VM: Let's follow the NEMA process. If we are satisfied, we will give authorisations. TM: I would advise submitting the reports to DMR after we have approved the reports.	Appendix 15. The draft EIA and EMP will be submitted to both departments at the same time, though LEDET will be sent the proof of submission to the DMR shortly.

Table 5.4: Questions/Issues Raised at the Meeting with the DWA held on 16 March 2011

Question/Issue Raised:	Answer:	Section in EIA where further addressed.
V.B. Sengani – DWA (VBS): Will the level of CO_2 released be minimal?	Mike Plaskitt – Exxaro (MP): Yes, much less than a normal coal boiler stack. In our case, only 15% of coal	Section 7.5 and Appendix 3

Question/Issue Raised:	Answer:	Section in EIA where further addressed.
	(volatiles) is burnt off, therefore we burn one sixth of the amount of a normal boiler. Thus we have cleaner stacks.	
VBS: What is the potential for acid rain from SO_2.	MP: We will design the plant to minimise SO_2 and CO_2. We will comply with regulations. Shelley Holt - Synergistics (SH): We are applying for an AEL.	Section 7.5, Appendix 3
Charles Linstrom – Exxaro (CL): We will apply for a WULA under section 21 G and B of the NWA. We have a surface water specialist and a groundwater specialist, whose data we will use in the application. We will also update the Integrated Water and Waste Management Plan (IWWMP) for the mine.		Section 1.5.4
VBS: Can we see a presentation of the results of the surface and groundwater monitoring?	CL: Yes, however we are in the early stages. We can give you the results at a later stage.	Sections 4.1.6, 4.1.7, 4.1.8 and Appendices 4 and 5.
MP: Waste water dams will also be constructed.	CL: Does DWA still require a 2 mm HDPE lining on the pollution control dams? Animals at our plant damage the HDPE lining. We may need to make a concrete lining. MM: Give us 3 different options for dam lining and we will recommend the most appropriate one.	Appendix 4. An HDPE lining with concrete is recommended.
VBS: Will there only be section 21 G and B applications?	MP: Regarding section 21 A, the Grootegeluk Mine has a current allocation from the Mokolo and Crocodile Water Augmentation Project (MCWAP).	Section 1.5.4
CL: Does dust suppression fall under section 21 G?	VBS: It is still a section 21 E activity. MP: Some dust may occur, but not large amounts. No crushing or screening takes place at the Char Manufacturing Plant.	Section 1.5.4
CL: Under the stockpile areas, what must we use to mitigate groundwater pollution from the stockpiles? We will also ask the groundwater specialist to recommend suitable measures.	VBS: Concrete. The leaching of sulphates can affect the ground water. We will check the application and whether the mitigation measures will reduce/prevent impacts.	Appendix 5. Concrete lining is recommended.
MM: Will you factor in the water balance and salt balance?	CL: The water balance will dictate storm water constraints, thus we may need to expand the pollution control dam, and ensure that it can withstand a 1:50 year flood. The water specialists will come up with a water monitoring programme. MP: The water specialist's water balance will ensure we recycle as much water as possible and that we	Section 3.2., Appendices 4 and 5, Volume 2 – EMP

Question/Issue Raised:	Answer:	Section in EIA where further addressed.
	have enough water.	
MM: There have been issues with the public regarding water in the area, so please include water issues in the public participation.	CL: Water issues will be included in public participation from the start.	Section 2.7, Section 5 and Appendix 1

Table 5.5: Questions/Issues Raised at the Meeting with the Waterberg District Municipality held on 17 March 2011

Question/Issue Raised:	Answer:	Section in EIA where further addressed.
Lily Mokonyane – Waterberg Municipality (LM): We have Integrated Water and Waste Management (IWWM) plans, Air management plans, and EMPs for our municipal area. The Environmental Management Framework combines all three. You should also consider the health impacts.	Shelley Holt - Synergistics (SH): We would like to obtain copies of those reports. Health impacts will be assessed during the EIA process.	The relevant issues in the Waterberg EMF have been included in the EIA – refer to sections 4.1.1; 4.1.5; 4.5 and 4.6. Issues in the Waterberg AQMP have been included in sections 1.5.5 and 4.1.5. Relevant issues from the Waterberg IWMP have been included in sections 1.5.2, 3.2.6.4 and 4.10.4.3. Appendix 3.
Peter Mphela – Waterberg municipality (PM): What is the potential for air pollution?	SH: We will do an air quality study. There is existing emissions data from the Char Manufacturing Plant. We will send you our reports, and you will be able to comment on them.	Sections 6 and 7.5; Appendix 3
Charles Linstrom – Exxaro (CL): Do you want the Char Manufacturing Plant data in the report? Should we include Medupi Power station in the baseline?	PM: Yes, it makes sense to include Medupi. If not included, it will not give a true idea of impacts. Mike Plaskitt – Exxaro (MP): Our plant will have less than 1 % of impact compared to Medupi and Matimba power stations. They contribute 99 % of air pollution due to their size.	Section 4.1.5 and Appendix 3.
PM: How have water issues been considered?	CL: We will compile water balances for the plants. If we don't have sufficient water, we will not go ahead with project. We will update water balances to try save water. I think the water in the Mokolo Dam has been 100 % allocated. DWA has taken over management of	Section 3.2., Appendix 4 and 5, Appendix 16.

Question/Issue Raised:	Answer:	Section in EIA where further addressed.
	the Mokolo Dam, so they allocate the water now. They indicated to us that our existing allocation is the maximum we will receive. MP: We will use the allocated water for the Grootegeluk Mine.	
LM: How does the development benefit the community? Short term construction jobs do not sustain people. Ensure the community is included.	SH: We will assess the socio-economic benefits, and jobs that will be created. We haven't assessed this in detail yet. MP: We have a social manager at Grootegeluk Mine. He arranges and deals with all social issues and community projects. SH: We will put those details in the report. MP: We need a lot of labour for these plants, up to 130 jobs will be created at Char and 230 at Coke and Co-Gen.	Section 4.10 and 7.8
Edwynn Louw – Synergistics (EL): Would you like to know whether unskilled, local people will be able to be trained to fill the employment opportunities at Char, coke and Co-generation plants?	MP: Yes, we will train the local unskilled people.	Section 4.10
PM: You are aware of Waterberg being declared a priority area in terms of NEM:AQA, therefore there may be stricter air quality standards for the area in future. Suitable abatement technology should be in place.	SH: We will take note of this.	Section 4.1.5, 7.5 and Appendix 3

Table 5.6: Questions/Issues Raised at the Meeting with the Lephalale Local Municipality held on 17 March 2011

Question/Issue Raised:	Answer:	Section in EIA where further addressed.
Joshua Hlapa – Lephalale (JH): The waste and air specialists should ensure that the applicable regulations are complied with. We would like a waste management plan, air monitoring plans and water monitoring plans. I spoke to Filomaine Swanepoel at Grootegeluk mine, they have an IWWMP. Is it not a good idea to incorporate the new plants into the IWWMP?	Shelley Holt - Synergistics (SH): Once the specialist studies are done, we will send you the reports and will update the Grootegeluk Mine IWWMP to include these plants.	Volume 2 – EMP. The IWWMP will be circulated for public review shortly and also submitted as part of the IWULA.
JH: What will you use to burn the coal?	Mike Plaskitt – Exxaro (MP): We will use coal gas. Once the coal is in the retort, we use LPG gas to start the process. After that, coal gas will heat the	Section 3.2.

Question/Issue Raised:	Answer:	Section in EIA where further addressed.
	coal. We add a little air to burn the gas. Once the process runs, only coal gas is used.	
JH: We will have more questions once you have the draft reports for us.		N/A

5.1.1 Review of the Draft and Final Scoping Reports

The draft and final scoping reports were made available for public and authority review. However, no comments were received from IAPs. All comments received from authorities on the final scoping report are collated in the table below.

Table 5.7: Comments Received from Authorities on the Final Scoping Report.

Commenting Authority	Comments Received	Section in EIA where addressed
FK Baloyi LEDET	Final Scoping Report (SR) dated April 2012 and received by the Department of Economic Development, Environment and Tourism on 18 April 2012 has reference	Not Applicable
LEDET	An in depth Air Quality Study taking into consideration suitable abatement technology should be undertaken.	Appendix 3.
LEDET	Proof of the Atmospheric Emission Licence in accordance with NEMAQA must be provided.	Appendix 1 and Appendix 15 – proof of correspondence and document submission regarding the AEL application. The AEL application has not yet been submitted. Proof of submission of the AEL application will be provided to LEDET shortly.
LEDET	Proof that an EMP in accordance with the MPRDA, submitted to the DMR for approval, must be provided,	Appendix 1 and Appendix 15 – proof of correspondence and document submission to the DMR. The EMP in accordance with the MPRDA will be submitted to the DMR at the same time as the final EIA and EMP are completed. Proof of submission of the EMP in terms of the MPRDA will be provided to LEDET shortly.
LEDET	Proof of submission to the Department of Water Affairs (DWA) for the Integrated Water Use Licence Application (IWULA), must be provided.	Appendix 1 and Appendix 15 – proof of correspondence and document submission to the DWA. The IWULA has not yet been submitted. Proof of submission of the IWULA will be provided to LEDET shortly.
LEDET	Proof that a Waste Management Licence application in accordance to NEMWA has been submitted to the Department of Environmental Affairs (DEA) must be provided.	Not applicable for the Market Coke and Co-generation Project, discussed in EIA, section 1.5.2.

Commenting Authority	Comments Received	Section in EIA where addressed
LEDET	Assessment of alternatives must take into consideration the Spatial Development Frameworks, Integrated Development Plans, Environmental Management Frameworks, etc. of the area. Advantages and disadvantages of each alternative must be investigated and reported during the compilation of the EIAR process. It is mandatory to investigate and assess the option of not proceeding with the proposed activity (the "no-go" option) in addition to the alternatives identified.	The relevant issues in the Waterberg EMF have been included in the EIA – refer to sections 4.1.1; 4.1.5; 4.5 and 4.6. Issues in the Waterberg AQMP have been included in sections 1.5.5 and 4.1.5. Relevant issues from the Waterberg IWMP have been included in sections 1.5.2, 3.2.6.4 and 4.10.4.3. Alternatives – section 3.2.7.
LEDET	The need and desirability of the proposed development must be clearly described	Section 1.4
LEDET	The IWWM, Air Management Plans as well as the Environmental Management Plans of Waterberg Environmental Framework must be taken into consideration during the preparation of the EIAR.	The relevant issues in the Waterberg EMF have been included in the EIA – refer to sections 4.1.1; 4.1.5; 4.5 and 4.6. Issues in the Waterberg AQMP have been included in sections 1.5.5 and 4.1.5. Relevant issues from the Waterberg IWMP have been included in sections 1.5.2, 3.2.6.4 and 4.10.4.3.
LEDET	An integrated waste management approach must be investigated as part of the compilation of the EIAR, and such an approach must be based on waste minimisation, and must incorporate reduction, recycling, re-use and disposal where appropriate.	EIA section 1.5.2 and 3.2.6. Volume 2 – the EMP.
LEDET	All reasonable mitigation measures to curb and manage potential contamination of groundwater must be investigated.	Volume 2 – EMP and Appendix 5.
LEDET	Service level agreements regarding the provision of service must be obtained from all relevant service providers and must be included in the draft EIAR.	Appendix 16
LEDET	Proof confirming that South African Heritage Resource Agency (SAHRA) was consulted must be provided.	Appendix 1
LEDET	All specialist studies as outlined in the PoSEIA must accompany the EIAR and an indication of specialist's competency to undertake the required studies must also be attached in the EIAR.	Appendices 2 to 8. CVs of specialists are included with the specialist studies.

6 ENVIRONMENTAL IMPACT ASSESSMENT

Please refer to the EMP (Volume 2) for more detail regarding the mitigation measures that will be implemented to address the impacts.

6.1 Planning and Design

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Frequency	Duration	Severity	Extent	Consequence	Probability	Impact Significance			MITIGATION MEASURES
									Without Mitigation	Mitigation Confidence	With Mitigation	
PROTECTION OF SOILS AND GROUNDWATER RESOURCES												
Loss of utilisable soils and contamination of groundwater.	Failure to include measures for the protection of soils and water resources in design.	3	2	5	3.3	1	2.2	0.8	1.7	High	Very Low	(1.) Planning should provide for impervious surfaces, bunding and dirty water management areas. (2.) Planning should allow for facilities for the management of general and hazardous waste. (3.) Waste management procedure to be developed including the management of builders' rubble and recyclable wastes. (4.) Agreements to be sought for the use of waste disposal sites and sewage treatment facilities which may be required. (5.) Exxaro Reductants procurement contract to make provision for compliance with EMP. (6.) Planning to include provision for the development of topsoil stockpiles.
PROTECTION OF SURFACE WATER RESOURCES												
Contamination of surface water.	Failure to include measures for the protection of surface water resources in design.	3	2	5	3.3	1	2.2	0.8	1.7	High	Very Low	(1.) The storm water management measures must be designed by a suitably qualified person and in accordance with the requirements of Regulation GN 704, dated June 1999, under the National Water Act, 1998 (Act 36 of 1998).
AIR QUALITY												
Decrease in air quality	Failure to consider the management of dust emissions in planning	3	3	4	3.3	2	2.7	0.8	2.1	Medium	Low	(1.) Methods for the management of dust at coal and coke product handling areas and on gravel roads must be planned for during this phase. (2) The Market Coke and Co-generation Plant process will be designed to comply with known existing atmospheric emission levels in South Africa.
	Failure to include design measures to ensure emissions that meet air quality standards	3	3	4	3.3	3	3.2	0.8	2.5	Medium	Low	1.) Design must ensure that all emissions meet the emissions limits set in the NEMAQA and the proposed Waterberg Priority area.
LAND USE												
Loss of land capability	Failure to plan and have financial provision for rehabilitation.	2	1	5	2.7	1	1.8	1	1.8	Medium	Low	(1.) Financial provision to be made for the rehabilitation of Market Coke and Co-generation Plant site.
TRAFFIC												
Decrease in traffic safety	Failure to consider road upgrading and maintenance issues during planning.	3	3	4	3.3	3	3.2	0.8	2.5	Medium	Low	(1) Negotiations must be undertaken with the Grootegeluk Coal Mine and other stakeholders with regard to the surfacing of problem areas on the coke product transport route (D2001 and R33) as well as the regular maintenance of the roads.
ENVIRONMENTAL AWARENESS AND TRAINING												
Unnecessary environmental and occupational health impacts if persons working at the plant are not aware of potential issues at the Market Coke and Co-generation Plant site.	Failure to plan for environmental and occupational health awareness and training.	2	2	4	2.7	1	1.8	1	1.8	Medium	Low	(1.) Environmental and occupational health induction training material must be ready prior to construction period for use in environmental induction training.

6.2 Construction Phase

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Frequency	Duration	Severity	Extent	Consequence	Probability	Impact Significance			MITIGATION MEASURES
									Without Mitigation	Mitigation Confidence	With Mitigation	
GROUNDWATER												
Decrease in groundwater availability	Abstraction of water for construction	2	3	4	3	2	2.5	0.4	1.1	Medium	Low	(1.) Water abstraction is to comply with water use licensing requirements. (2) All groundwater-monitoring points for the plant shall be monitored on a quarterly basis. Boreholes to be monitored include WBR 50, WBR 57 and WBR 43. Both groundwater level and groundwater quality are to be measured.
Decrease in groundwater quality	Chemical pollutants from construction activities reaching groundwater	3	3	4	3.3	2	2.7	0.6	1.6	Medium	Low	(1.) Pollution control measures for the protection of soils to be put in place. (2) Sampling is to be conducted by a suitably qualified and competent person using appropriate sampling techniques. The samples will be analysed at an accredited, independent laboratory for chemical and physical constituents normally associated with the presence of coal and carbonaceous material, as well as those which are specific to Market Coke and Co-generation Plant operations.
	Existing pollutants on site reaching groundwater	3	3	4	3.3	2	2.7	0.8	2.16	Medium	Low	(1) The remaining coal layer/carbonaceous material will be removed from the Market Coke and Co-generation Plant site and either returned to the Grootegeluk beneficiation plants or will be disposed of on the Grootegeluk discard dumps where there is no risk of combustion. The coal/carbonaceous material will not be stockpiled on the surrounding area. (2)The removal of the upper soil layer to a depth of 60cm where contamination has been identified (refer to the report by Golder, 2011 – Appendix 2 of the EIA). The contaminated soil must be disposed of at a Hazardous Waste Disposal Facility.
SURFACE WATER												
Decrease in surface water quality	Sedimentation of surface water run-off. Release of dirty water into environment.	3	3	4	3.3	2	2.7	0.8	2.16	Medium	Low	(1) Construction activities should take place in the dry season as far as practical (2) Footprint of disturbed areas to be minimised (3) "no-go" zones for construction plant and personnel will be delineated (4) Appropriate storm water management measures will be implemented, including the temporary diversion of upstream run-off from the construction and laydown areas. (5) Surface water management measures, such as stormwater canals and sediment traps are to be constructed first to ensure that runofff and dirty water spills are contained (6) Servicing of construction vehicles will take place only in dedicated areas that are equipped with drip trays. (7) Bunded containment and settlement facilities will be provided for hazardous material, such as fuel and oil. (8) Spill-sorb or a similar type product must be kept on-site and used to clean up hydrocarbon spills in the event that they should occur (9) Erosion protection measures will be implemented at steep areas (10) Development of a waste management plan for the construction phase (11) An appropriate sewage management strategy to be implemented during construction phase (12) Water quality monitoring will be undertaken downstream of the constructiona area, before and during construction where preactical, in order to detect any increase in suspended solids or turbidity (13) If erosion is evident or the water quality monitoring indicates an increase in suspended solids, water management around the construction areas will be reviewed.

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Frequency	Duration	Severity	Extent	Consequence	Probability	Impact Significance			MITIGATION MEASURES
									Without Mitigation	Mitigation Confidence	With Mitigation	
Impact on Catchment Yield	Containment of runoff from the construction areas, including contractor's camp and laydown areas											(1) The site is located within the Grootegeluk Mine dirty water area and as such is already excluded from the natural catchment. There is therefore no incremental impact on catchment yield. (2) However, the containment of additional areas on the Grootegeluk Reductant Manufacturing process results in a potential reduction in the quantity of the water reporting to the Bosbok Dam, incrementally reducing the amount of water available to the Grootegeluk Mine for use in their process. (3) The aerial extent of the disturbed areas will be kept to a minimum (4) Areas where dirty construction activities are carried out (e.g. plant servicing areas and workshops, fuel storage areas, waste storage areas) will be minimised. (5) Upslope runoff will be diverted around construction activities
SOIL												
Loss of utilisable soils	Failure to strip and conserve topsoil	4	3	5	4.0	1	2.5	0.6	1.5	High	Very Low	(1.) Where not contaminated, the upper 70 cm of soils of the construction footprint (i.e. any area to be disturbed by construction activities) must be removed and stored as topsoil . (2) To minimise poterntial soil erosion, appropriate storm water control measures will be provided for the site, which will comply with the GN704 Regulations on the Use of Water for Mining and Related activities. (3) Topsoil stockpiles must be protected through seeding as soon as possible, or within 30 days after the formation of the stockpile. (4) Topsoil stockpiles must be benched and sloped to 1: 6. (5.) Once the construction activity has been completed, the remaining disturbed area which will not be used must be topsoiled, sloped and re-vegetated as soon as possible using suitable grass species. This re-vegetation will assist in reducing the potential for soil erosion. (6) The topsoil will be analysed to determine imbalances prior to the replacement of soil. Inorganic fertilisers will be used to supplement the soils before seeding of the area takes place.
	Compaction of soils during construction activities	2	2	4	2.7	1	1.9	0.6	1.1	High	Very Low	(1.) Before any construction activity takes place, the proposed Market Coke and Co-generation Plant Expansion site will be pegged out and fenced. All construction activities will take place within this area to limit the extent of impacts. (2.) No off-road driving allowed. (3.) All roads and compacted areas used during construction (which are not required for operation) are to be ripped and the establishment of vegetation promoted.
Contamination of soils by chemical spills.	Spillage of hydrocarbons and other hazardous chemicals, failure to contain dirty water run-off.	3	3	4	3.3	1	2.2	0.8	1.8	Medium	Low	(1) If vehicles or machinery will be serviced or maintained on site , this must be done on an impervious surfaces (hard-standing, trip trays etc.) (2) All vehicles must be checked for leaks before commencing work on site. All equipment that leaks fluid must be repaired immediately or removed from site when necessary. (3) Drip trays must be placed beneath parked vehicles which drip oil. (4) All spills of chemicals or hydrocarbons (oil, grease, diesel, petrol, etc.) will be cleaned with the use of suitable absorbent materials such as drizit or oclansorb. (5) All soils that have become contaminated with oils, fuels and lubricants must be removed and managed as hazardous waste. Bioremediation of contaminated soils shall take place should such a facility be available on site. (6) Within the plant area, self-contained bunded areas will be provided for the collection of spillage

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Frequency	Duration	Severity	Extent	Consequence	Probability	Impact Significance			MITIGATION MEASURES
									Without Mitigation	Mitigation Confidence	With Mitigation	
												where the following substances are stored: • Hazardous waste storage; • Flammable and combustible liquid; • Electrical transformers containing oil and/or PCBs and • Locations where spills are common, including trasfer points, workshops, and where hazardous substances are transferred and used on a regular basis. (7) The self-contained bunded areas will be lined with an impermeable material to limit seepage into the ground water environment. (8) For flammable liquids, bunded areas should have 110% of the capacity of the total storage volume for the flammable liquid. For other potentially dangerous/hazardous materials, the capacity of the bund should: • Equal 100% of the largest drum/tank/container; PLUS • 35% of the maximum intended stoage capacity ; PLUS • Additional capacity for firewater. (9) Material Safety Data (MSD) sheets for all chemicals must be displayed in close proximity to the area of storage. (10) Chemical spills are to be regarded as an environmental incident and reported through the incident reporting system. (11) Hazardous chemicals (such as those used for cleaning) must not be released into the environment or sewage treatment system. These materials must be contained and disposed of as hazardous waste. (12) All fuel tanks used in construction must be aboveground and bunded in accordance with the requirements for flammable liquids. (13) Hydrocarbon handling areas must be supplied with stormwater diversion measures. (14)The integrity of the bund for hydrocarbon storage is to be monitored regularly to ensure that no seepage escapes it.
Contamination of soils by wastes.	Spillage of sewage and incorrect management and disposal of waste.	3	3	4	3.3	1	2.2	0.8	1.8	Medium	Low	(1) All waste will be classified and disposed of accordingly. No illegal dumping or disposal will take place - general waste must be disposed of at a permitted landfill site and hazardous waste must be disposed of at a permitted hazardous waste site. (2) All hazardous waste must be handled on impervious surfaces. (3) Chemical toilets will be provided for construction personnel during the construction phase if the sewage system is found to be insufficient for the number of people on site during construction.
BIODIVERSITY (Flora)												
Species diversity loss of vegetation	Unnecessary destruction of vegetation. Establishment or spread of alien species. Introduction of problem species during construction rehabilitation.	2	3	4	3.0	1	2.0	0.8	1.6	Medium	Low	(1) Unnecessary disturbance of vegetation not to be allowed - vegetation clearance must be restricted to footprint areas required for the development of the Plant. (2) All contractors/employees will be informed that no fires will be permitted on site or adjacent to the site. (3) All contractors/employees will be informed that the collection of plant material or the picking of plants on site or the surrounds is prohibited. (4) Dust suppression will be practiced in order to prevent air-borne deposition on the surrounding natural vegetation.

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Frequency	Duration	Severity	Extent	Consequence	Probability	Impact Significance			MITIGATION MEASURES
									Without Mitigation	Mitigation Confidence	With Mitigation	
												(5) Source populations of alien plants, if present, must be removed during construction phase. (6.) Seed mix used for construction rehabilitation is to include only species indigenous to the area.
	Site is not suitably rehabilitated.	2	2	5	3.0	1	2.0	0.8	1.6	Medium	Low	(1) The revegetated areas will not be grazed before the climax species are well established. If necessary, the revegetated areas will be fenced in order to avoid grazing. (2) Vegetation growth on rehabilitated areas must be monitored until the following rainy season to ensure re-growth and sustainable growth. (3) All infrastructure including foundations and concrete surfaces that will not be used during operation of the Market Coke and Co-generation Plant must be removed from site after construction.
BIODIVERSITY (Fauna)												
Killing of fauna	Vehicle collisions. Poaching.	3	2	3	2.7	1	1.8	0.6	1.1	Medium	Low	(1.) Education of staff on safe driving and protection of animals (2.) All contractors/employees will be informed that no poaching/trapping of animals will be allowed.
NOISE												
Increase in ambient noise levels	Transportation of construction workers and materials on nearby roads.	1	3	2	2.0	3	2.5	0.8	2.0	Low	Moderate	No mitigation practicable.
	Construction activities at the Market Coke and Co-generation Plant	1	3	2	2.0	1	1.5	0.8	1.2	Medium	Very Low	(1.) Where possible, working hours are to be limited to day time to minimise night time noise levels. (2) All machinery to be used during the construction phase should be properly muffled and maintained so as to reduce noise generation to a minimum. (3) Working procedures should be structured so as to avoid the unnecessary generation of noise. (4) Standards pertaining to noise must be stipulated and monitoring for management purposes should be carried out at regular intervals. Where the standards have been exceeded, appropriate action should be taken to rectify the situation.
AIR QUALITY												
Decrease in air quality	Entrainment of dust resulting from site clearance and movement of machinery on site.	2	2	2	2.0	2	2.0	0.8	1.6	Medium	Low	(1) Appropriate measures are to be taken to minimise the generation of dust as a result of work, operations or activities. Such measures must include regular and effective wetting or chemical dust suppression of gravel access roads and working areas. (2) During windy conditions, dust generation should be minimised and dust suppression activities intensified. (3) The use of water sprays for dust suppression should be included in potential mitigating measures, especially during the dry season. (4) Dust suppression should be done with water hoses in inaccessible areas where vehicular traffic is impossible. (5) Abstracted ground water could be used for dust suppression purposes since groundwater quality only marginally exceeds SANS 241: 2011 standards.
	Entrainment of dust as a result of construction vehicles.	1	2	2	1.7	3	2.3	0.8	1.9	Medium	Low	(1.) Dust suppression to be implemented along main construction roads during construction phase where necessary.

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Frequency	Duration	Severity	Extent	Consequence	Probability	Impact Significance			MITIGATION MEASURES
									Without Mitigation	Mitigation Confidence	With Mitigation	
TRAFFIC												
Decrease in road safety during construction.	Dust from heavy vehicles using the access roads to the Market Coke and Co-generation Plant site.	2	2	2	2	3	2.5	0.8	2	Medium	Low	(1.) Implementation of dust control measures.
	Compromised pavement surface on access roads.	2	2	2	2.0	3	2.5	0.6	1.5	Medium	Low	(1) Negotiations must be undertaken with the Grootegeluk Coal Mine, Department of Transport and other stakeholders with regard to the surfacing of problem areas on the coke product transport route (D2001 and R33) as well as the regular maintenance of the roads.
SOCIO-ECONOMICS												
Employment of people from local communities	Employment of construction workers	3	1	2	2.0	3	2.5	1	2.5	High	Moderate	(1.) Employment policy to give preference to employment of local people.
Safety and security for surrounding landowners	Influx of people to the construction area in search of employment	2	2	2	2.0	3	2.5	0.6	1.5	Medium	Low	(1.) Employment and procurement policies to be in place and clearly communicated to public e.g. through community leaders. (2.) Under no circumstances is recruitment to take place at the gate. (3.) Access control to be in place at the project.
CULTURAL HERITAGE												
Disturbance of heritage sites	Site clearance and excavations for the development of Market Coke and Co-generation Plant infrastructure.	2	1	5	2.7	1	1.8	0.4	0.7	Medium	Very Low	(1.) If any archaeological remains are exposed during the construction phase, construction at that site must be immediately suspended and the South African Heritage Resources Agency (SAHRA) and the Limpopo Department of Economic Development, Environment and Tourism must be informed.
ENVIRONMENTAL AWARENESS AND TRAINING												
Persons working at the plant are not aware of potential environmental and occupational health issues at the Market Coke and Co-generation Plant site.	Failure to implement environmental and occupational health awareness and training.	2	2	2	2	1	1.5	1	1.5	Medium	Low	(1.) Environmental induction training is to be undertaken by all persons undertaking work at the Plant (to be incorporated into normal induction training) including permanent workers, contractors and consultants. As part of the induction, all workers on site must be made aware of the conditions of the EMP. (2) A copy of the EMP and all environmental authorisations must be kept at the main site office. (3) A copy of the EMP must be given to each contractor on site. (4) Each contractor must keep a copy of the EMP at their office and this copy must be made available to staff. (5) It will be ensured that operators of specialist equipment are properly trained by auditing the training certificates before any job commences. (6) Employees must wear the correct PPE at all times.
PUBLIC RELATIONS												
Disturbance of sense of place.	Noise and dust emissions from construction work and increased road traffic.	3	1	2	2.0	3	2.5	0.6	1.5	Medium	Low	(1) The general public forum which is conducted by the Grootegeluk Mine, must also allow members of the community to raise their issues of concern regarding the Market Coke and Co-generation Plant project. (2) Communication between the contractors, Grootegeluk Coal Mine and the various interested and affected parties will be established and maintained. (3) A complaints register for the development will be kept at the construction camp. (4) The complaints register will record the following: Date when complaint/concern was received; Name of person to whom the complaint/concern was reported; Nature of the complaint/concern reported; The way in which the complaint/concern was addressed (date to be included). (5) Any complaints regarding the said development will be brought to the attention of the

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Frequency	Duration	Severity	Extent	Consequence	Probability	Impact Significance			MITIGATION MEASURES
									Without Mitigation	Mitigation Confidence	With Mitigation	
												Environmental Manager within 24 hours after receiving the complaint. The complaints must be investigated and remedied where possible. (6) The complaints register will be kept up to date for inspection by members of the Limpopo Department of Economic Development, Environment and Tourism.
ENVIRONMENTAL COMPLIANCE												
All environmental impacts mentioned above resulting from not implementing mitigation measures.	Non-compliance with the mitigation measures and EMP could result in negative environmental impacts during construction.	4	3	3	3.3	2	2.7	0.4	1.1	Medium	Low	(1) An environmental compliance officer will be appointed to monitor all environmental aspects relating to the construction phase. (2) The responsible person will monitor and audit the construction activities on a weekly basis and ensure compliance with this EMP and the Envrionmental Authorisation. (3) A register of environmental monitoring and auditing results will be available for inspection at the construction camp. These results should also be forwarded to the Environmental Manager of the Market Coke and Co-generation Plant on a regular basis. (4) Records relating to the compliance and non-compliance with the conditions of the Authorization and Record of Decision will be kept in good order. Such records must be made available to the Limpopo Department of Economic Development, Environment and Tourism within seven (7) working days of the date of the written request by the Department for such records.

6.3 Operation Phase

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Frequency	Duration	Severity	Extent	Consequence	Probability	Impact Significance			MITIGATION MEASURES
									Without Mitigation	Mitigation Confidence	With Mitigation	
SURFACE WATER												
Contamination of storm water	Contamination of surface water run-off. Release of dirty water into environment.	4	3	4	3.7	2	2.9	0.8	2.3	Medium	Low	(1.) Sediment originating from operation activities (e.g. runoff from unpaved roads) is to be prevented from contaminating surrounding surface water by ensuring such water is captured in the storm water management system. (2.) Dirty water run-off is to be contained and not allowed to enter into the surrounding environment. (3) All identified surface water quality monitoring points for the plant shall be monitored 6 times per annum (every 2 months). Sampling points include the Pollution Control Dam (PCD), The PCD extension and the Bosbok Dam (which will need to also be sampled during a spill event). (4) Ground and surface water monitoring results must be kept on site and made available to the Plant Manager and the Environmental Manager on a monthly basis. Potential negative impacts should be identified and addressed as soon as possible. (5) A quarterly report must be submitted to DMR/ DWA and consist of the following: Brief compliance assessment description, brief description of monitoring actions performed, highlight significant issues that require immediate corrective/ preventative action, historical and present source chemistry report, hydro chemical imaging: Piper and Durov diagrams, time dependent

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Frequency	Duration	Severity	Extent	Consequence	Probability	Impact Significance			MITIGATION MEASURES
									Without Mitigation	Mitigation Confidence	With Mitigation	
												graphs for the relevant water quality variables. (6) Appropriate storm water control measures will be maintained on the site, which will comply with the GN704 Regulations on the Use of Water for Mining and Related activities. (7) A storm water cut-off drain according to the Regulations (see 2.24) specifications will be maintained around the site. (8)The storm water control measures will be inspected on a weekly basis for signs of erosion or blockages during the first rainy season. Thereafter, inspections should occur on a monthly basis during the rainy and dry seasons. Any blockages or erosion should be repaired within 24 hours of discovery. (8) A water balance will have to be set up for the plant in order to accurately record the water usage and to monitor the potential impact on the overall Grootegeluk Coal Mine water system. (9) All spills will be contained within dedicated bunded areas (at workshops etc.) (10) All contaminated runoff and spills that escape the bunded areas will be collected and contained in the PCD and PCD extension. (11) Runoff from the upslope catchment will be diverted around the plants and associated infrastructure (12) The footprint of the Coking and Co-Generation Power Plants will be minimised as far as practical. (13) All storm water management facilities will be designed to have a risk of spill of 2% or less (1:50 year recurrence interval) in any one year (14) All pipeline routes will be inspected regularly to enable early detection of leaks (15) Sewage water will be collected in an adequately sized sump and pumped to the Grootegeluk sewage treatment plant (16) All storm water from coal and product handling facilities, as well as from the general plant area will be collected in the PCD. Surplus water will report from the PCD to the PCD extension. (17) A maintenance plan will be implemented on the storm water system to ensure that all oil skimming and sediment handling facilities are maintained and that storm water canals and pipelines remain unblocked and free flowing. (18) Bunded containment and settlement facilities will be provided for hazardous materials, such as fuel and oil. (19) Spill-sorb or a similar type product must be kept on site and used to clean up hydrocarbon spills in the event should that they occur.
Catchment Yield	Containment of runoff from the Coke and Co-generation Power Plant area	2	3	4	3	2	2.5	0.4	1.1	Medium	Low	(1) The site is located within the Grootegeluk Mine dirty water area and as such is already excluded from the natural catchment. There is therefore no incremental impact on catchment yield (2) However, the containment of additional areas on the Coke and Co-generation Power Plant results in a potential reduction in the quantity of water reporting to Bosbok Dam, incrementally reducing the amount of water available to Grootegeluk Mine for use in their process. (3) The aerial extent of the disturbed areas will be kept to a minimum (4) Upslope runoff will be diverted around the Coke and Co-generation Power Plant area.

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Frequency	Duration	Severity	Extent	Consequence	Probability	Impact Significance			MITIGATION MEASURES
									Without Mitigation	Mitigation Confidence	With Mitigation	
												(5) Water required for the process plant will be sourced first from the pollution control dam, then from the PCD Extension, then from the Grootegeluk Mine dirty (process) water system.
GROUNDWATER												
Decrease in groundwater availability	Abstraction of water for operation	2	3	4	3	2	2.5	0.4	1.1	Medium	Low	(1) Any water abstraction is to comply with water use licensing requirements. (2) Minimise water abstraction by preventing losses and through efficient use and recycling (3) All groundwater monitoring points for the plant shall be monitored on a quarterly basis. Boreholes to be monitored include WBR 50, WBR 57 and WBR 43. Both groundwater level and groundwater quality are to be measured.
Decrease in groundwater quality	Chemical pollutants from operation activities reaching groundwater	4	3	4	3.7	2	2.9	0.8	2.3	Medium	Low	(1) Pollution control measures for the protection of soils and surface water to be put in place. (2) Sampling is to be conducted by a suitably qualified and competent person using appropriate sampling techniques. The samples will be analysed at an accredited, independent laboratory for chemical and physical constituents normally associated with the presence of coal and carbonaceous material, as well as those which are specific to Market Coke and Co-generation Plant operations.
SOILS												
Loss of utilisable soils	Failure to conserve topsoil.	4	3	5	4.0	1	2.5	0.6	1.5	Medium	Very Low	(1) To minimise potential soil erosion, appropriate storm water control measures will be provided for the site, which will comply with the GN704 Regulations on the Use of Water for Mining and Related activities. (2) Topsoil stockpiles must remain protected through seeding as soon as possible, or within 30 days after the formation of the stockpile. (3) Topsoil stockpiles must remain benched and sloped to 1: 6. (4) The topsoil will be analysed to determine imbalances prior to the replacement of soil. Inorganic fertilisers will be used to supplement the soils before seeding of the area takes place.
	Compaction of soils during operation activities	2	2	4	2.7	1	1.9	0.6	1.1	Medium	Very Low	(1.) No off-road driving allowed.
Contamination of soils by chemical spills.	Spillage of hydrocarbons and other hazardous chemicals, failure to contain dirty water run-off.	3	3	4	3.3	1	2.2	0.8	1.8	Medium	Low	(1) If vehicles or machinery are serviced or maintained on site , this must be done on an impervious surfaces (hard-standing, trip trays etc.) (2) All vehicles must be checked for leaks before commencing work on site. All equipment that leaks fluid must be repaired immediately or removed from site when necessary. (3) Drip trays must be placed beneath parked vehicles which drip oil. (4) All spills of chemicals or hydrocarbons (oil, grease, diesel, petrol, etc.) will be cleaned with the use of suitable absorbent materials such as drizit or oclansorb. (5) All soils that have become contaminated with oils, fuels and lubricants must be removed and managed as hazardous waste. Bioremediation of contaminated soils shall take place should such a facility be available on site. (6) Material Safety Data (MSD) sheets for all chemicals must be displayed in close proximity to the area of storage. (7) Chemical spills are to be regarded as an environmental incident and reported through the incident reporting system. (8) Hazardous chemicals (such as those used for cleaning) must not be released into the

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Frequency	Duration	Severity	Extent	Consequence	Probability	Impact Significance			MITIGATION MEASURES
									Without Mitigation	Mitigation Confidence	With Mitigation	
												environment or sewage treatment system. These materials must be contained and disposed of as hazardous waste. (9)The integrity of the bund for hydrocarbon storage is to be monitored regularly to ensure that no seepage escapes it.
Contamination of soils by wastes.	Spillage of sewage and incorrect management and disposal of waste.	3	3	4	3.3	1	2.2	0.8	1.8	Medium	Low	(1) All waste will be classified and disposed of accordingly. No illegal dumping or disposal will take place - general waste must be disposed of at a permitted landfill site and hazardous waste must be disposed of at a permitted hazardous waste site. (2) All hazardous waste must be handled and stored on impervious surfaces.
BIODIVERSITY (FAUNA)												
Killing of fauna	Vehicle collisions. Poaching.	3	2	4	3	1	2	0.6	1.2	Medium	Low	(1.) Education of staff on safe driving and protection of animals (2.) All contractors/employees will be informed that no poaching/trapping of animals will be allowed.
BIODIVERSITY (FLORA)												
Species diversity loss of vegetation	Establishment or spread of alien species.	2	3	4	3.0	1	2.0	0.8	1.6	Medium	Low	1) Site will be inspected annually for populations of alien plants. If present, these must be removed.
AIR QUALITY												
Decrease in air quality	Entrainment of dust resulting from movement of machinery on site.	2	2	2	2.0	2	2.0	0.8	1.6	Medium	Low	(1) Appropriate measures are to be taken to minimise the generation of dust as a result of work, operations or activities. Such measures must include regular and effective wetting or chemical dust suppression of gravel access roads and working areas. (2) During windy conditions, dust generation should be minimised and dust suppression activities intensified. (3) The use of water sprays for dust suppression should be included in potential mitigating measures, especially during the dry season. (4) Dust suppression should be done with water hoses in inaccessible areas where vehicular traffic is impossible. (5) Abstracted ground water could be used for dust suppression purposes since groundwater quality only marginally exceeds SANS 241: 2011 standards.
	Entrainment of dust as a result of operation vehicles.	1	2	2	1.7	3	2.3	0.8	1.9	Medium	Low	(1) Dust suppression to be implemented along main haul roads during operation phase. (2) Trucks should not be overloaded to prevent spillages of coal feedstock or products
	Release of dust emissions from the product and feedstock handling at the Market Coke and Co-generation Plant.	3	5	2	3.3	3	3.2	1	3.2	Medium	Moderate	(1) Water sprays will be used where possible to limit coal dust generation. (2) Coal would be introduced from the coal silos to the compacting stations in a controlled manner, then push-charged into the coke ovens while maintaining positive draft , negative pressure in the coke battery ,thereby limiting fugitive emissions.
	Release of gaseous emissions from the production process at the Market Coke and Co-generation Plant.	4	5	3	4	3	3.5	1	3.5	Medium	Moderate	(1) The Market Coke and Co-generation Plant will be operated in accordance with the National Environmental Management: Air Quality Act, 2004 any applicable regulations made under this act and the Atmospheric Emissions Licence (AEL) when issued. (2) An air quality monitoring system specific to the plant will be put in place as required in terms of the legislation. The instantaneous peak, the 1-hour and 24-hour average as well as the monthly average will be obtained and the results compared to the limits in the AEL. (3) An ambient air quality monitoring programme must be set up in consultation with Grootegeluk

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Frequency	Duration	Severity	Extent	Consequence	Probability	Impact Significance			MITIGATION MEASURES
									Without Mitigation	Mitigation Confidence	With Mitigation	
												Coal Mine and Matimba Power Station. (4) Air quality monitoring results must be made available to the Market Coke and Co-generation Plant manager and the Environmental Manager of Grootegeluk Coal Mine on a monthly basis. Potential negative impacts should be identified and addressed as soon as possible. (5) An air quality monitoring report will be forwarded to the province until such time that an air quality officer for the local municipality is appointed in terms of the National Environmental Management: Air Quality Act, 2004. A copy thereof will also be forwarded to the National Department of Environmental Affairs and Tourism. (6) An operator awareness and training programme based on safety procedures would be developed and implemented in order to ensure safe operation and maintenance of the plant.
NOISE												
Increase in ambient noise levels	Transportation of operational workers and products on nearby roads.	1	3	2	2.0	2	2	0.8	1.6	Low	Low	No mitigation practicable.
	Construction activities at the Market Coke and Co-generation Plant Project.	1	3	2	2.0	1	1.5	0.8	1.2	Medium	Very Low	(1.) Where possible, scheduled maintenance is to be limited to daytime to minimise night-time noise levels. (2) All machinery to be used should be properly muffled and maintained so as to reduce noise generation to a minimum. (3) Working procedures should be structured so as to avoid the unnecessary generation of noise. (4) Standards pertaining to noise must be stipulated and monitoring for management purposes should be carried out at regular intervals. Where the standards have been exceeded, appropriate action should be taken to rectify the situation.
TRAFFIC												
Decrease in road safety during operation.	Dust from heavy vehicles using the access roads to the Market Coke and Co-generation Plant site.	2	2	2	2	2	2	0.8	1.6	Medium	Low	(1) Implementation of dust control measures.
	Compromised pavement surface on access roads.	2	2	2	2.0	3	2.5	0.6	1.5	Medium	Low	(1) Negotiations must be undertaken with the Grootegeluk Mine and other stakeholders with regard to the surfacing of problem areas on the coke product transport route (D2001 and R33) as well as the regular maintenance of the roads.
SOCIO-ECONOMICS												
Employment of people from local communities	Employment of operation workers	3	1	2	2.0	3	2.5	1	2.5	High	Moderate	(1.) Employment policy to give preference to employment of local people.
Safety and security for surrounding landowners	Influx of people to the operation area in search of employment	2	2	2	2.0	3	2.5	0.6	1.5	Medium	Low	(1.) Employment and procurement policies to be in place and clearly communicated to public e.g. through community leaders. (2.) Under no circumstances is recruitment to take place at the gate. (3.) Access control to be in place at the project.
OCCUPATIONAL HEALTH AND SAFETY												
Safety of workers at the Market Coke and Co-generation Plant.	Failure to wear adequate PPE.	3	3	4	3.3	1	2.2	0.4	0.9	Medium	Very low	(1) The Employees and contractors will adhere (at all times) to the requirements of the Occupational Health and Safety Act, 1993 (Act 85 of 1993) and the Mine Health and Safety Act, 1996 (Act 29 of 1996).

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Frequency	Duration	Severity	Extent	Consequence	Probability	Impact Significance			MITIGATION MEASURES
									Without Mitigation	Mitigation Confidence	With Mitigation	
												(2) The workers and contractors must ensure that the necessary protective gear is worn at all times.
ENVIRONMENTAL AWARENESS AND TRAINING												
Persons working at the plant are not aware of potential environmental and occupational health issues at the Market Coke and Co-generation Plant site.	Failure to implement environmental and occupational health awareness and training.	2	2	4	4	1	2.5	0.4	1	Medium	Low	(1.) Environmental induction training is to be undertaken by all persons undertaking work at the Plant (to be incorporated into normal induction training) including permanent workers, contractors and consultants. As part of the induction, all workers on site must be made aware of the conditions of the EMP. (2) An environmental awareness programme to be implemented for plant work force addressing pertinent topics as required. (3) A copy of the EMP and all environmental authorisations must be kept at the main site office. (4) A copy of the EMP must be given to each contractor on site. (5) Each contractor must keep a copy of the EMP at their office and this copy must be made available to staff. (6) It will be ensured that operators of specialist equipment are properly trained by auditing the training certificates before any job commences. (7) Employees must wear the correct PPE at all times.
PUBLIC RELATIONS												
Disturbance of sense of place.	Noise and dust emissions from operations and increased road traffic.	3	1	2	2.0	3	2.5	0.6	1.5	Medium	Low	(1) The general public forum which is conducted by the Grootegeluk Mine, must also allow members of the community to raise their issues of concern regarding the Market Coke and Co-generation Plant project. (2) Communication between the contractors, Grootegeluk Coal Mine and the various interested and affected parties will be established and maintained. (3) A complaints register for the development will be kept at the Market Coke and Co-generation Plant site. (4) The complaints register will record the following: Date when complaint/concern was received; Name of person to whom the complaint/concern was reported; Nature of the complaint/concern reported; The way in which the complaint/concern was addressed (date to be included). (5) Any complaints regarding the said development will be brought to the attention of the Environmental Manager within 24 hours after receiving the complaint. The complaints must be investigated and remedied where possible. (6) The complaints register will be kept up to date for inspection by members of the Limpopo Department of Economic Development, Environment and Tourism.
EMP IMPLEMENTATION AND MONITORING												
All environmental impacts mentioned above resulting from not implementing mitigation measures.	Non-compliance with the mitigation measures and EMP could result in negative environmental impacts during construction.	4	3	3	3.3	2	2.7	0.4	1.1	Medium	Low	(1) Monthly internal audits of EMP compliance. (2) Annual external audit of EMP compliance. (3) Submission of external annual report to environmental authorities

6.4 Decommissioning Phase

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Frequency	Duration	Severity	Extent	Consequence	Probability	Impact Significance			MITIGATION MEASURES
									Without Mitigation	Mitigation Confidence	With Mitigation	
SURFACE WATER												
Water Quality	Mobilisation of contaminants during the clean-up, demolition and rehabilitation process	4	3	4	3.7	2	2.9	0.8	2.3	Medium	Low	(1) All waste from ablution facilities will be removed and treated prior to decommissioning (2) The dirty water management system (storm water drainage canals, pollution control dam and pollution control dam extension, including erosion control measures) will remain in place until the entire site has been decommissioned and rehabilitated. These components will be decommissioned last. (3) All traces of hydrocarbons and residual waste will be cleaned up and removed from the site (4) All remaining material in the feed coal and product stockpiles will be reclaimed and removed from the site before demolition of the stockpile areas. (5) The feed coal and product stockpiles will be completely removed, (6) Once all infrastructure has been demolished and removed from site, and all waste and contaminated material (including soils) has been removed and disposed of, the site will be reshaped, rehabilitated and grassed.
Catchment yield	Clean runoff draining back to the clean water system	2	3	4	3	2	2.5	0.4	1.1	Medium	Low	(1) The decommissioning, demolition and rehabilitation processes will result in the area being clean post closure, and runoff will be suitable for release to the natural system. No further mitigation measures are considered necessary.
NOISE												
Increase in noise levels	Demolition of Market Coke and Co-generation Plant infrastructure	1	3	2	2.0	2	2.0	0.4	0.8	Low	Very Low	(1.) Where possible, demolition activities are to be limited to daytime to minimise night noise impacts.
AIR QUALITY												
Decrease in ambient air quality	Demolition of structures and movement of machinery on site	1	3	3	2.3	2	2.2	0.6	1.3	Low	Low	(1.) Dust mitigation measures to be implemented as in Construction Phase.
SOCIO-ECONOMIC												
Loss of jobs	Scaling down of operation activities	3	1	5	3.0	3	3.0	0.8	2.4	Low	Moderate	(1) Implement measures identified in the Social and Labour Plan for promoting portable skills for employees
SOILS												
Contamination of soils	Pollution due to mishandling of hydrocarbons and other hazardous substances.	2	1	2	1.7	1	1.3	0.6	0.8	High	Very Low	(1) Spill prevention measures to be implemented during decommissioning phase as in operation phase. (2) All soils that have become contaminated with oils, fuels and lubricants must be removed and managed as hazardous waste. Bioremediation of contaminated soils shall take place should such a facility be available on site.
LAND CAPABILITIES												
Reduction in land capability	Unsuccessful rehabilitation	4	1	5	3.3	2	2.7	0.6	1.6	High	Low	(1) All disturbed areas must be topsoiled, sloped and re-vegetated as soon as possible using suitable grass species. This re-vegetation will assist in reducing the potential for soil erosion. (2) The topsoil will be analysed to determine imbalances prior to the replacement of soil. Inorganic fertilisers will be used to supplement the soils before seeding of the area takes place. (3) Appropriate soil conservation measures will be provided in order to prevent soil erosion and loss of topsoil.

6.5 Post Closure Phase

ENVIRONMENTAL IMPACT	IMPACT SOURCE/DESCRIPTION	Intensity	Frequency	Duration	Severity	Extent	Consequence	Probability	Impact Significance			MITIGATION MEASURES
									Without Mitigation	Mitigation Confidence	With Mitigation	
SOCIO-ECONOMIC												
Loss of jobs	Final closure of the Market Coke and Co-generation Plant	3	1	5	3.0	3	3.0	0.8	2.4	Low	Moderate	(1) Implement measures identified in the Social and Labour Plan for promoting portable skills for employees
GROUNDWATER												
Groundwater contamination	Contamination of groundwater by possible contamination sources.	1	5	5	3.7	1	2.3	0.4	0.9	High	Very Low	(1) The groundwater monitoring programme should be continued for the period stipulated by the relevant authorities
LAND CAPABILITIES												
Reduction in land capability	Unsuccessful rehabilitation	4	1	5	3.3	2	2.7	0.6	1.6	High	Low	(1) Exxaro Reductants is to monitor success of rehabilitation for at least 3 years after closure. Should rehabilitation not prove successful, a rehabilitation specialist is to be included in the rehabilitation process.

6.6 Cumulative Impact Assessment

The process used for determining the cumulative impact assessment has been explained in section 2.6.5. Note that the cumulative impact assessment is based on an objective view of the current state of degradation of the environment and the contribution that the Market Coke and Co-generation Plant will have on the current environment.

The **existing impacts** are the current level of degradation associated with existing developments (i.e. existing Char Manufacturing Plant and Grootegeluk Mine) and developments under construction (i.e. Grootegeluk Mine Expansion Project (GMEP) and Medupi Power Station). The **incremental impacts** are the impacts of the proposed Market Coke and Co-generation Plant project *after mitigation* has been used (refer to sections 6.1 to 6.5). For the **cumulative impact** assessment, the existing impacts are added to the incremental impacts. It is important to note that for certain impacts, the significance of the cumulative impact may be less that the existing impact. This may happen in situations where the development of the project will actually minimise the existing impact. It should be noted that for the purposes of this assessment, cognisance has been given to activities within a 5 km radius of the proposed Market Coke and Co-generation Plant (refer to figure 4.42). The cumulative impacts of the project are given below:

ENVIRONMENTAL IMPACTS	IMPACT SOURCE	SIGNIFICANCE			COMMENT
		EXISTING IMPACT	INCREMENTAL IMPACT (with mitigation)	CUMULATIVE IMPACT	
Soils					
Loss of utilisable soil	Soil stripping for plant infrastructure	**Low**	**Low**	**Low**	It is not anticipated that the project will result in an increase in the significance of the loss of utilisable soils provided that soils are salvaged and used in rehabilitation.
Contamination of soils	Existing contamination from old coal stockpile. Spillage of hydrocarbons and other chemical contaminants.	**High**	**Low**	**Moderate**	The existing impact is regarded as high as coal stockpiling on the proposed Market Coke and Co-generation Plant site does have an impact on the environment. Provided that the contaminated soil is removed and either disposed of or remediated, this impact will likely improve as a result of the project.
Groundwater					
Reduction in groundwater quality	Seepage from inadequately managed storm water, spills and dirty water dams.	**Low**	**Low**	**Low**	Provided the mitigation measures are in place, the development of Market Coke and Co-generation Plant will not increase the existing impact.

Surface Water					
Change in surface water quality	Spills on the ground. Dirty water run-off reaches the surface water resources.	**Low**	**Low**	**Low**	Provided the PCD and storm water management system functions as designed, the development of the Market Coke and Co-generation Plant will not increase the existing impact.
Biodiversity					
Disturbance of habitats and species of conservation importance	Site clearance	**Low**	**Low**	**Low**	Much of the natural vegetation has been removed and replaced by mining activities in the area. The Market Coke and Co-generation Plant will not contribute significantly to this impact as the site is already disturbed. Rehabilitation must take place following plant closure to restore natural vegetation.
Air Quality					
Increased levels of gases which are considered to be contaminants of concern.	Increased emissions from the Market Coke and Co-generation Plant.	**Moderate**	**Moderate**	**Moderate**	The char manufacturing process produces gases and some of these have the potential to cause pollution. Proposed mitigation measures will be implemented for the Market Coke and Co-generation Plant project, reducing the levels of these gases within legislative limits, resulting in a moderate impact.
Increase in dust levels	Movement of vehicles and material handling at the plant.	**Moderate**	**Low**	**Moderate**	The Market Coke and Co-generation Plant is also anticipated to contribute to dust levels in the area, though as long as the mitigation measures are implemented, the cumulative impact is anticipated to continue to be moderate.
Noise					
Increase in noise levels	Vehicles, mechanical equipment and blasting.	**Low**	**Low**	**Low**	The main source of noise in the area is the neighbouring Grootegeluk Mine operations. The additional noise from the Market Coke and Co-generation Plant Project is not expected to contribute significantly to the noise levels in the area.
Social and Economic					
Employment opportunities	Additional workforce	**Moderate Positive**	**Moderate Positive**	**Moderate Positive**	The Market Coke and Co-generation Plant will result in considerable numbers of additional job opportunities during the construction and operational phases.
Reduced safety and security	Influx of new people to the area.	**Low**	**Low**	**Low**	Construction activities do result in an influx of persons into an area. This results in a risk to the safety and security of other persons in the area. The impact is however not expected to be of high significance.

Traffic					
Decrease in road safety	Dust from heavy vehicles and compromised pavement surface.	**Low**	**Low**	**Low**	This impact, though low, is difficult to mitigate. The Market Coke and Co-generation Plant should negotiate with other stakeholders to ensure that the roads are maintained and that the safety of users is not compromised.
Cultural Heritage					
Disturbance of graves and other heritage sites	Site clearance	**Very Low**	**Very Low**	**Very Low**	Due to the highly disturbed nature of the area from existing mining, there are unlikely to be any heritage sites on the site of Market Coke and Co-generation Plant. The very low impact will not change.

7 DISCUSSION

7.1 Surface water

A draft report on the Market Coke and Co-generation Plant operation impacts on surface water is given in Appendix 4. There are no major surface water features in the plant area and run-off from the area is unlikely to reach surrounding catchments. Due to the limited gradient, surface water falling on site is likely to seep into the surface or evaporate.

Of concern is the risk of water run-off from construction and plant areas becoming contaminated and this water being allowed to enter into the natural environment. This is of particular concern due to the fact that the soils on site are currently contaminated from previous use as a coal stockpiling area. Pollution control measures to manage the contaminated soil and contain hydrocarbons and other potential contaminants during the construction and operation periods are thus essential. Further, the dirty water generated on site is distinctly different from that generated on the mine, as it can potentially have high organic hydrocarbon content. It is therefore important that the same legislated requirements that are set for clean and dirty water separation must also be set for containment of dirty water on the Market Coke and Co-generation Plant site (Jones and Wagener, 2012).

Such water must be managed and prevented from entering the surrounding environment. Provision has been made for the management of dirty water from the plant, stockpile and maintenance areas and this water will be contained in the PCD and prevented from entering into the surrounding environment. The water balance model also indicates that the proposed Market Coke and Co-generation Plant project will operate at a water deficit. The PCD and PCD extension are also adequately sized to prevent spillage of contaminated water for events up to at least the 1:50 year recurrence interval. Thus, the risk of spillage from the extended PCD is very low, with a risk of less than 2% in any one year. In the unlikely event of spillage, all spills would report to the Bosbok Dam (downstream of the PCDs) and would be reused in the Grootegeluk Mine process.

Therefore, if the waste management and storm water management measures are constructed and used according to their design specifications, there are unlikely to be any negative impacts on surface water resources.

7.2 Groundwater

7.2.1 Change in Groundwater Levels

The use of water for the Market Coke and Co-generation Plant project is likely to have little effect on the groundwater levels in the nearby vicinity. This is because the plant will not be abstracting any groundwater. The plant will also not cause any groundwater recharge (increase in groundwater level) due to the impermeable linings of the PCD, PCD extension and storm water channels. Thus water on the site is unlikely to reach the water table.

7.2.2 Change in Groundwater Quality

The groundwater quality at the site is currently slightly polluted (particularly with sulphates) due to the historic use of the site as a coal stockpile area. If the storm water systems, stockpile linings and waste management measures are implemented, then there is likely to be little additional effect on groundwater quality. Regular monitoring will be required to ensure that the systems are functioning correctly and that pollutants cannot reach the groundwater. Monitoring of groundwater quality in boreholes upstream and

downstream of the site should also be undertaken. If groundwater pollution is detected, then the source must be investigated and repaired.

The contaminated soil (from the old coal stockpile) currently on the Market Coke and Co-generation Plant site will need to be removed and appropriately remedied or disposed of. This is required to ensure that the contaminated soil does not further contaminate the groundwater through the ingress of pollutants. Clean fill material must be used for the construction of the Market Coke and Co-generation Plant.

7.3 Soils and Land Capability

The clearance of soils is required for the development of the Market Coke and Co-generation Plant infrastructure. The soils on site are currently contaminated from previous use as a coal stockpiling area. Prior to the start of construction, the remaining coal layer/carbonaceous material must be removed from the Market Coke and Co-generation Plant site and either returned to the Grootegeluk beneficiation plants or be disposed of on the Grootegeluk discard dumps where there is no risk of combustion. The coal/carbonaceous material must not be stockpiled on the surrounding area

Uncontaminated soils are regarded as a valuable resource as they are essential for rehabilitation. Site development could result in loss of soils should such soils not be stripped and stockpiled correctly.

Conservation of soils requires correct stockpiling and treatment during construction and operation. The uncontaminated soil should also be protected from pollution as a result of spillage of hydrocarbons, raw sewage, chemicals, etc. The storage and handling of these substances will have to be managed to ensure minimum contamination of soils.

The impact on soils is considered to be low as any impacts that occur will be limited to the Market Coke and Co-generation Plant site. Mitigation measures such as separate stockpiling of clean soils, limiting the height of such stockpiles and erosion control measures will keep the impacts at a low level.

7.4 Ecology

A full description of the flora and fauna is provided in the specialist biological report Appendix 6. The project will have little effect on flora and fauna as the site is already highly disturbed as a result of current uses. The impact is low and no mitigation is required.

7.5 Air Quality

The operation of the Market Coke and Co-generation Plant project will result in the emissions of various gases and particulate matter (dust) that will impact on air quality. These emissions will be as a result of the chimney stack emissions from the coke ovens, material handling, dust from vehicles travelling on haul roads, dust from vehicles on the public roads and wind erosion of stockpile areas. An air quality study was undertaken to establish the project's impacts on air quality see Appendix 3 for the draft report. The study focused on gases and particulates considering impacts on human health and dust nuisance.

The impacts of the emissions of the gases studied were predicted to be below the limits for ambient air quality. The proposed Market Coke and Co-generation Plant will not add significantly to existing pollution levels in the area.

SO_2 emissions from future Market Coke and Co-generation Plant operations result in ambient SO_2

concentrations that are in compliance with the NAAQS. NOx emissions from future Market Coke and Co-generation Plant operations result in ambient concentrations below the long and short term NAAQS. Incrementally, PM10 emissions result in concentrations that are in compliance with the NAAQS.

Cumulatively the Market Coke and Co-generation Plant contributes marginally to existing background concentrations of SO_2, NOx and PM10 over a small area and in close proximity to the plant. No exceedance of the SO_2 and NO_2 NAAQS is predicted for long or short term periods at Maropong which is considered to be the closest sensitive receptor area.

Elevated background PM10 concentration is predicted in the study area with predicted PM10 cumulative concentrations in exceedance of the NAAQS over a wide area, including Maropong. The exceedance of the NAAQS PM10 limits are mainly due to mining operations at the Grootegeluk mine.

7.6 Noise

Noise impacts are likely to be minor as the Market Coke and Co-generation Plant project will take place within an existing mining area and adjacent to an existing industrial plant. The closest possible sensitive noise receptors are over 4km away and it is likely that the main noise effect is from the D2001 road adjacent to the Grootegeluk Mine.

Thus the additional noise from the Market Coke and Co-generation Plant expanded plant will have little noticeable effect.

7.7 Traffic

The draft traffic assessment report is included in Appendix 8. Current traffic levels on public roads in the area are relatively high due the large amount of construction activities in the area, these include the Eskom Medupi power station and the Grootegeluk Expansion Project. Key safety issues relate to the surface road condition, the presence of slow moving traffic and dust.

The conclusions of the traffic impact study were as follows:

- The traffic operating conditions during the am peak hour in the vicinity of Grootegeluk mine and haul routes will not be significantly affected by the implementation of the Coke and Co-gen plants.
- The possible expansion of the Char plant, over and above the implementation of the aforementioned Coke and Co-gen plants, will not be significantly affect the critical am peak hour.
- Minor intersection improvements are required by the horizon year (2021) to intersections M1 and M2 (refer to Appendix 8).
- The surfacing of the haul route will need to be replaced at the problem areas identified along the D2001 and R33. At the very least a surface treatment is recommended.
- Intersection and heavy vehicle warning signs on the approaches to the mine accesses (M1 and M4) should be erected in accordance with the South African Road Traffic Signs Manual.

Taking the above into account, the impacts associated with the proposed project can be managed and accommodated within acceptable limits. Further investigation in future may be required to determine the pavement capacity of the haul routes and the maintenance required.

7.8 Socio-Economic Impacts

Major social impacts are unlikely due to the fact that the area is already undergoing a considerable amount of development. Additional housing, infrastructure and social services are being developed in the Lephalale area to cater for the increased demand from the growing population.

As mentioned, the proposed Market Coke and Co-generation Plant will generate approximately 275 jobs, which will have a positive impact on employment in the area. Contractors are responsible for finding suitable accommodation for their construction personnel.

Since Exxaro Reductants plans to implement appropriate recruitment practices including preferences to local labour during the construction and operational phases, it is expected that the potential impacts of new people coming into the area will be curtailed.

The direct Market Coke and Co-generation Plant project operation impacts such as air quality, noise, and groundwater impacts will be limited to the site, or possibly immediate neighbours. There are no sensitive receptors which have been identified nearby.

However, as most of the potential impacts have been simulated through models, it is important that the suggested monitoring is undertaken to verify the impacts. In addition to monitoring, it is recommended that the existing Grootegeluk Mine forum includes the Market Coke and Co-generation Plant project for open communication and discussion of grievances that affected parties may have once project implementation commences.

The development of the Market Coke and Co-generation Plant will also result in the following positive socio-economic impacts:

- Employment opportunities for local people;
- Providing and additional tax base; and
- Overall contribution to South Africa's economy.

7.9 Heritage Resources

No archaeological or paleontological resources were observed on site (see Appendix 7). The impact on these resources is therefore considered to be very low. However, there is possibility of unearthing these resources during construction and this will need to be managed in accordance with the EMP.

8 ENVIRONMENTAL MANAGEMENT PROGRAMME

A detailed Environmental Management Programme is provided as a separate report as Volume 2. It includes the management actions to be implemented in the various stages of the project: planning and design phase, construction, operation, decommissioning and post closure.

Each action is linked to an objective, responsibility and schedule for implementation. Rehabilitation requirements, environmental monitoring, environmental performance assessment and public grievance mechanisms are included.

9 CONCLUSIONS AND KEY FINDINGS

This report forms part of the EIA phase of the Market Coke Plant and C-generation Plant Project environmental assessment. It outlines the results of the public participation and authority consultation processes undertaken during 2011 and 2012, explains the results of the specialist studies undertaken, assesses the environmental and socio-economic impacts and outlines mitigation measures.

The key finding of the impact assessment of the Market Coke and Co-generation Plant is that air quality impacts will be the most significant impacts, though with mitigation, the impact on air quality will be moderate. The air quality assessment has predicted that the Market Coke and Co-generation Plant will have a negligible additional impact on air quality, but the baseline impacts in the area already exceed the permitted ambient levels for PM10 dust.

As most of the assessment was undertaken using modelling exercises, it is vital that suggested monitoring is undertaken to ensure better understanding of the environmental impacts.

The EAP considers that the environmental process followed meets the requirements of the legislation to ensure that the regulatory authorities receive sufficient information to enable them to make an informed decision.

The mitigation measures which are presented in the EMP which accompanies this report are considered to be sufficient to mitigate the impacts to environmentally acceptable levels. There are no impacts which have a high significance after mitigation. There have been no fatal flaws identified during the EIA phase.

The EAP considers that the environmental process followed meets the requirements of the legislation to ensure that the regulatory authorities receive sufficient information to enable them to make an informed decision.

Synergistics Environmental Services (Pty) Ltd, as independent environmental assessment practitioners, conclude that there is no environmental reason why the development of the Market Coke and C-generation Plant Project should not be authorised with an environmental authorisation, atmospheric emissions licence and amendment of the EMP from the competent authorities. The EAP therefore considers that the project should proceed to the final EIA phase.

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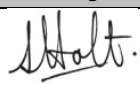
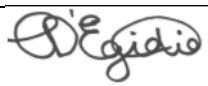
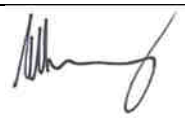
CONSULTANT'S EXPERIENCE
AND
DECLARATION OF INDEPENDENCE

Synergistics Environmental Services (Pty) Ltd is an independent environmental consultancy that was established in 2004. The company has extensive experience in environmental impact assessments; environmental management plans, programmes and systems; environmental auditing; environmental monitoring reporting; environmental performance assessments; closure and rehabilitation costing and planning; and development of environmental action plans.

Matthew Hemming is an Environmental Assessment Practitioner in South Africa has over 6 years' environmental management and assessment experience, specifically in the mining, waste and infrastructure development sectors.

The undersigned herewith declare that this report represents an independent, objective assessment of the environmental impacts associated with the proposed Market Coke and Co-generation Plant Project:

	Name	Qualification and Designation	Signature	Date
Prepared by:	Shelley Holt	BSc Hons Zoology Senior Environmental Consultant		8/11/2012
	Chiara D'Egidio	MSc Ecology, Environment and Conservation Environmental Consultant		8/11/2012
Reviewed by:	Matthew Hemming	MSc Conservation Biology Director and EAP		8/11/2012