BOHLWEKI SSI

Environmental

REVISED ENVIRONMENTAL SCOPING REPORT FOR THE PROPOSED COMBINED CYCLE GAS TURBINE (CCGT) POWER PLANT IN THE AMERSFOORT AREA, MPUMALANGA PROVINCE

(DEAT REF 12/12/20/1074)

FINAL

PROJECT OF ESKOM HOLDINGS LIMITED

AUGUST 2008

Eskom

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EXECUTIVE SUMMARY

1. INTRODUCTION

Eskom Holdings Limited (Eskom) has appointed Bohlweki-SSI Environmental as an Environmental Assessment Practitioner (EAP) to conduct the Environmental Impact Assessment (EIA) process for the proposed Combined Cycle Gas Turbine (CCGT) power plant in the Amersfoort area, in terms of the EIA regulations published in Government Notice R385 to R387 of 21 April 2006 - read with Section 24(5) and Section 44,of the National Environmental Management Act, 1998 (Act No 107 of 1998, "NEMA")(as amended).

1.1 Need and Justification of the Project

Eskom has a mandate to satisfy potential customer and economic needs, which implies certain responsibilities. One of the most significant responsibilities is to find and maintain the balance between satisfying the needs of society and remaining within the capabilities of the environment. In order to achieve this, Eskom must continually re-assess its present infrastructure and take into account new developments to ensure that there is a continued supply of electricity, without significantly impacting on the environment.

Eskom is the primary supplier of electricity in South Africa, providing approximately 95% of the electricity consumed. The decision to expand Eskom's electricity generation capacity was based on national policy and informed by on-going strategic planning undertaken by the national Department of Minerals and Energy (DME), the National Energy Regulator of South Africa (NERSA) and Eskom. Eskom applies an Integrated Strategic Electricity Planning (ISEP) process to identify long-term options regarding both the supply and demand sides of electricity provision in South Africa.

The most recently approved ISEP (October 2005) identifies the need for increased peaking supply by about 2006/7 and base load by about 2010.

Based on the above planning processes, and in order to meet the projected increase in the demand for electricity, various projects are underway and are at various stages of implementation. These include base load technologies such as coal fired plants, combined cycle gas turbines and conventional nuclear as well as peaking technologies such as pumped storage schemes and open cycle gas turbines.

Eskom is committed to investigating and evaluating various options for the diversification of the energy mix over time (including renewable resources) and as part of an ongoing effort to assess the viability/feasibility of all supply-side options, a number of power generation technologies, not yet implemented in South Africa on a commercial basis, are being evaluated in terms of technical, socio-economic and environmental aspects.

One such type of technology is Underground Coal Gasification (UCG), which has been successfully proven to be commercially viable, and Eskom plans to implement it as a fully commercially operating operation. In this current project, it is proposed that an Underground Coal Gasification-Combined Cycle Gas Turbine (UCG-CCGT) complex is constructed and operated.

The current study only focused on the **CCGT plant component** of the complex.

1.2. Overview of the Proposed Project

It is anticipated that the CCGT power plant will have approximately 2100 MW of installed capacity. The proposed project will consist of the following components:

- the CCGT power plant (comprising up to 6 units of approximately 350 MW each);
- a compressor plant;
- ignition gas plant, for unit start-up (using commercial propane);
- weather and communication mast of up to 60 meters in height and air quality monitoring station;
- high voltage yard;
- a gas pipeline from the adjacent gas cleaning plant to the CCGT;
- a water supply pipeline from the Majuba allocation or the Rietpoort Balancing Dam (for construction and operational water supply);
- electricity supply for construction;
- a water treatment plant as well as ancillary works such as other associated infrastructure;
- access roads (temporary and permanent);
- sewage treatment plant;
- storage facility for hazardous materials including cement, batching plants etc.;
- storage facility for waste (temporary and permanent storage of general and hazardous waste);
- construction village; and
- borrow pits.

The CCGT plant and associated infrastructure are required to be constructed on a site that is environmentally, economically and technical feasible. A Screening Study (Site selection) encompassing a sensitivity mapping exercise was undertaken by independent consultants in order to establish the best possible sites to evaluate during This revised Scoping Phase of the project. The purpose of such an exercise was to identify suitable areas within the wider study area that could accommodate the CCGT plant and to pro-actively identify sensitive areas that should ideally be avoided (see Chapter 5 – Site Selection Summary and Appendix H for full site selection/screening report).

2. Initial Environmental Scoping Study

2.1 Site Alternatives

The environmental studies for the proposed CCGT power plant commenced in July 2007 with a Screening Study. The Screening Study (Site selection), encompassing a sensitivity mapping exercise, was undertaken by independent consultants in order to establish the most feasible sites to evaluate during the Scoping Phase and the EIA phase of the project. The purpose of such an exercise was to identify **environmentally and technically** feasible sites within the wider study area that could accommodate the CCGT plant and to pro-actively identify sensitive areas that should ideally be avoided (see Chapter 5 – Site Selection Summary). The study area was demarcated using a 10 km radius around the UCG plant, off-coal resources.

Ten (10) sites were deemed environmentally feasible for further assessment in the Scoping phase of study. However, with workshops with the project technical team, four (4) of these sites were deemed to be no longer feasible from a technical point of view and were therefore discarded. A Scoping level assessment was conducted on the six (6) remaining sites: Sites 1, 2A, 2B, 3A, 3B and 3C. In undertaking the initial Scoping Study, Bohlweki-SSI Environmental was assisted by a number of specialists in order to comprehensively identify both potential positive and negative environmental impacts (social and biophysical) associated with the project.

After further workshops with Eskom, the sites that were nominated for further assessment during EIA in the Scoping Study (Sites 1, 3A and 3B) were no longer technically feasible. After some interventions with Eskom, the process of site evaluation and scoping undertaken had to be revised, and it resulted in a recommendation that Sites 2A (larger footprint which includes the mine), 2B and 4 were more feasible for the location and operation of the CCGT (also refer to Screening report attached – Appendix H) – these sites are now further investigated in this revised Scoping Study.

Through the public participation process that was initiated at the beginning of the Scoping phase, additional specialist studies were identified including: a Micro-economic study, a Wetland Delineation Exercise and a Soils and Agricultural Potential Study. These studies including the studies listed above have been conducted as part of this revised Environmental Scoping Study.

2.2 Other alternatives

Alternatives relating to the CCGT power plant layout, technology selection, pipeline corridors as well as access roads and construction village positioning will be further assessed during the EIA phase.

3. APPROACH TO THE ENVIRONMENTAL SCOPING STUDY (ESS) AND PUBLIC PARTICIPATION PROCESS

- **Environmental Scoping Study**

The ESS aims to provide a description of how the environment may be affected by the development of the proposed project. Desktop studies making use of existing information, and ground-truthing during site visits, were used to highlight and assist in the identification of potential impacts (biophysical, social and economic) associated with the proposed project.

Additional issues for consideration have been extracted from feedback obtained from the earlier public participation process, which commenced at the beginning of the initial Scoping phase, and will continue throughout the duration of the project. All issues identified during this phase of the study have been documented within this issues-based Environmental Scoping Report. Thus, this Environmental Scoping Report provides a record of all issues identified, and a preliminary evaluation of the significance of the issues in order to make recommendations regarding the project and further studies required to be undertaken within the EIA phase of the proposed project.

The Scoping Study aims to address the following:

- description of the sites selected for the proposed CCGT power plant and associated infrastructure;
- identification of potential positive and negative environmental (biophysical and social) impacts;
- optimisation of positive impacts to the benefit of the local environment and community; and
- undertaking of a fully inclusive public participation process to ensure that Interested and Affected Party (I&AP) issues and concerns are recorded and form part of the scoping process.

As the proposed project includes a number of listed activities from Government Notices R386 and R387 of April 2006, a full Environmental Impact Assessment process is being undertaken in a two-phased approach:

- *Phase 1:* Environmental Scoping Study (ESS) including Screening Study
- *Phase 2:* Environmental Impact Assessment and Environmental Management Plan (EMP)

A number of specialist studies were conducted in order to comprehensively identify both potential positive and negative environmental impacts (biophysical, social and economic) associated with the project. These studies are presented in Table 1 below.

Table 1 Specialist studies conducted in the Environmental Scoping Study

Specialist Study	Organisation
Hydrogeology and Hydrology	SRK Consulting
Soils and Agricultural Potential	Terra Soil Science
Fauna and Flora	Bathusi Environmental Consulting
Wetlands	SiVEST Environmental
Air Quality	Bohlweki Environmental
Noise	Jongens Keet Associates
Social Environment	MasterQ Research
Heritage	National Cultural History Museum
Visual aspects and aesthetics	MetroGIS
Risk	Riscom
Traffic	SSI Engineers and Environmental Consultants

- **Public Participation Process**

A public participation process has been undertaken as part of the Scoping process, and involved the consultation of individuals throughout the broader study area representing a range of sectors of society. To date, this consultation has included telephonic consultations, a Focus Group Meeting and documentation distributed via mail, background information documents and via the printed media. Issues and concerns raised during the Scoping process thus far have been recorded and captured within an Issues Trail (Appendix D).

4. CONCLUSIONS AND RECOMMENDATIONS

Based on the specialist studies, no environmental fatal flaws have been identified as a result of the proposed project on any of the sites evaluated. However, a number of potentially significant environmental impacts have been identified that requires further in-depth study.

Therefore, an EIA is to be undertaken in order to provide an assessment of these potential impacts and recommend appropriate mitigation measures, where required.

In the consideration of the environmental, social and economic criteria along with the technical criteria, the nominated sites for further study within an environmental impact assessment would be:

SITE NUMBER	FARM	PORTION
Revised site 2A (which includes the mine)	Bergvliet 65 HS Rietpoort 83 HS Werda 116 HS	Portion 7 Portion 4 Portion 29 of Bergvliet 65 HS and Remainder of the farm Rietpoort 83 HS
2B	Rietpoort 83 HS Werda 116 HS	Portions 3 and 4 Portion 29 of Bergvliet 65 HS and Remainder of the farm Rietpoort 83 HS
4	Rietpoort 83 HS Welgedacht 82 HS	Portion 1 Portions 2, 6 and 7

This revised Environmental Scoping Study evaluated **Sites 2A, 2B and 4**.

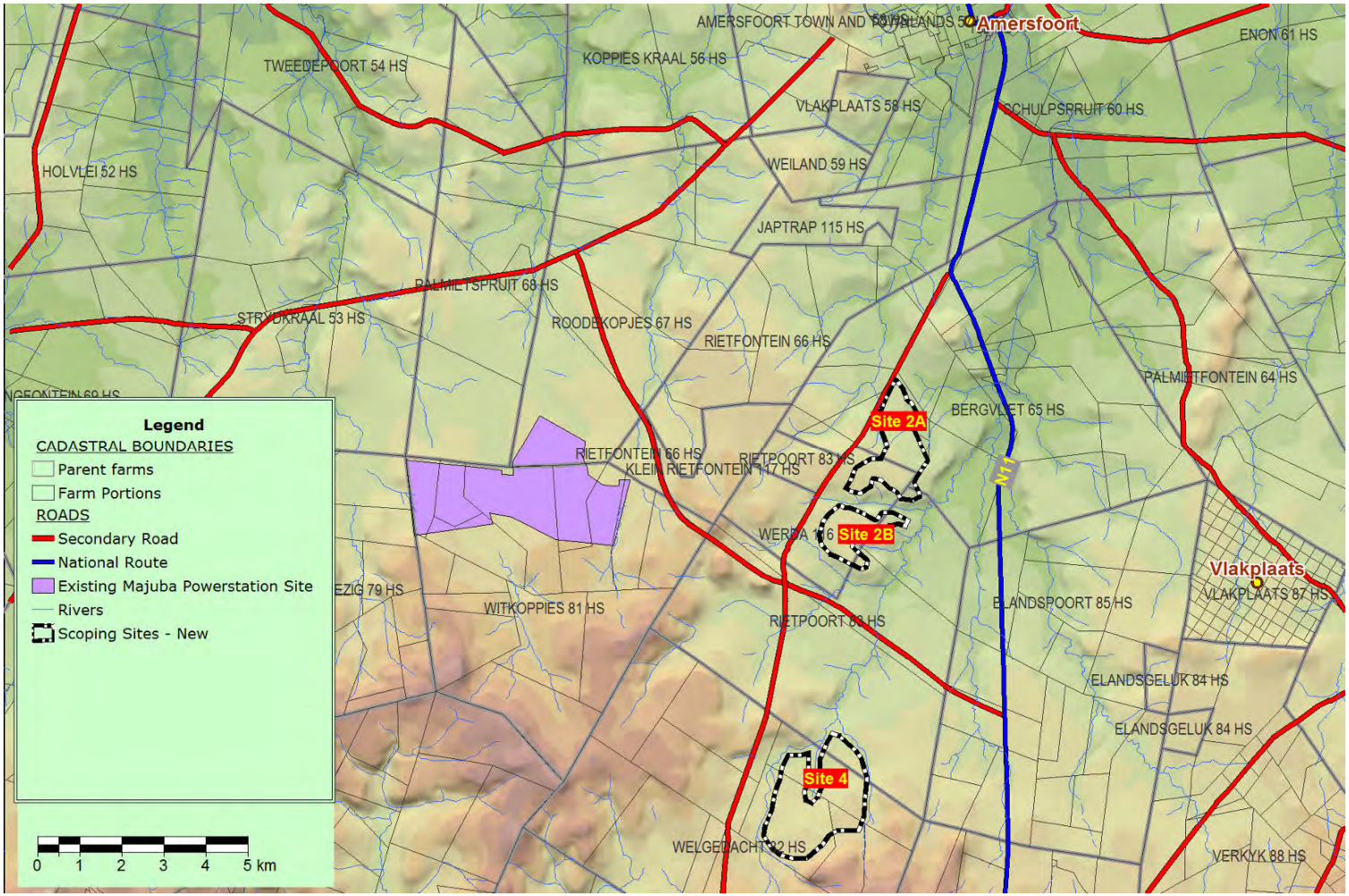

Figure 1 Three alternative environmentally and technically feasible sites identified for the development of the CCGT power plant

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GLOSSARY OF TERMS

Alternatives: means different means of meeting the general purpose and requirements of the activity, which may include site or location alternatives; alternatives to the type of activity being undertaken; the design or layout of the activity; the technology to be used in the activity and the operational aspects of the activity.

Ambient sound level or **ambient noise:** means the totally encompassing sound in a given situation at a given time, and usually composed of sound from many sources, both near and far. Note that ambient noise includes the noise from the noise source under investigation. The use of the word *ambient* should however always be clearly defined (compare with *residual noise*).

Combined Cycle Gas Turbine (CCGT): In a combined cycle power plant or CCGT plant, a gas turbine generator generates electricity and the waste heat is used to make steam to generate additional electricity via a steam turbine; this last step enhances the efficiency of electricity generation.

Cumulative impact: means the impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

Direct dry cooling: In the direct system, steam from the last stage turbine blades is channelled directly into radiator-type heat exchangers adjacent to the turbine hall of the power station (there are no cooling towers.). The heat is conducted from the steam to the metal tubes of the exchanger. Air passing through the exchanger is supplied by a number of electrically driven fans. The air removes the heat, thus condensing the steam back into water which will be used once again to produce steam in the boiler.

Do-nothing alternative: The 'do-nothing' alternative is the option of not undertaking the proposed activity.

Environmental impact assessment, in relation to an application to which scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application as defined in NEMA.

Environmental Screening Study: An exercise to identify suitable areas within the study area that could accommodate the CCGT plant and to pro-actively identify sensitive areas that should ideally be avoided.

Gas turbine: The gas turbine (also called a combustion turbine) is a rotary engine that extracts energy from a flow of combustion gas and is the first stage in the process of producing electricity through the CCGT plant.

Indirect dry cooling: Indirect dry cooling systems have a condenser and turbine exhaust system as for wet systems, with the circulating water being passed through finned tubes in a natural draught cooling tower.

Interested and affected party: any person, group of persons or organisation interested in or affected by an activity; and any organ of state that may have jurisdiction over any aspect of the activity.

Outflow of labourers: Locals who secure employment with the contractors might also receive training, thereby enabling them to secure more permanent employment, which in turn might cause them to move out of the area and becoming part of the migrant labour force.

Phase 1 Archaeological Survey: Walk through the entire footprint of the preferred site/s and document any/all heritage resources that exist on the site/s.

Plan of study for environmental impact assessment: means a document which forms part of a scoping report and sets out how an environmental impact assessment must be conducted.

Public participation process: means a process in which potential interested and affected parties are given an opportunity to comment on, or raise issues relevant to, specific matters.

Red Data species: Species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species, and/or in terms of the South African Red Data List. In terms of the South African Red Data List, species are categorised as being extinct, endangered, vulnerable, rare, indeterminate, insufficiently known or not threatened.

Underground coal gasification: UCG is a process carried out on “unminable” coal seams. These are coal seams that cannot be mined by using the conventional coal mining methods e.g. open cast or underground mining. UCG involves injecting steam and air (or oxygen) into a cavity created in an underground coal seam, to form a synthetic natural gas.

Vadose zone: The portion of Earth between the land surface and zone of saturation. It extends from the top of the ground surface to the water table.

Vulnerable (vegetation): Vegetation types that have lost up to 20% of their original extent, which could result in some ecosystem function being altered.

ABBREVIATIONS AND ACRONYMS

CCGT	Combined cycle gas turbine
DEAT	Department of Environmental Affairs and Tourism
DME	Department of Minerals and Energy
DWAF	Department of Water Affairs and Forestry
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ESS	Environmental Scoping Study
FGM	Focus Group Meeting
HRSG	Heat recovery steam generator
I&AP	Interested and Affected Party
IEP	Integrated Energy Planning
ISEP	Integrated Strategic Electricity Plan
KSW	Key Stakeholder Workshop
MDALA	Mpumalanga Department of Agriculture and Land Administration
NEMA	National Environmental Management Act (Act No 107 of 1998)
NERSA	National Energy Regulator of South Africa
NGO	Non-Governmental Organisation
NHRA	National Heritage Resources Act (Act No 25 of 1999)
SAHRA	South African Heritage Resources Agency
SANRAL	South African National Roads Agency Limited
UCG	Underground coal gasification

1. INTRODUCTION

Eskom Holdings Limited (Eskom) is mandated by the South African Government to ensure the provision of reliable and affordable power to South Africa. Eskom currently generates approximately 95% of the electricity used in South Africa. Electricity cannot be stored in large quantities and must be used as it is generated. Therefore, electricity must be generated in accordance with supply-demand requirements. Eskom's core business is in the generation, transmission (transport), trading and retail of electricity. In terms of the Energy Policy of South Africa "energy is the life-blood of development". Therefore, the reliable provision of electricity by Eskom is critical for industrial development and related employment and sustainable development in South Africa.

1.1 Energy Policy Framework

Eskom is the primary supplier of electricity in South Africa, providing approximately 95% of the electricity consumed. The decision to expand Eskom's electricity generation capacity was based on national policy and informed by on-going strategic planning undertaken by the national Department of Minerals and Energy (DME), the National Energy Regulator of South Africa (NERSA) and Eskom. The hierarchy of policy and planning documentation that reflects this state of affairs is illustrated by Figure 1.1 and described below.

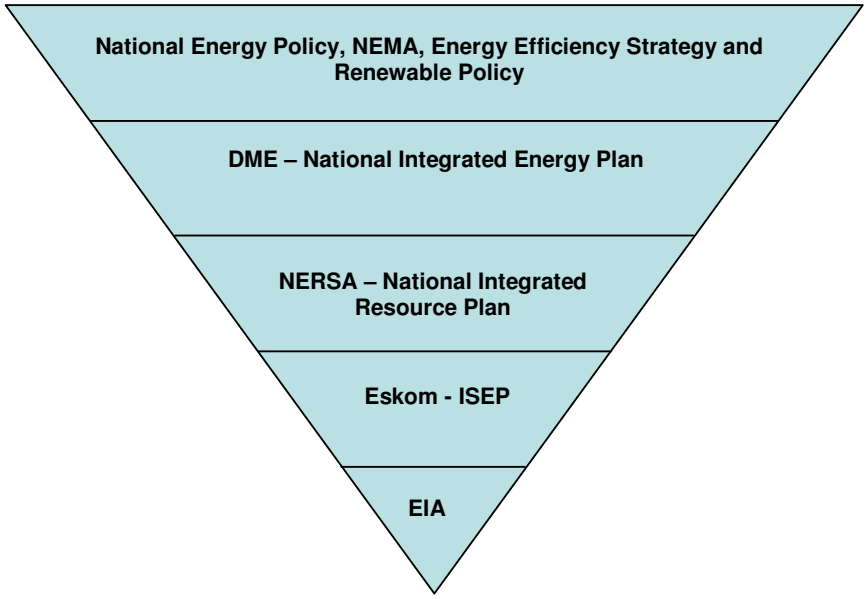

Figure 1.1 Hierarchy of policy and planning documents (courtesy of Ninham Shand)

1.1.1 White Paper on the Energy Policy of the Republic of South Africa – 1998

Development within the energy sector in South Africa is governed by the White Paper on the Energy Policy, published by DME in 1998.

This White Paper sets out five objectives for the further development of the energy sector. The five objectives are as follows:

- Increased access to affordable energy services;
- Improved energy governance;
- Stimulating economic development;
- Managing energy-related environmental and health impacts; and
- Securing supply through diversity.

Furthermore, the Energy Policy identified the need to undertake an Integrated Energy Planning (IEP) process in order to achieve a balance between the energy demand and resource availability, whilst taking into account health, safety and environmental parameters. In addition, the policy identified the need for the adoption of a National Integrated Resource Planning (NIRP) approach to provide a long-term cost-effective resource plan for meeting electricity demand, which is consistent with reliable electricity supply and environmental, social and economic policies.

1.1.2 Integrated Energy Plan (IEP) – 2003

The DME commissioned the IEP to provide a framework in which specific energy policies, development decisions and energy supply trade-offs can be made on a project-by-project basis. The framework is intended to create a balance in providing low cost electricity for social and economic development, ensuring a security of supply and minimising the associated environmental impacts.

The IEP projected that the additional demand in electricity would necessitate an increase in electricity generation capacity in South Africa by 2007. Furthermore, the IEP has concluded that, based on energy resources available in South Africa, coal will be the primary fuel source for the current expansion period.

1.1.3 National Integrated Resource Plan (NIRP) – 2003/2004

In response to the White Paper's objective relating to affordable energy services, the National Electricity Regulator (now NERSA) commissioned a National Integrated Resource Plan (NIRP). The objective of the NIRP is to determine the least-cost supply option for the country, provide information on the opportunities for investment into new power stations and evaluate the security of supply.

The national electricity demand forecast took a number of factors into account. These are:

- A 2.8% average annual economic growth;
- The development and expansion of a number of large energy-intensive industrial projects;
- Electrification needs;
- A reduction in electricity-intensive industries over the 20 year planning horizon;

- A reduction in electricity consumers – NIRP anticipates people switching to the direct use of natural gas;
- The supply of electricity to large mining and industrial projects in Namibia and Mozambique; and
- Typical demand profiles.

The outcome of the NIRP determined that while the coal-fired option of generating electricity would still be required over the next 20 years, additional energy generation facilities would be required by 2007.

1.1.4 Eskom Integrated Strategic Electricity Planning (ISEP) – 2005

Eskom applies an Integrated Strategic Electricity Planning (ISEP) process to identify long-term options regarding both the supply and demand sides of electricity provision in South Africa. The most recently approved ISEP plan identifies the need for increased peaking supply by about 2006/7 and base load by about 2010. Figure 1.2 overleaf illustrates Eskom's "project funnel", which shows the range of supply options being considered by Eskom to meet the increasing demand for electricity in the country. There are currently a number of projects in the project funnel ranging from research projects to new-build projects. Research projects include a demonstration solar power project, underground coal gasification and the pebble bed modular reactor (PBMR). Three 'mothballed' stations, *viz.* the Camden, Komati and Grootvlei power stations, are currently being returned-to-service, and are therefore reflected in the 'build' portion of the funnel diagram.

Based on the above planning processes, and in order to meet the projected increase in the demand for electricity, various projects are underway and are at various stages of implementation. These include base load technologies such as coal fired plants, combined cycle gas turbines and conventional nuclear as well as peaking technologies such as pumped storage schemes and open cycle gas turbines.

Eskom is committed to investigating and evaluating various options for the diversification of the energy mix over time (including renewable resources) and as part of an ongoing effort to assess the viability/feasibility of all supply-side options, a number of power generation technologies, not yet implemented in South Africa on a commercial basis, are being evaluated in terms of technical, socio-economic and environmental aspects. One such type of technology is Combined Cycle Gas Turbine (CCGT) Power plant that uses gas from an Underground Coal Gasification (UCG) process as a primary energy, which has been successfully proven to be commercially viable in other countries. Eskom plans to use the gas from the UCG facility, which will be implemented as a full commercial operation, as a primary source of fuel for the CCGT power plant to be implemented as a full commercial operation. In this current project, it is proposed that an Underground Coal Gasification-Combined Cycle Gas Turbine (UCG-CCGT) complex is constructed and operated, as explained below.

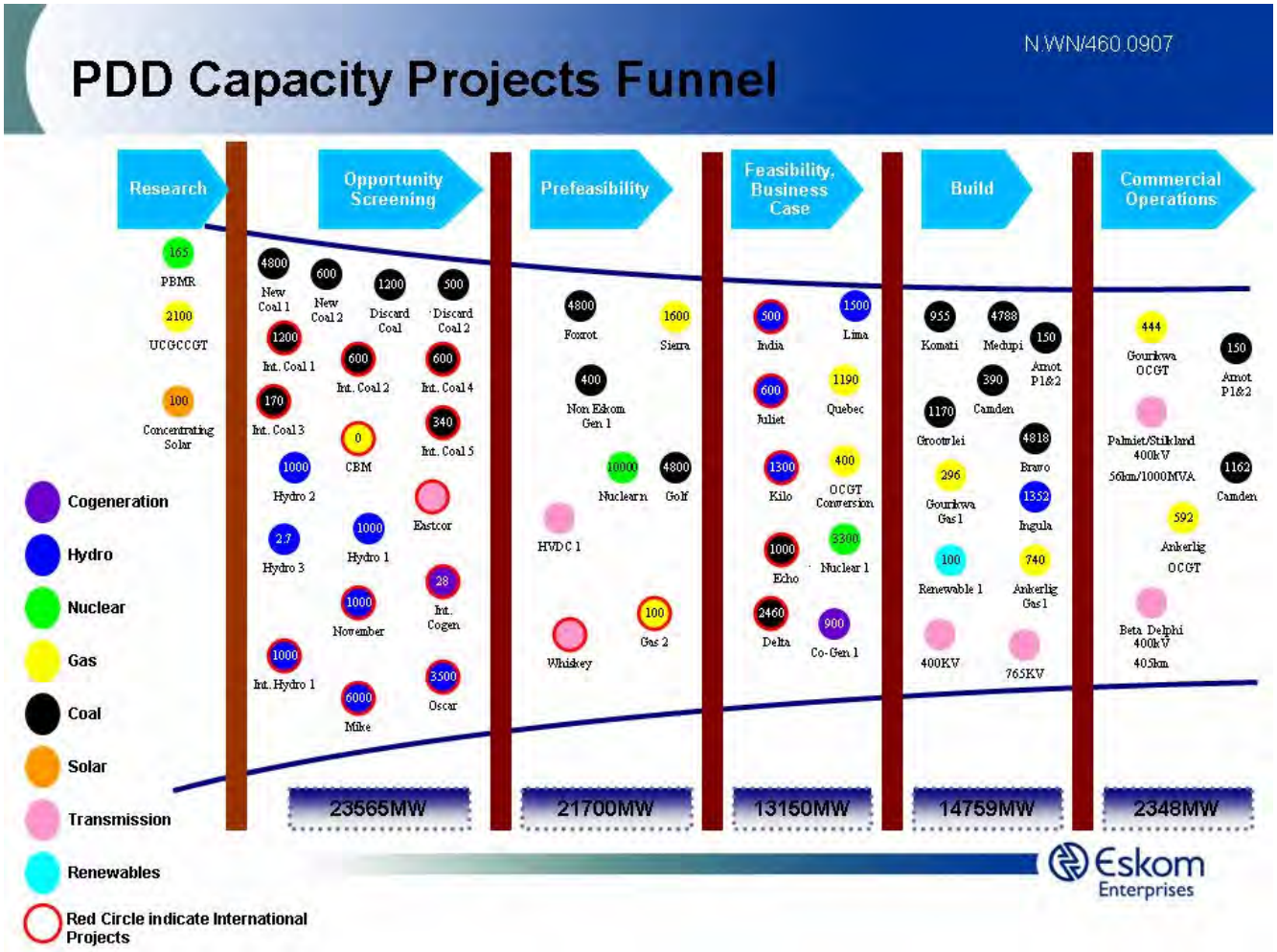

Figure 1.2 Project funnel

UCG is a process carried out on coal seams that are not economically viable to mine through conventional mining methods, such as open cast or underground mining. UCG involves injecting steam and air (or oxygen) into a cavity created in an underground coal seam, to form a synthetic burnable natural gas. The burnable natural gas from the UCG plant in the Majuba area will be used as fuel for combined cycle gas turbine (CCGT) technology thus the development of a UCG-CCGT power complex and co-firing with coal in the Majuba power station. The UCG plant on the farm Roodekopjes, Mpumalanga, has proven to be technically feasible for operation beyond the pilot plant level, and its area of operation will expand to identified nearby coal resources in the future.

In a CCGT plant, a gas turbine generator generates electricity and the waste heat is used to make steam to generate additional electricity *via* a steam turbine; this last step enhances the efficiency of electricity generation. As a result, most new gas power plants in North America and Europe are of this type.

The current study only focuses on the **CCGT plant component** of the complex.

1.2 Overview of the Proposed Project

The project involves the establishment of a CCGT power plant and associated infrastructure in the Amersfoort area, Mpumalanga Province (refer to Figure 1.3 – Locality Map). It is anticipated that the CCGT power plant will have approximately 2100 MW of installed capacity. The proposed project will consist of the following components:

- the CCGT power plant (comprising up to 6 units of approximately 350 MW each);
- a compressor plant;
- ignition gas plant, for unit start-up (using commercial propane);
- weather and communication mast of up to 60 meters in height and air quality monitoring station;
- high voltage yard;
- a gas pipeline from the adjacent gas cleaning plant to the CCGT;
- a water supply pipeline from the Majuba allocation or the Rietpoort Balancing Dam (for construction and operational water supply);
- electricity supply for construction;
- a water treatment plant as well as ancillary works such as other associated infrastructure;
- access roads (temporary and permanent);
- sewage treatment plant;
- storage facility for hazardous materials including cement, batching plants etc.;
- storage facility for waste (temporary and permanent storage of general and hazardous waste);
- construction village; and
- borrow pits.

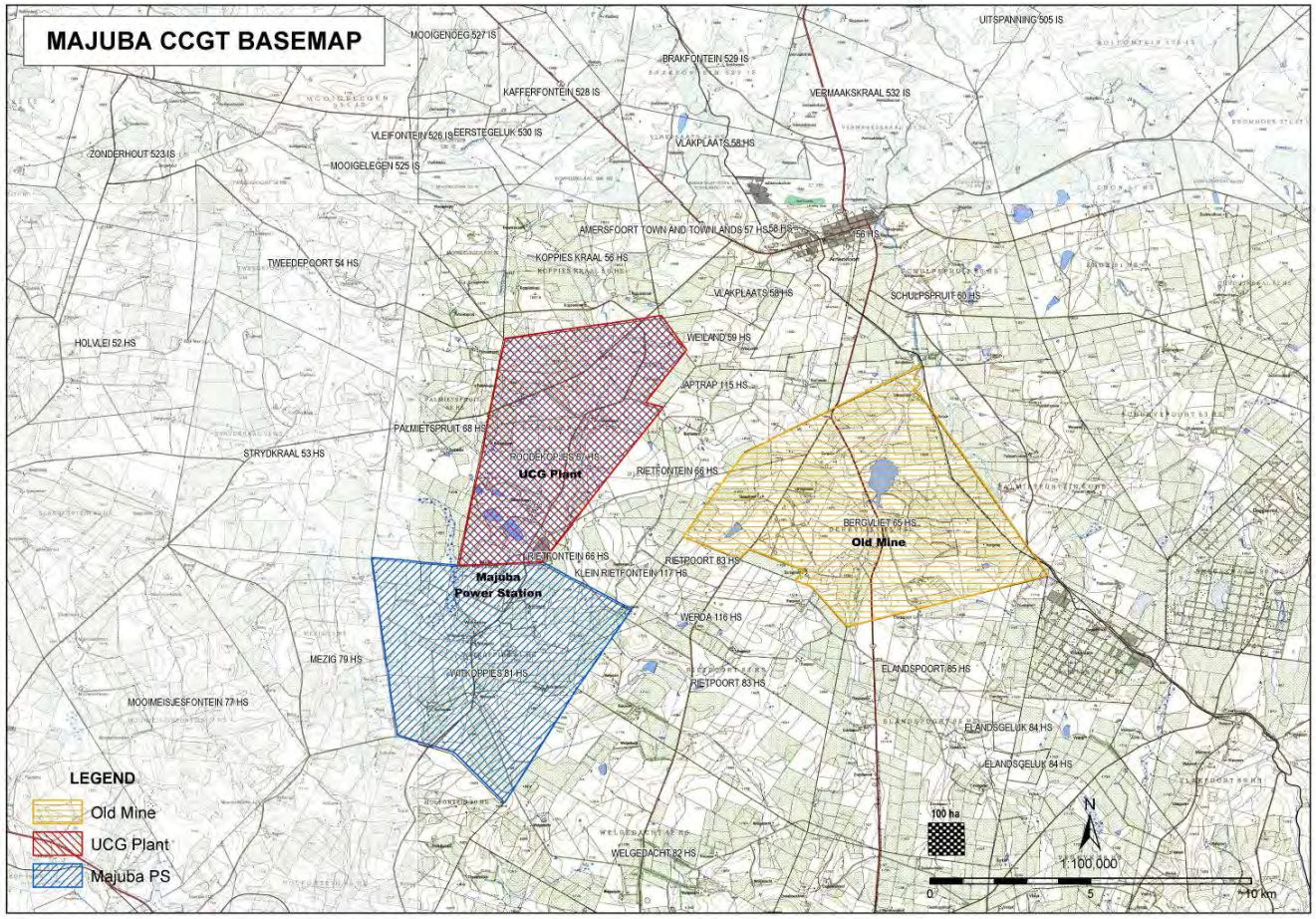

Figure 1.3 Locality Map

1.3 Initial Environmental Scoping Study

The environmental studies for the proposed CCGT power plant commenced in July 2007 with a Screening Study. The Screening Study (Site selection) encompassing a sensitivity mapping exercise was undertaken by independent specialists in order to establish the best possible sites to evaluate during the Scoping Phase of the project. The purpose of such an exercise was to identify **environmentally** feasible sites within the wider study area that could accommodate the CCGT plant and to pro-actively identify sensitive areas that should ideally be avoided (see Chapter 5 – Site Selection Summary). The study area was demarcated using a 10 km radius around the UCG plant, off-coal resources.

At the commencement of the site selection process, ten (10) sites were identified. With the refinement of technical information, these ten (10) sites were then narrowed down to six (6) sites, of which four (4) sites were discounted for the CCGT plant because they were earmarked for extension of the UCG project, since they have coal resources. The Scoping level assessment was conducted on the six (6) remaining sites: Sites 1, 2A, 2B, 3A, 3B and 3C. In undertaking the previous Scoping Study, Bohlweki-SSI Environmental was assisted by a team of specialists (as shown in Table 1.1 below) to comprehensively identify both potential positive and negative environmental impacts (social and biophysical) associated with the project, per specialist field.

Table 1.1 Showing the list of specialist studies undertaken:

Specialist Study	Organisation
Hydrogeology and Hydrology	SRK Consulting
Fauna and Flora	Bathusi Environmental Consulting
Air Quality	Bohlweki-SSI Environmental
Noise	Jongens Keet Associates
Social	MasterQ Research
Visual aspects and aesthetics	MetroGIS
Heritage	National Cultural History Museum
Risk	Riscom
Traffic	SSI Engineers and Environmental Consultants

Further refinement of the scoping phase with some technical criteria used in the screening phase resulted in three (3) sites nominated for further assessment in the EIA phase (**Site 1, Site 3A and Site 3B** being deemed no longer feasible. from a technical point of view. On investigation of the sites delineated for expansion of the UCG operation, Site 4 was found to have devolatised coal, rendering it unsuitable for the expansion project, and thus available for location of the CCGT plant. Also, at scoping phase, due to the challenges faced with the current sites (as explained in the Screening report), it was decided to relax the requirement of proximity to the UCG operation, and for the process to have a re-look at the sites. Thus the process of site evaluation, with the proponent, recommended that **Site 2A** (with a larger footprint which includes the closed mine), **Site 2A** and **Site 4** were more feasible for the location and operation of the CCGT (also refer to Screening report attached) – these sites are now further investigated in this revised Scoping Study.

Through the public participation process that was initiated at the beginning of the Scoping phase, additional specialist studies were identified including: a Micro-economic study, a Wetlands Delineation study and a Soils and Agricultural Potential Study. These studies

including the studies listed in Table 1.1 above were conducted as part of this revised Environmental Scoping Study.

1.4 Environmental Legal Requirements

In order to protect the environment and ensure that this development is undertaken in an environmentally responsible manner, there are a number of significant pieces of environmental legislation that focus this assessment. They are the following:

1.4.1 The Constitution of South Africa

The Bill of Rights, in the Constitution of South Africa (No. 108 of 1996), states that everyone has a right to a non-threatening environment and requires that reasonable measures are applied to protect the environment. This protection encompasses preventing pollution and promoting conservation and environmentally sustainable development. These principles are embraced in NEMA and given further expression.

1.4.2 The National Environmental Management Act

The National Environmental Management Act (NEMA) (No. 107 of 1998) states that the principles of Integrated Environmental Management (IEM) should be adhered to in order to ensure sustainable development. A vital underpinning of the IEM procedure is accountability to the various parties that may be interested in or affected by a proposed development. Public participation is a requirement of the IEM procedure, in terms of the identification of potentially significant environmental impacts during the Scoping Phase. The IEM procedure aims to ensure that the environmental consequences of development proposals are understood and adequately considered during all stages of the project cycle, and that negative aspects are resolved or mitigated and positive aspects enhanced.

Furthermore, Section 28(1) of the Act states that “every person who causes or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring”. If such pollution cannot be prevented then appropriate measures must be taken to minimise or rectify such pollution. Eskom therefore has the responsibility to ensure that the proposed activity as well as the EIA process conforms to the principles of the National Environmental Management Act. In developing the EIA process Bohlweki have been cognisant of this need, and accordingly the EIA process undertaken here has been informed by the underlying NEMA principles.

The NEMA EIA regulations, which replace the Environment Conservation Act - ECA EIA regulations, have been promulgated and came into effect on 3 July 2006. Sections 24 and 24D of NEMA, as per Government Notices R386 and R387 of April 2006, contain a schedule of activities that may have substantial detrimental effects on the environment and which require authorisation from the competent environmental authority.

The nature of the proposed project includes activities listed in these schedules. The primary triggers are (according to Government Notice R387):

The construction of facilities or infrastructure, including associated structures or infrastructure, for:

***Activity 1(a)** - the generation of electricity where –*

- *the electricity output is 20 megawatts or more; or*
- *the elements of the facility cover a combined area in excess of 1 hectare.*

***Activity 1(c)** - the above ground storage of a dangerous good, including petrol, diesel, liquid petroleum gas or paraffin, in containers with a combined capacity of 1000 cubic meters or more at any one location or site including the storage of one or more dangerous goods, in a tank farm.*

***Activity 1(e)** - any process or activity which requires a permit or license in terms of legislation governing the generation or release of emissions, pollution, effluent or waste and which is not identified in Government Notice No. R. 386 of 2006.*

***Activity 1(f)** – the recycling, re-use, handling, temporary storage or treatment of general wate with a throughput capacity of 50 tons or more daily average measure over a period of 30 days.*

***Activity 1(g)** – the use, recycling, handling, treatment, storage or final disposal of hazardous waste.*

***Activity 1(j)** - the bulk transportation of dangerous goods using pipelines, funiculars or conveyors with a throughput capacity of 50 tons or 50 cubic meters or more per day.*

***Activity 1(l)** - the transmission and distribution of above ground electricity with a capacity of 120 kilovolts or more.*

***Activity 1(p)** – the treatment of effluent, wastewater or sewage with an annual throughput capacity of 15 000 cubic meters or more.*

***Activity 2** - Any development activity, including associated structures and infrastructure, where the total area of the developed area is, or is intended to be, 20 hectares or more.*

***Activity 7** – Reconnaissance, exploration, production and mining as provided for in the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), as amended in respect of such permits and rights.*

***Activity 8** - In relation to permits and rights granted in terms of 7 above, or any other right granted in terms of previous mineral legislation, the undertaking of any reconnaissance exploration, production or mining related activity or operation within a exploration, production or mining area, as defined in terms of section 1 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).*

The proposed project may entail various other actions that would also be construed as scheduled activities in terms of Government Notice R386 and thus require authorisation. These include:

Activity 1(m) - *The construction of facilities or infrastructure, including associated structures or infrastructure for any purpose in the one in ten year flood line of a river or stream, or within 32 metres from the bank of a river or steam where the fold line is unknown, excluding purposes associated with existing residential use, but including:*

(i) canals;
(ii) channels;
(iii) bridges;
(iv) dams; and
(v) weirs.

Activity 1(s) *- the treatment of effluent, wastewater or sewage with an annual throughput capacity of more than 2 000 cubic metres but less than 15 000 cubic meters.*

Activity 12 *- The transformation or removal of indigenous vegetation of 3 hectares or more or of any size where the transformation or removal would occur within a critically endangered or an endangered ecosystem listed in terms of section 52 of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).*

Activity 13 *- The abstraction of groundwater at a volume where any general authorisation issued in terms of the National Water Act, 1998 (Act No. 36 of 1998) will be exceeded.*

Activity 14 *- The construction of any masts of any material or type and of any height, including those used for telecommunication broadcasting and radio transmission, but excluding –*

(a) masts of 15 meters and lower exclusively used
(i) by radio amateurs; or
(ii)for lighting purposes
(b) flag poles; and
(c) lightning conductor poles.

Activity 15 *- the construction of a road that is wider than 4 metres or that has a reserve wider than 6 metres, excluding roads that fall within the ambit of another listed activity or which are access roads of less than 30 metres long.*

Activity 16 (b) *- The transformation of undeveloped, vacant or derelict land to residential, mixed, retail, commercial, industrial or institutional use where such development does not constitute infill and where the total area to be transformed is bigger than 1 hectare.*

Activity 18 *– The subdivision of portions of land 9 hectares or larger into portions of 5 hectares or less.*

It is thus clear that the proposed project includes activities listed under Regulations 386 and 387, which has the effect that a Scoping and EIA Application, as prescribed in Regulations 27

to 36 (Scoping and EIA Process – Regulation 387) of the NEMA Environmental Impact Assessment Regulations (Regulation 385), will have to be submitted by the applicant.

While other approvals (e.g. DME approval for borrow pits to provide material for the construction of access roads) are likely to be required for this development, construction can only proceed if an environmental approval is granted according to the NEMA regulations. This study is therefore in accordance with Chapter 5 of the NEMA.

All other potential environmental permitting requirements that are potentially applicable to the project including national, provincial and/or local legislation are listed in Appendix A. Specific legal requirements will be expanded upon within the EIA phase of the project.

1.4.3 Legal requirements in terms of other Acts

In addition to the NEMA and the Constitution, the following Acts may have some bearing on the proposed activities:

- The National Heritage Resources Act (No. 25 of 1999): The proposed CCGT power plant and associated infrastructure is to comprise certain activities that require authorisation in terms of this Act. The requirements of the National Heritage Resources Act will be addressed as an element of this study. Section 38 (8) of the Act states that if heritage considerations are taken into account as part of an application process undertaken in terms of the ECA, there is no need to undertake a separate application in terms of the National Heritage Resources Act. This is also applicable to applications in terms of NEMA. The Mpumalanga offices of the South African Heritage Resource Agency (SAHRA) will be provided with all relevant documentation, since they have a statutory role to play in the decision-making process, acting as commenting authorities.

- The Minerals and Petroleum Resources Development Act (No. 28 of 2002): Comment will be sought from DME, which will then be forwarded to DEAT to consider during their decision-making process. In order to mine borrow pits to provide material for roads, Eskom will need to apply to DME (as the competent authority) for a Mining Permit, though it is not at this stage certain whether borrow pits will need to be established as part of this project – should commercial sources of the required material be available, use may be made of these instead of establishing borrow pits. Should borrow pits be required, an appropriate application will be made independently of the current EIA process, since the DME is the agent for such authorisation.

- The Air Pollution Prevention Act (No. 45 of 1965): As the proposed activities would entail emissions to the atmosphere, particularly during the construction phase, this Act requires that a permit application be submitted to the Chief Air Pollution Control Officer (CAPCO) by Eskom. However, this Act is scheduled to be entirely replaced by the National Environmental Management: Air Quality Act (see below).

- National Environmental Management: Air Quality Act (No. 39 of 2004): This Act was promulgated in February 2005 but has not yet fully come into force. It aims to reform current air quality law and provide national standards regulating the monitoring, management and

control of air quality, while at the same time promoting justifiable economic and social development. It requires that Eskom applies for an atmospheric emissions licence. However, in the transition period before this Act is completely enacted, Eskom can apply for a registration certificate in terms of the Air Pollution Prevention Act (see above).

1.5 Environmental Study Requirements

The environmental impacts associated with the proposed project require investigation on compliance with the Environmental Impact Assessment Regulations published in Government Notice No. R. 385 to No. R. 387 and read with Section 24 (5) of the National Environmental Management Act - NEMA (Act No 107 of 1998)(as amended). The required environmental studies include the undertaking of an Environmental Impact Assessment (EIA) process. This process is being undertaken in two phases:

- Phase 1: Environmental Scoping Study (ESS) phase (including Site selection and Screening exercise); and
- Phase 2: Environmental Impact Assessment (EIA) phase and Environmental Management Plan (EMP).

This ESS will recommend the most favourable alternative site/s for the CCGT power plant and ancillary infrastructure for further investigation in the EIA phase. In addition, this ESS also provides a record of all issues identified by the public participation process, in order to make recommendations regarding any further investigations required within an EIA and EMP.

The Environmental Impact Assessment phase will aim to achieve the following:

- to provide an overall assessment of the social and biophysical environments of the affected area by the proposed construction of the CCGT plant and associated infrastructure;
- to undertake a detailed assessment of the preferred site/s in terms of environmental criteria including the rating of significant impacts;
- to identify and recommend appropriate mitigation measures (to be included in an EMP) for potentially significant environmental impacts; and
- to undertake a fully inclusive public participation process to ensure that I&AP issues and concerns are recorded and commented on and addressed in the EIA process.

Bohlweki-SSI Environmental (Bohlweki) has been appointed as an Environment Assessment Practitioner (EAP), by Eskom, to undertake the appropriate environmental studies for this proposed project. The professional team of Bohlweki has considerable experience in the environmental management and EIA fields.

Bohlweki-SSI Environmental has been involved in and/or managed several of the largest Environmental Impact Assessments undertaken in South Africa to date. A specialist area of focus is on assessment of multi-faceted projects, including the establishment of linear developments (national and provincial roads, and power lines), bulk infrastructure and supply (e.g. wastewater treatment works, pipelines, landfills), electricity generation and transmission, the mining industry, urban, rural and township developments, environmental aspects of Local

Integrated Development Plans (LIDPs), as well as general environmental planning, development and management. Contact details for Bohlweki-SSI Environmental are:

Bohlweki-SSI Environmental
Building No. 5, Country Club Estate
21 Woodlands Drive
Woodmead
Gauteng
Tel: (011) 798-6001
Fax: (011) 798-6010

2. TECHNICAL DESCRIPTION OF THE PROJECT

2.1 What is a Combined Cycle Gas Turbine (CCGT) Plant?

A CCGT power plant uses a cycle configuration of gas turbines, heat recovery steam generators (HRSGs) and steam turbines to generate electricity (see Figure 2.1 below). A combined cycle is characteristic of a power producing engine or plant that employs more than one thermodynamic cycle. Heat engines are only able to use a portion of the energy their fuel generates (usually less than 50%). The remaining heat from combustion is generally wasted. The combination of two or more "cycles" such as the Brayton Cycle and Rankine Cycle results in improved overall efficiency.

In a CCGT power plant, a gas turbine generator generates electricity and the 'waste' heat is utilised to produce steam to generate additional electricity *via* a steam turbine cycle; this last step enhances the efficiency of overall electricity generation. In a thermal power plant, high-temperature heat as input to the power plant, usually from burning of fuel, is converted to electricity as one of the outputs and low-temperature heat as another output. As a rule, in order to achieve high efficiency, the temperature difference between the input and output heat levels should be as high as possible (Carnot efficiency). This is achieved by combining the Rankine (steam) and Brayton (gas) thermodynamic cycles.

The CCGT plant has a boiler called a Heat Recovery Steam Generator (HRSG) which produces steam using the exhaust gas at approximately 600 °C from an open cycle gas turbine. The steam is then used to drive the steam turbine which is also linked to the generator.

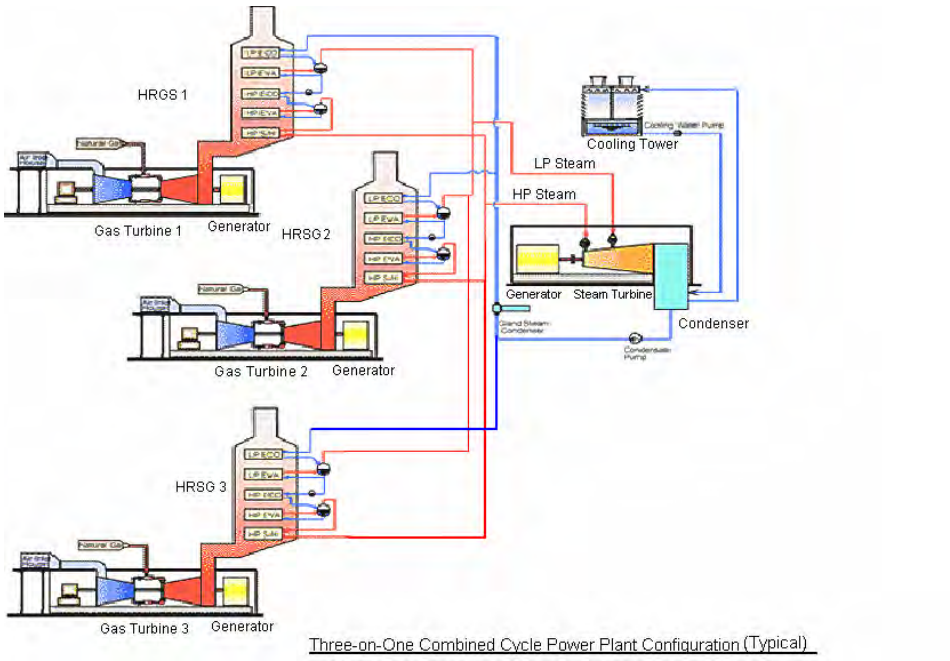

Figure 2.1 A typical 3-in-1 CCGT power plant configuration, in model form

2.2 How does a Combined Cycle Gas Turbine (CCGT) work?

The gas turbine (also called a combustion turbine or just the turbine element) is a rotary engine that extracts energy from a flow of combustion gas, and is the first stage in the process of producing electricity through a CCGT plant. It has an upstream compressor coupled to a downstream turbine, and a combustion chamber in-between. Figure 2.2 is the schematic of a gas turbine used for the electrical power production. A typical gas turbine unit consists of three major parts:

- **Compressor** – which compresses the incoming air to high pressure;
- **Combustion area** – which burns the fuel and produces high-pressure, high-velocity gas; and
- **Turbine** – which extracts the energy from the high-pressure, high-velocity gas flowing from the combustion chamber

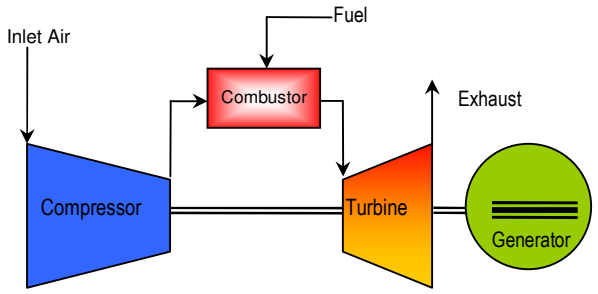

Figure 2.2 Schematic of a process of that a gas turbine undergoes in order to produce electricity.

The gas turbine compressor draws in air from the environment *via* a filter. This air is compressed in the compressor, thus being elevated to a higher pressure, and then directed into the combustion chamber. This combustible gas is then mixed in and combustion takes place generating hot gases under high pressure. The energy released is converted into a mechanical rotation which powers the compressor and the generator.

When used for power production, gas turbines can either be operated in an open cycle mode (exhaust to atmosphere) often referred to as an Open Cycle Gas Turbine (OCGT), or in a combined-cycle mode (CCGT – Combined Cycle Gas Turbine) as shown in Figure 2.3. A key feature of the thermodynamics of the gas turbine cycle is that the temperature of the turbine exhaust stream is typically in the range of 500°C – 600°C. This heat energy is transferred to the water in the heat recovery steam generator. The heat is used to generate water vapour, which powers the steam turbine. The resulting mechanical energy is transferred to the generator. In the generator mechanical energy from the steam turbine is converted into electricity. The condenser converts exhaust steam from the steam turbine back into water by means of cooling.

The power island shown in Figure 2.3 overleaf clearly illustrates the proposed CCGT operation mode for the Majuba site which is to also house the UCG production and syngas processing plants (as illustrated in Figure 2.3). When the gas production and combined cycle occur at the same site as shown in Figure 2.3, then one may refer to this configuration as Integrated Gasification Combined Cycle (IGCC).

When the front end engineering design (FEED) is initiated, the configuration for the CCGT power plant in the Amersfoort area will be determined. Previous FEED results for other projects have shown that for nine installed gas turbines, 3 x 2-on-1 (2 gas turbines per HRSG) and 1 x 3-on-1 (3 gas turbines per HRSG) configuration is optimum.

2.3 Water and Cooling

The purpose of the main cooling system is to cool the steam that turns the turbines so that it can be pumped back to the boilers as water. The proposed power station would implement either a direct or indirect dry cooling system. Dry cooling systems are used where there is insufficient water, or where the water is too expensive to be used in an evaporative system.

Dry cooling systems are the least used systems as they have a much higher capital cost, higher operating temperatures, and lower efficiency than wet cooling systems. In the dry cooling system, heat transfer is by air to finned tubes. The minimum temperature that can be theoretically provided is that of the dry air, which can be regularly over 30ºC and up to 40ºC on typical summer afternoons. Compare this to wet cooling towers, which cool towards the wet bulb temperature, which is typically 20ºC on summer afternoons. The steam condensing pressures and temperatures of a dry cooled unit are significantly higher than a wet cooled unit, due to the low transfer rates of dry cooling and operation at the dry bulb temperature.

There are two basic types of dry cooling systems:

1. The direct dry cooling system; and
2. The indirect dry cooling system.

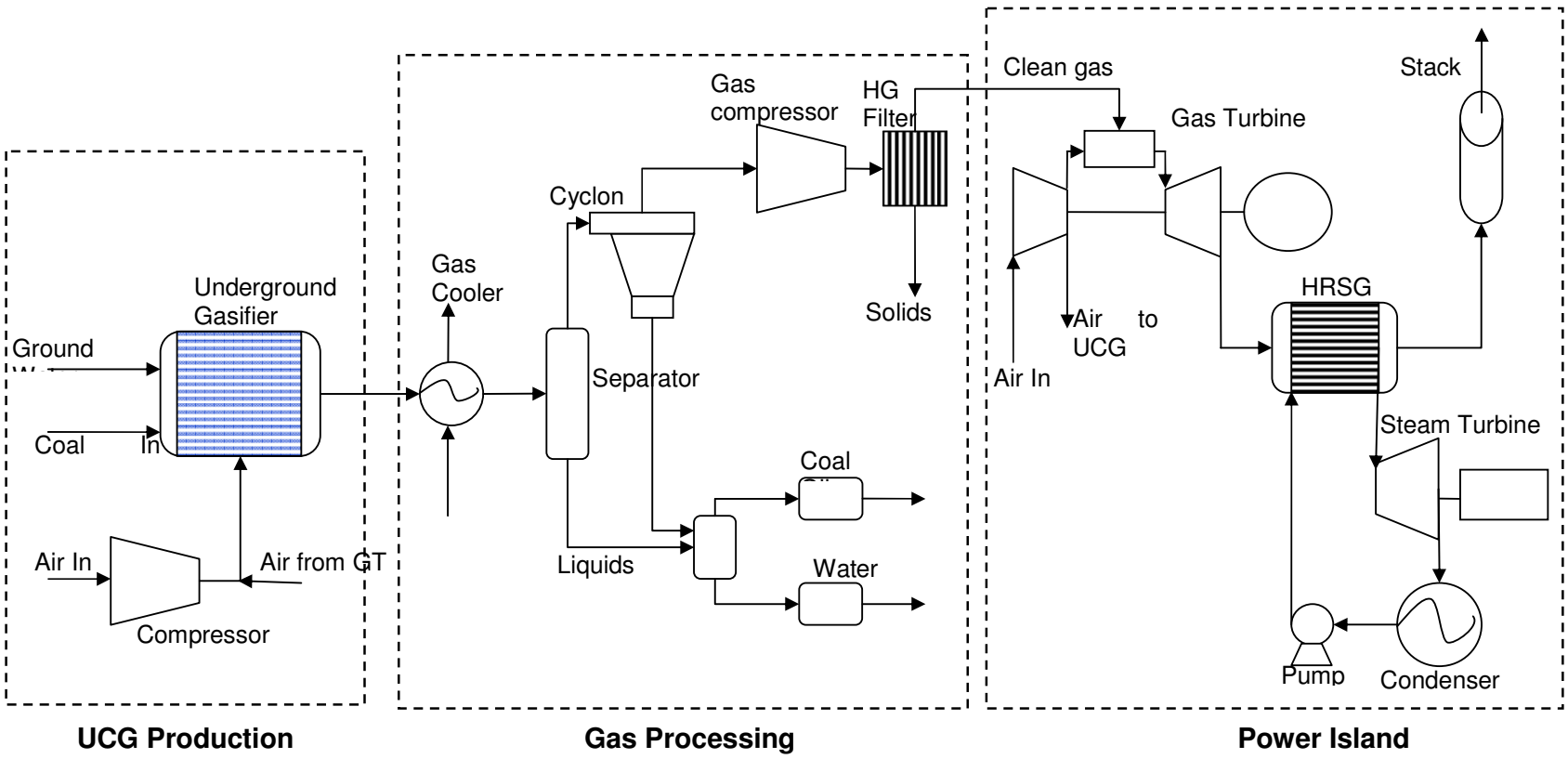

Figure 2.3 Layout of UCG-CCGT plant

- ***Direct dry cooling***

In the direct dry system, the turbine exhaust steam is piped directly to the air-cooled, finned tube, condenser. The finned tubes are usually arranged in the form of an 'A' frame or delta over a forced draught fan to reduce the land area. The steam trunk main has a large diameter and is as short as possible to reduce pressure losses, so that the cooling banks are usually as close as possible to the turbine. A schematic of a direct dry cooling system is illustrated in Figure 2.4.

In the direct system, steam from the last stage turbine blades is channelled directly into radiator- type heat exchangers adjacent to the turbine hall of the power station (there are no cooling towers.). The heat is conducted from the steam to the metal tubes of the exchanger. Air passing through the exchanger is supplied by a number of electrically driven fans. The air removes the heat, thus condensing the steam back into water which will be used once again to produce steam in the boiler.

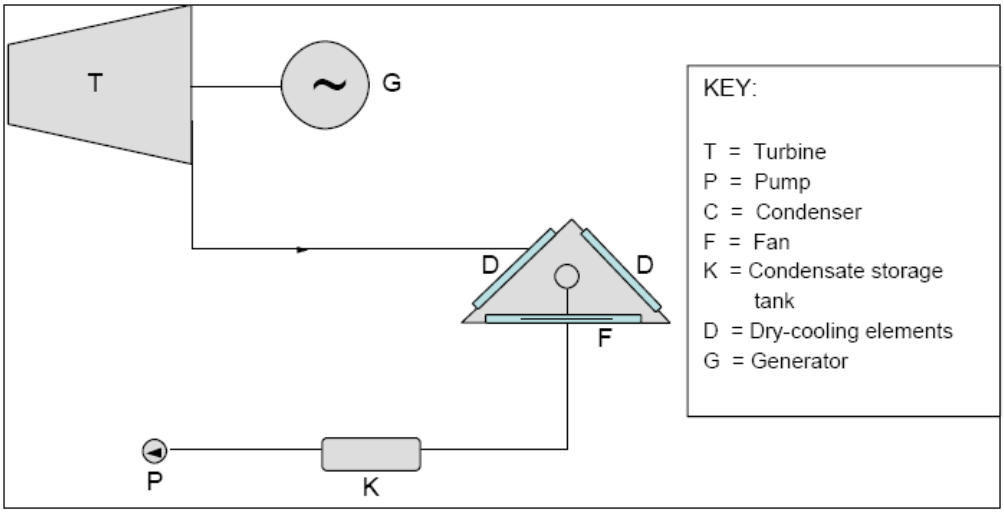

Figure 2.4 Showing a direct dry cooling system

- ***Indirect dry cooling***

Indirect dry cooling systems have a condenser and turbine exhaust system as for wet systems, with the circulating water being passed through finned tubes in a natural draught cooling tower. The water pipework allows the towers to be sited away from the station. A schematic of an indirect dry cooling system is illustrated in Figure 2.5.

The indirect system also uses a cooling tower and water. However, the principle of operation is similar to that used in a car radiator. Heat is conducted from the water through A- frame bundles of cooling elements arranged in concentric rings inside the tower.

The cooling water flows through these elements, cools down as the cold air passes over them and returns to the condenser. This is referred to as a closed system as there is no loss of water due to evaporation.

A variation on this type of indirect system is the system that uses a direct contact condenser in place of the traditional tube type condenser. In the spray condenser, the water from the cooling cycle mixes with the boiler water. The maintenance of the water quality to suit all circuits is critical to the successful operation of the system.

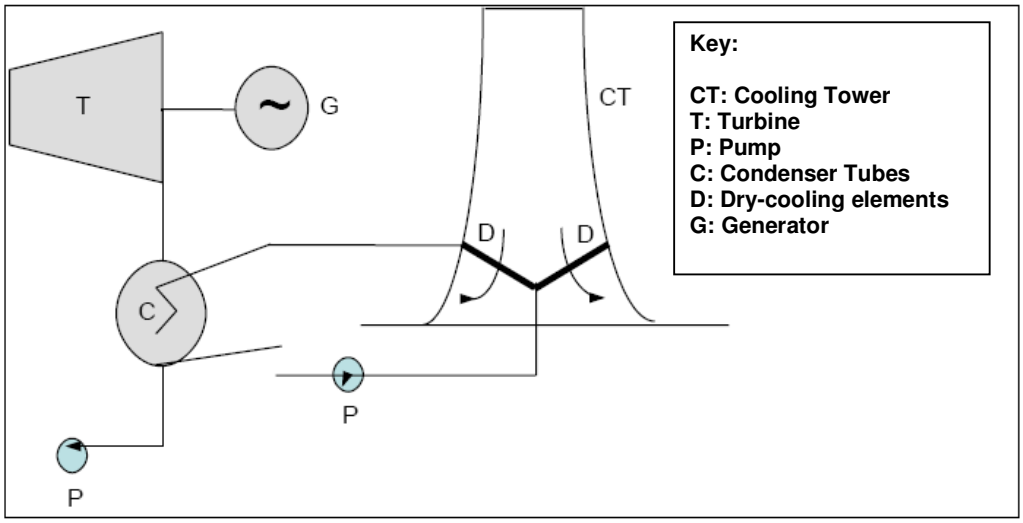

Figure 2.5 Showing an indirect dry cooling system

The relative humidity at the site and the availability of water will dictate the method of cooling to be employed. The FEED will address the issue of water availability and cooling method. As a guide, in regions of water scarcity, air cooled condensers (ACC) are generally adopted over wet cooling towers due to the huge difference in relative water consumption.

2.4 Storage Tanks

The proposed development includes the installation of a number of storage tanks within the boundary of the study site. The number and volumes of tanks required would be informed by further technical planning as well as the current environmental investigation. At this stage, it is anticipated that storage tanks may typically be required for the following liquids:

- Ignition gas (typically propane)
- Diesel;
- Demineralised water;
- Neutralised water;
- Acid;
- Caustic soda;

- Lubricating oil.

2.5 Other Infrastructure

Other infrastructure for the proposed project includes:

- Weather and communication mast of up to 60 meters in height and air quality monitoring station;
- high voltage yard;
- a gas pipeline from the adjacent gas cleaning plant to the CCGT power plant;
- a water supply pipeline from the Majuba allocation or the Rietpoort Balancing Dam (for construction and operational water supply);
- electricity supply for construction;
- a water treatment plant as well as ancillary works such as other associated infrastructure;
- sewage treatment plant;
- storage facility for hazardous materials;
- storage facility for waste;
- borrow pits;
- construction village (of 2 hectares);
- Re-routing of Transmission lines / Distribution lines on site, if needed;
- Relocation of other identified structures or activities (occurring on site) which are listed under the EIA regulations
- Temporary Diesel generators for construction; and
- Transmission and Distribution of power (120 kilovolts or more);

2.5.1 Access Roads (and bridge/s)

Appropriate access roads (temporary and permanent) will be constructed to link the proposed power station with the nearby existing roads network. Due to the position of the sites, the access roads might have to cross streams. In these situations, the road would have to have a bridge to avoid impacting the streams. The final routing of the road network for both the construction and operational phases will be dependent on the final site selected for the CCGT power plant. These routes will be identified in the form of access roads corridors from which alignments may be designed. The corridors will cater for temporary (to be used during construction) and permanent (to be used during operation) access and site roads. All the corridors will be identified and studied in detail in the EIA phase of the process. The impacts of the proposed power station on the local traffic conditions will be studied through a traffic specialist study.

2.5.2 Construction Village

A construction village will be required to house workers during the construction phase. The hostel at the old mine site or the village used for workers during the construction of the Majuba Power Station may also be considered for the housing of construction workers. The exact position of the construction village has not been decided at this stage. However, impacts associated with the construction village will be determined during the design phase and will be completely studied in the EIA phase.

3. SCOPE OF ENVIRONMENTAL INVESTIGATIONS

3.1 Approach to Undertaking the Scoping Phase

The Screening exercise undertaken has produced feasible sites that could be used for locating the CCGT plant. Associated with these sites were environmental issues that were identified and needed consideration in the process. This revised final Scoping Study together with findings of the earlier Scoping Study seeks to identify positive and negative environmental (biophysical and social) impacts associated with the construction and operation of the proposed CCGT plant and associated infrastructure, for further investigation in the EIA phase.

This chapter discusses the process which was followed to fulfill the requirements of the Scoping phase of the project.

3.2 Authority Consultation

3.2.1 Consultation with Decision-making Authorities

The relevant authorities required to review the proposed project and provide Environmental Authorisation were consulted from the outset of this study, and have been engaged throughout the project process. These authorities included the National Department of Environmental Affairs and Tourism (DEAT), who are the lead decision making authority for this project, and the Mpumalanga Department of Agriculture and Land Administration (MDALA) who are acting as the commenting authority.

3.2.2 Consultation with other Relevant Authorities

Consultation with non-DEAT authorities was undertaken through telephone calls, written correspondence and meetings in order to actively engage these authorities and provide background information to the proposed project during the Environmental Scoping Phase. The representatives from these Departments were requested to formally provide input into the EIA process. The other Authorities consulted include *inter alia*:

- Department of Water Affairs and Forestry (DWAF);
- Pixley ka Seme Local Municipality;
- Gert Sibande District Municipality;
- South African Heritage Resources Agency (SAHRA) – Mpumalanga office;
- South African National Roads Agency Limited (SANRAL);
- National Department of Minerals and Energy (DME);
- Department of Transport; and
- Department of Health.

3.2.3 Application for Authorisation

An application for authorisation in terms of the National Environmental Management Act (NEMA), (Act No 107 of 1998), in respect of the activities identified in terms of Section 24 and 24D of the said Act was submitted to DEAT on 25 October 2007. This application included information regarding the proponent, as well as the proposed project and was submitted together with a declaration of independence from the environmental consultants. See Appendix B for the acceptance of application letter from DEAT and MDALA.

3.3 Environmental Scoping Study

The ESS provides a description of the receiving environment and how the environment may be affected by the development of the proposed project. Desktop studies making use of existing information, and ground-truthing through site visits, were used to highlight and assist in the identification of potential significant impacts (both social and biophysical) associated with the proposed project.

Additional issues for consideration will be extracted from feedback from the public participation process, which commenced at the beginning of the Scoping phase, and will continue throughout the duration of the project. All issues identified during this phase of the study have been documented within this Environmental Scoping Report. Thus, this Environmental Scoping Report provides a record of all issues identified as well as any fatal flaws in order to make recommendations regarding the project and further studies required to be undertaken within the EIA phase of the proposed project.

The Scoping Study aimed to address the following:

- description of the sites selected for the proposed CCGT power plant and associated infrastructure;
- identification of potential significant positive and negative environmental (biophysical and social) impacts, and an evaluation of their significance in terms of the project;
- Undertaking of a fully inclusive public participation process to ensure that Interested and Affected Party (I&AP) issues and concerns are recorded and form part of the EIA process.

The Scoping Study identified some technological, layout and mitigation alternatives to be evaluated and investigated during the EIA phase of the project. Issues related to terrestrial and aquatic biodiversity (fauna and flora), hydrogeology (groundwater); hydrology (surface water), soils and agricultural potential, wetlands, existing infrastructure, socio-economic including social issues, air quality; noise; heritage sites, risk; traffic and visual impacts have been investigated in this ESS. Issues that are considered to be of significance will be nominated for further investigation and assessment within the EIA phase of the project.

3.3.1 Specialist Studies

Table 3.1 Specialist studies undertaken as part of the Scoping process

Specialist Study	Organisation
Hydrogeology and Hydrology	SRK Consulting
Fauna and Flora	Bathusi Environmental Consulting
Soils and Agricultural Potential	Terra Soil Science
Wetlands	SiVEST
Air Quality	Bohlweki-SSI Environmental
Noise	Jongens Keet Associates
Social and Micro-economic study	MasterQ Research
Visual aspects and aesthetics	MetroGIS
Heritage	National Cultural History Museum
Risk	Riscom
Traffic	SSI Engineers and Environmental Consultants

3.4 Overview of the Public Participation Process undertaken during the Scoping Phase

The primary aims of the public participation process were:

- To inform interested and affected parties (I&APs) and key stakeholders of the proposed development.
- To initiate meaningful and timeous participation of I&APs.
- The identification of issues and concerns of key stakeholders and I&APs with regards to the proposed development (i.e. focus on important issues).
- The promotion of transparency and an understanding of the proposed project and its potential environmental (social and biophysical) impacts (both positive and negative).
- To provide information used for decision-making.
- To provide a structure for liaison and communication with I&APs and key stakeholders.
- To ensure inclusivity (the needs, interests and values of I&APs must be considered in the decision-making process).
- To focus on issues relevant to the project, and issues considered important by I&APs and key stakeholders.
- To provide responses to I&AP queries.
- To encourage shared responsibility and a sense of ownership.

3.4.1 Advertising

In compliance to the EIA Regulations, notification of the commencement of the EIA process for the project was advertised in a local newspaper, namely the *Recorder* on 01 February 2008 and in a national newspaper, namely the *City Press* on 03 February 2008 (refer to Appendix C). Interested and affected parties were requested to register their interest in the project, and become involved in the EIA process. The primary aim of these advertisements

was to ensure that the widest group of I&APs possible was informed and invited to provide input and questions and comments on the project.

In addition to advertisements, site notices were also placed at the following public places advertising the EIA process for the proposed project (see Appendix C for proof of placement of site notices):

- Offices of the Pixley ka Seme Municipality
- Security check-in office at the Majuba Power Station
- UCG Pilot Plant
- Entrance to the Old Mine (Bergvliet Colliery)
- Offices of the Amersfoort Municipality

3.4.2 Identification of Key Stakeholders and Interested and Affected Parties

An important step in the public participation process entailed the identification of key stakeholders and I&APs, including:

- National government and Provincial government;
- Local (Pixley ka Seme Local Municipality) and District Municipality (Gert Sibande District Municipality);
- Affected and neighbouring landowners;
- Farmers Associations; and
- Environmental NGOs.

The existing I&AP database provided by Eskom from the Coal Transport System (CTS) project was utilised as a starting point. The identification of additional I&APs was undertaken through existing contacts, responses to newspaper advertisements, and networking to identify key I&APs within the nominated study area.

All I&AP information (including contact details), together with dates and details of consultations and a record of all issues raised is recorded within a comprehensive database of I&APs. This database is updated on an on-going basis throughout the project process (refer to Appendix D).

Consultations, in the form of telephone calls and letters have been undertaken with individuals, businesses, institutions and organisations, including the following:

- Department of Water Affairs and Forestry (DWAF);
- South African Heritage Resource Association (SAHRA) – Mpumalanga office;
- Pixley ka Seme Local Municipality;
- Gert Sibande District Municipality;
- Neighbouring property owners/landowners;
- Local residents/Residents Associations/Community Organisations from the surrounding area;
- Local businesses surrounding the area;
- Environmental interest groups and Environmental NGOs; and

- Other parties interested in the proposed project including those from a business point of view.

Examples of letters sent to I&APs and key stakeholders are included in Appendix E.

3.4.3 Briefing Paper

A briefing paper for the project has been compiled in English (refer to Appendix E). A summary of the proposed project has also been compiled in Afrikaans and Zulu. The aim of this document was to provide a brief outline of the new proposed project, provide preliminary details regarding the Scoping and EIA process, and explain how I&APs could become involved in the project. The briefing paper was distributed to all identified stakeholders, together with a registration/comment sheet, inviting I&APs to submit details of any issues and concerns.

3.4.4 Consultation and Public Involvement

Through consultations, issues for inclusion within the EIA were identified and confirmed. Telephonic consultation, a public meeting/open day, key stakeholder workshop as well as focus group meetings with I&APs and key stakeholders were undertaken in the earlier Scoping Study in order to identify additional key issues, needs and priorities for input into the EIA for the proposed project. Copies of minutes of all meetings held during both the original and revised Scoping Study for all formal public involvement meetings held during the process are included in Appendix G.

Networking with I&APs will continue throughout the duration of the project until the completion of the EIA phase. This process will be undertaken through Open Day and Public Meeting, KSW, FGM and one-on-one meetings.

- ***Open Day and Public Meeting:***
  An Open Day and public meeting was held on 12 March 2008, at the Volksrust Town Hall during the review period of the draft Environmental Scoping Report during the initial ESS in order to inform I&APs of the proposed project. The primary aim of this meeting was to:

  * provide I&APs and stakeholders with information regarding the proposed CCGT and associated infrastructure;
  * provide I&APs and stakeholders with information regarding the EIA process;
  * provide an opportunity for I&APs and stakeholders to seek clarity on the project;
  * record issues and concerns raised; and
  * provide a forum for interaction with the project team.

This meeting was advertised in the *City Press* and *Recorder* newspapers. Registered I&APs and stakeholders were invited to attend the public meeting by individualised letters.

- ***Key Stakeholder Workshop:***

  A key stakeholder workshop was held on 07 March 2008 at the Eskom Convention Centre, Midrand with I&APs who were identified as key stakeholders with regards to the project. The purpose of this meeting was to allow key stakeholders with specific issues to air their views and to facilitate interaction between the key stakeholder and the project team. The meeting also allowed for smaller groups of I&APs and/or representatives of larger interest groups or organisations to play an active role in the process and provide an opportunity for dialogue and consultation with these parties.

- ***Focus Group Meetings***:

  Focus group meetings with identified key stakeholders in the study area were held during the Scoping phase of the project. These meetings were held with groups that have similar interests, such as environmental NGOs, local authorities, landowner's associations, etc. The main aims of these meetings were to provide stakeholders with information regarding the proposed project and provide them with the opportunity to raise any comments, issues or concerns regarding the proposed project. Identified key stakeholders were invited in writing to attend these focus group meetings.

  The following focus group meetings have taken place:

  - Meeting with the Pixley ka Seme Local Municipality, Volksrust– 08 February 2008 at 10h00.
  - Meeting with the Provincial Authorities (MDALA, Mpumalanga Tourism Authority, Department of Local Government), MDALA offices, Ermelo – 06 March 2008 at 09h00.
  - Community meeting, eZamokuhle Community Hall, Amersfoort – 06 March 2008 at 12h00.
  - Community meeting, Daggakraal Community Hall, Daggakraal – 06 March 2008 at 15h00.
  - Meeting with landowners, Mahawane Country Resort, Volksrust – 06 March 2008 at 18h00.

Three additional FGMs were held during the public review period for the revised draft Environmental Scoping Report. These included:

- Meeting with the Provincial Authorities (MDALA, Mpumalanga Tourism Authority, Department of Local Government), MDALA offices, Ermelo – 24 July 2008 at 09h00.
- Meeting with landowners, Main Boardroom, UCG site, Majuba Power Station – 24 July 2008 at 16h00.

Refer to Appendix G for the Minutes of Meetings held during the public review period for the initial as well as the revised draft ESRs.

3.4.5 Social Issues Trail

All issues, comments and concerns raised during the public participation process for the initial Scoping study has been compiled in a Social Issues Tail (Version 1). All issues, comments and concerns raised during the public participation process for the revised Scoping study has been compiled in a Social Issues Tail (Version 2). These Social Issues Trails are included in Appendix D. The Social Issues Trail will be updated on an on-going basis.

3.5 Review of the Revised Draft Environmental Scoping Report and Plan of Study for EIA

3.5.1 Public Review of Revised Draft Scoping Report and Plan of Study for EIA

The revised draft Environmental Scoping Report and Plan of Study (PoS) for EIA was made available for public review for a 30-day review period from **02 July 2008** until **01 August 2008.** Hard copies of the report were also made available for inspection at the following public venues:

- Volksrust Public Library
- Daggakraal Library
- Amersfoort Library
- Offices of the Pixley ka Seme Local Municipality
- Offices of the Gert Sibande District Municipality
- Offices of Bohlweki-SSI Environment (Building 5, Country Club Estate, Woodmead)
- Bohlweki-SSI Environmental website (www.bohlweki.co.za/library.php)
- Eskom website (www.eskom.co.za/eia) – Revised: Amersfoort – Combined Cycle Gas Turbine (CCGT) Power Plant.

The availability of the revised draft report was advertised in the *Recorder* (27 June 2008) and *City Press* (29 June 2008) newspapers (refer to Appendix F). I&APs registered on the project database were notified of the availability of the report by individualised letters (refer to Appendix F).

All issues and comments received during the review period the revised Scoping Report have been included in this Final Environmental Scoping Report.

3.5.2 Authority Review of Revised Draft Environmental Scoping Report and Plan of Study for EIA

The revised draft Environmental Scoping Report was made available to the DEAT; MDALA; Pixley ka Seme Local Municipality; Gert Sibande District Municipality as well as the Mpumalanga SAHRA simultaneously for review and comment.

3.6 Submission of Final Environmental Scoping Report

The submission of the final Environmental Scoping Report and Plan of Study for EIA is the last stage of the Environmental Scoping Phase for the proposed project. The Final Scoping Report will be submitted to DEAT and MDALA for review and decision-making.

4. GENERAL DESCRIPTION OF THE STUDY AREA ENVIRONMENT

4.1 The Biophysical Environment

4.1.1 Locality

The proposed project falls in the Mpumalanga Province in Ward 7 of the Pixley ka Seme Local Municipality (MP304) within the Gert Sibande District Municipality (DC30). The Pixley Ka Seme Local Municipality is situated on the eastern border between Mpumalanga and KwaZulu-Natal. Furthermore, the municipal area is framed by the Mkhondo Municipality in the east, Msukaligwa Municipality to the north and Lekwa Municipality to the west (refer to Figure 4.1). The Pixley Ka Seme Local Municipality comprises an area of approximately 5227,98 km² which includes the following major urban areas or towns: Amersfoort; Ezamokuhle; Perdekop; Siyazenzela; Volksrust; Vukuzakhe; Wakkerstroom and eSizameleni. Other residential areas include Daggakraal ext 1, 2 and 3 as well as Sinqobile A, B, C, and D.

Figure 4.1 Map indicating the Pixley ka Seme Local Municipality and surrounding municipalities

4.1.2 Climate and Rainfall

The study area is characterised by daily summer temperatures that range between ~2 °C and ~32 °C with an average of ~17 °C. Winter temperatures range between ~-8 °C and ~23 °C with an average of ~7 °C. Figure 4.2 illustrates the average monthly maximum and minimum temperatures recorded in the Majuba area, respectively.

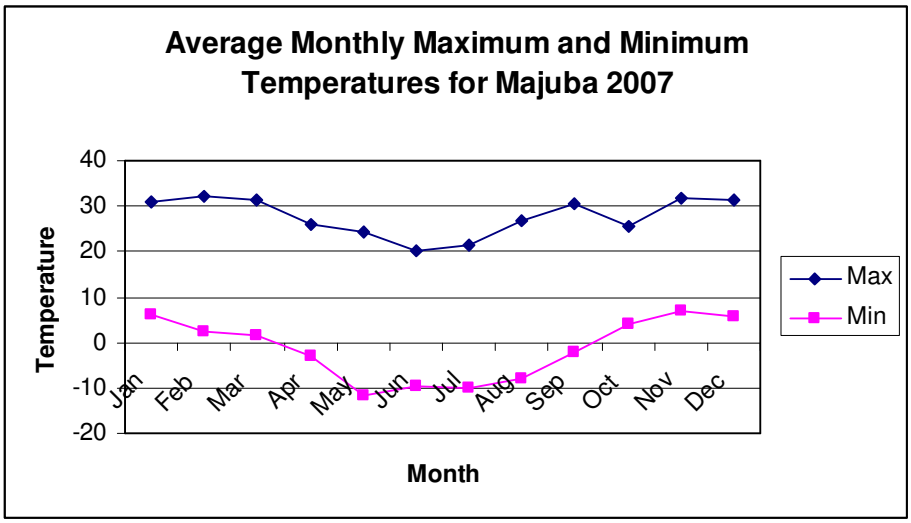

Figure 4.2 **Average monthly maximum and minimum temperatures recorded in the Majuba area (Weather Services Station, 2007)**

The study area can be characterised as being a summer rainfall area with the warmer months being October to April. The mean annual rainfall for the Majuba area is 1008 m. Total monthly rainfall figures for modelled South African Weather Services (SAWS) data are illustrated in Figure 4.3.

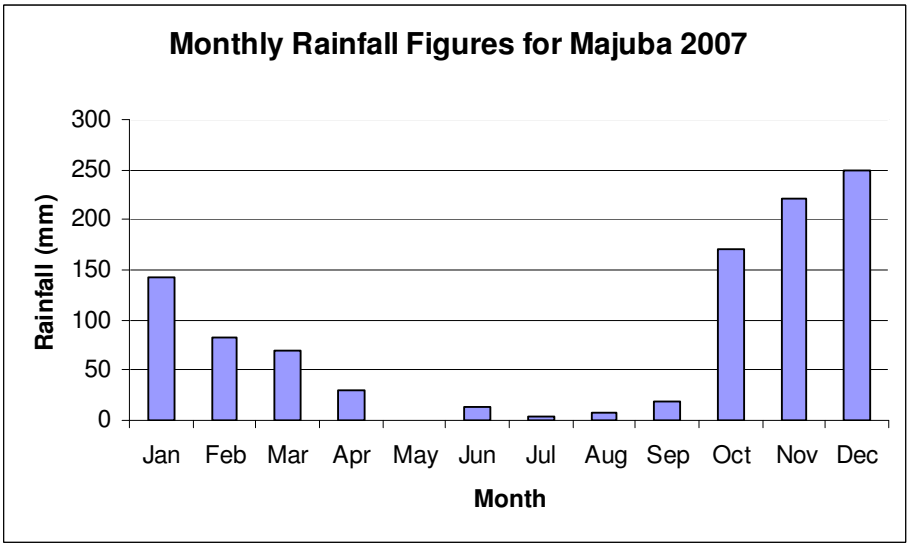

Figure 4.3 **Monthly rainfall figures for Majuba area (Weather Services Station, 2007)**

4.1.3 Topography and Landscape

The region is known for its rolling grass landscapes and the study area is a typical example thereof (Photograph 4.1). The area is situated within the Highveld Region, consisting of undulating hill landscapes of an elevation of about 1550 m above sea level. The area drains into streams of mainly the Mahawane Stream, which in turn falls in the perennial catchment area of the perennial Buffalo river catchment area.

Photograph 4.1 Study area showing the rolling grass landscape

4.1.4 Geology

The majority of the study area is underlain by Karoo Supergroup sedimentary rocks of the Vryheid and Volksrust Formations of the Ecca Group. These are largely comprised of sandstone, mudstone, shale, siltstone, and coal seams.

The available geological maps covering the study area did not indicate any major structural features such as faults or fractures. Limited tectonic activity is recognised within the study area, and the only evidence of secondary processes is outcrops of intrusive younger dolerite sills mapped in the Karoo sediments.

Four generations of dolerite intrusions are recognised within the study area, based on olivine or plagioclase content, alteration, and texture. The intrusive dolerite has produced large-scale devolatilisation and structural displacement of the coal. These adverse geological conditions caused the closure of the Majuba Colliery in 1993. The lithostratigraphy of the study area is presented in Table 4.1 below.

Table 4.1 Lithostratigraphy of the study area

Age	Supergroup	Group	Subgroup	Formation	Lithology
Jurassic					Dolerite
Permian	Karoo	Ecca		Volksrust	Mudstone, siltstone, shale
Permian	Karoo	Ecca		Vryheid	Sandstone, siltstone, shale, coal

4.1.5 Hydrogeology

The groundwater potential of the Karoo formations located in the study area is limited in their pristine state due to low permeability and storage capacity. Secondary processes, such as weathering, fracturing, etc., are required to enhance the groundwater potential.

Based on regional data, the hydrogeological resource maps, the following hydrogeological information is available for the formations within the study area: -

Volksrust Formation	-	Upper and middle Ecca
	-	Predominantly argillaceous rocks
	-	Fractured aquifers
	-	Borehole yields 0.5 to 2.0 l/s
Vryheid Formation	-	Lower Ecca
	-	Intergranular and fractured aquifers
	-	Borehole yields 0.1 to 0.5 l/s

Groundwater hydrochemistry associated with the sediments is variable; the groundwater salinity associated with the formations in the study area can have electrical conductivity concentrations of < 250 up to 1000 mS/m.

The sandstones of the Vryheid Formation of the Ecca Group can be massive and dense and have limited permeability and storage. It thus offers only moderate groundwater yield, especially in the absence of dolerite intrusions.

Contacts between different rock lithologies and bedding planes within the sediments often yield groundwater. The contact zone between the dolerites and the sandstone lithologies can be high yielding. Fractured fault zones, especially if related to tensional stresses, are potentially rich targets for groundwater development.

Groundwater occurs within the joints, bedding planes, and along dolerite contacts within the sediments (as recognised across the study area).

4.1.6 Hydrology

The region in which the CCGT power plant will be situated has a high degree of variation in slope varying between from below 0 degrees to above 57.02 degrees and contains a number of streams and rivers. Most of these are small drainage lines that flow only periodically but a few are perennial rivers with a constant overview. The steeper slopes and the areas around the rivers are the most sensitive areas from a surface water point of view and hence a large area within the 12 km zone around the pilot UCG plant is sensitive from a hydrological point of view.

4.1.7 Biodiversity

The vegetation of the region is described in the VEGMAP database (Mucina and Rutherford; 2006) as Amersfoort Highveld Clay Grassland. This vegetation type extends in a north-south band from just south of Ermelo, down through Amersfoort to the Memel area in the south. It comprises undulating grassland plains, with small scattered patches of dolerite outcrops in areas. The vegetation is characterised by a short closed grassland cover; largely dominated by a dense *Themeda triandra* (Red Grass) sward, often severely grazed.

Although, the conservation status of this vegetation type is regarded as Vulnerable[1], no area is formally protected. Some 25% of the unit is transformed, predominantly by cultivation (22%). The area is not suited to afforestation. Silver and black wattle (*Acacia* species) and *Salix babylonica* invade the drainage lines and the erosion potential is generally low.

Over-grazing frequently leads to invasion of *Stoebe vulgaris* (Bankrupt Bush). Parts of this unit were once cultivated and now lies fallow and have been left to re-vegetate with pioneer species.

The Wakkerstroom region (Maputoland – Pondoland region) is considered an area of sensitive vegetation and faunal habitats and is situated approximately 25km towards the east and southeast of the study area, (ENPAT, 2001). This area of sensitive vegetation and associated faunal communities is not considered to be threatened by the proposed development. The study area is situated with the African Grasslands/ Ekengela Initiative Transition Zone, rendering all areas of natural grassland as being sensitive (ENPAT, National Database, Biosphere).

4.1.8 Soils and Agricultural Potential

The land type investigation identifies specific soil groupings in three distinct landscape positions. The landscape positions are: Crest, Midslope and Valley Bottom. The soils found in each of these areas are as follows:

- ***Crest***

The soils in this section are well-drained, predominantly rocky and shallow (300 to 600 mm deep with localised areas up to 900 mm deep). Soils tend to be sandy and light in colour (red soils do not occur widely). The dominant soil forms, depth ranges and percentage occurrence for this landscape position are:

- Exposed rock outcrops (5 %)
- Mispah / Cartref / Glenrosa – 100-450 mm (20 %)
- Hutton – 100-450 mm (5 %)
- Kroonstad – 450-900 mm (20 %)
- Clovelly – 450-900 mm (35)
- Avalon – 500-900 mm (5 %)
- Westleigh – 300-450 mm (5 %)

[1] Vegetation types that have lost up to 20% of their original extent, which could result in some ecosystem function being altered.

- ***Midslope***

The soils in this section are well-drained with E-horizons dominating due to the sandy nature of the soils and the sandstone as parent material. Red soils are scarce and there is a limited occurrence of duplex soils. Depths range from 300 to 600 mm deep with localised areas up to 900 mm deep. The dominant soil forms, depth ranges and percentage occurrence for this landscape position are:

* Exposed rock outcrops (2 %)
* Mispah / Cartref / Glenrosa – 100-450 mm (10 %)
* Hutton – 100-450 mm (3 %)
* Kroonstad – 450-900 mm (40 %)
* Clovelly – 450-900 mm (15 %)
* Avalon – 500-900 mm (10 %)
* Estcourt – 300-600 mm (10 %)
* Westleigh – 300-450 mm (5 %)
* Valsrivier – 250-450 mm (5 %)

- ***Valley Bottom***

In this section structured soils dominate, often with swelling properties. Soils with sandy E-horizons occur occasionally and many stream canals are dominated by exposed rocks and eroded soils. The dominant soil forms, depth ranges and percentage occurrence for this landscape position are:

* Kroonstad – 450-900 mm (10 %)
* Valsrivier – 250-450 mm (10 %)
* Willowbrook / Arcadia / Rensburg – 300-600 mm (50 %)
* Stream beds (30 %)

From the satellite image of the study area it appears that the three sites are very similar in terms of current and historic land use in that all three sites are covered by grasslands. All three sites show signs of historic cultivation in the form of tilling of fields but these areas are covered by grass at present. This aspect could indicate that the fields are used as improved grasslands or that cultivation has been abandoned in the past.

4.1.9 Wetlands

The three sites (2A, 2B and 4) being assessed for the Scoping Phase of the study are all located to the south of the town of Amersfoort , to the east of the Majuba Power Station, and to the west of the N11 road that links Amersfoort and Volksrust. The area is located on the Mpumalanga Highveld (the sites are located at an altitude of approximately 1700m above sea level), and is thus characterised by rolling grasslands of the Amersfoort Highveld Clay Grassland vegetation type.

The area forms part of the upper catchment of the Vaal River, and wetlands and drainage lines feed into the north-draining Skulp and Riet Rivers that are tributaries of the Upper Vaal River. Sites 2A and 2B are the most northerly sites, being located directly east of (about 7,5km from) the Majuba Power Station. Site 2A is located on ground that slopes up from a

number of drainage lines (wetlands) to the south, east and west of the site. A large part of the site is occupied by a disused mine. Site 2B is located close to site 2A and is also located on higher ground surrounded by lower-lying drainage lines/wetlands on all sides of the site. The site appears to be grazing land or old disused croplands.

Site 4 is located slightly to the south. This site is also bounded by wetlands on most of its perimeters and the northern part of the site is bisected by a valley bottom wetland. The site appears to be comprised largely of old, disused croplands, and is thus expected to be largely transformed.

4.2 The Social Environment

4.2.1 Air Quality

- ***Wind***

Wind is important in that it cleans by diluting and dispersing pollutants but it can also transport pollutants over large distances. For the proposed study area, both monitored meteorological data from the pilot UCG plant and modelled data from the South African Weather Services (SAWS) was made available.

Wind is important in that it cleans by diluting and dispersing pollutants but it can also transport pollutants over large distances. For the proposed study area, both monitored meteorological data from the pilot UCG plant and modelled data from the South African Weather Services (SAWS) was made available

According to the SAWS modelled meteorological data, winds predominated from the eastern and western sector (Figure 4.4c). The wind rose profile is typical of that experienced by low lying areas surrounded by an escarpment. The majority of the wind experienced within the study area is from the east (~15%). From the eastern vector wind speeds of between 3.8 and 5.7 m/s occurred most of the time (~6%). Wind speeds between 5.7 and 8.8 m/s also occurred but less frequently (~2%). From the west, winds are occurring ~12% of the time, with the majority of these falling between 3.8 and 5.7 m/s (~4%). Small percentages of wind speeds greater than 8.8 m/s were also experienced from the west. According to the frequency distribution graph presented in Figure 4.4d, wind speeds between 0.5 and 2.1 m/s occur for the majority of the time.

In comparison, the monitored data from the UCG site (Figure 4.4a and Figure 4.4b), also indicates winds predominating from the east and west but with the majority of the wind speeds experienced ranging between 3.8 and 5.7 m/s. This will result in a higher dispersion potential when assessing the impacts due to the release of pollutants to atmosphere, than would be case when assessing impacts using the SAWS modelled data.

- ***Sensitive Receptors***

Those receptors identified during the current study are listed as follows:

* Amersfoort including eZamokuhle;
* Vlakplaats and Daggakraal communities; and

* adjacent surrounding livestock farms and associated farm houses (on farms Palmietspruit; Strydkraal; Mezig; Holfontein; Welgedacht; Rietpoort; Rietfontein; Werda and Bergvliet).

- ***Other Polluting Sources in the Area***

Based on a site visit and 1:50 000 topographical maps; the following sources of other air pollution have been identified.

* existing Majuba coal-fired power station;
* agricultural activities (animal husbandry);
* vehicle entrainment and exhaust gas emissions;
* veld fires; and
* domestic fuel burning.

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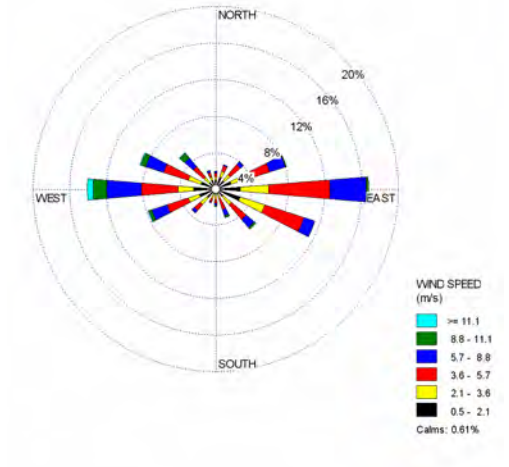
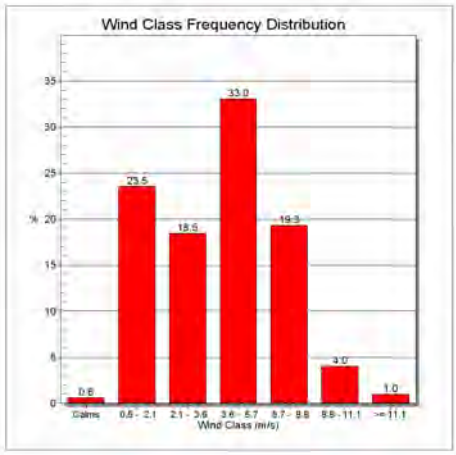
Those receptors identified during the current study are listed as follows:

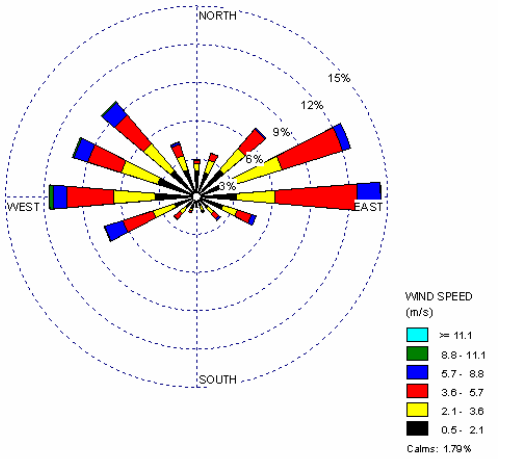
* Amersfoort including eZamokuhle;
* Vlakplaats and Daggakraal communities; and
* adjacent surrounding livestock farms and associated farm houses (on farms Palmietspruit; Strydkraal; Mezig; Holfontein; Welgedacht; Rietpoort; Rietfontein; Werda and Bergvliet).



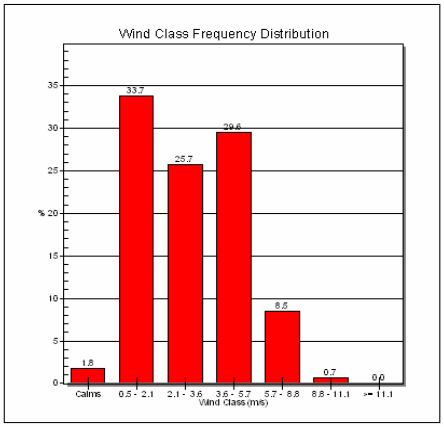
A. Period wind rose derived from monitored data from the UCG pilot plant.



B. Frequency distribution derived from monitored data.



C. Period wind rose derived from modelled data.



D. Frequency distribution derived from modelled data.

Figure 4.4 The period wind rose and wind frequency distribution for data taken at the UCG Pilot Plant and for modelled data received from the South African Weather Services respectively.

- ***Other Polluting Sources in the Area***

Based on a site visit and 1:50 000 topographical maps; the following sources of other air pollution have been identified:

- stack, vent and fugitive emissions from the existing Majuba power station operations;
- Flaring at the UCG operations;
- agricultural activities on the surrounding farms;
- vehicle entrained dust and exhaust emissions;
- domestic fuel burning; and
- veld fires.

4.2.2 Noise

The *noise climate* (ambient noise condition) in the Amersfoort area is quiet and is representative of a rural (farming) noise district (SANS 10103). There is, therefore, a potential for an increase in noise impact with the introduction of a new facility such as the CCGT power plant. There are a number of major noise sources in the area namely the existing Majuba power station, the traffic on the main roads, coal trucks transporting coal to Majuba Power Station and the coal supply railway line to the power station. The noise sensitive sites/areas are Amersfoort town (approximately 12 km from the Majuba power station) and various farm houses and farm labourer residences in the surrounding area (on farms Palmietspruit; Strydkraal; Mezig; Holfontein; Welgedacht; Rietpoort; Rietfontein; Werda and Bergvliet).

4.2.3 Social

As mentioned earlier, the study area falls within the Pixley ka Seme Local Municipality. A total of 80 737 people reside within the area in 16 726 households (average 4.8 people per household). Of these residents, 68% of the people live in urban areas, with the remaining 32% residing in largely rural areas. In 2001, just over half (51%) of the people were unemployed, which differs significantly with the unemployment rate of 1996 where it was estimated that only 33% of the population were unemployed. Of those employed, the majority (24%) are employed in the agriculture/forestry and fishing economic sector. This is closely followed by those employed in private households (20%).

According to the IDP of the Pixley ka Seme Local Municipality (2000 Demarcation Data and 2001 Census Data), the ward is characterised by:

- About 5% of the Local Municipality's population falls in this ward;
- One (1) in Five (5) inhabitants is Indian;
- The majority of the population falls within the 15-64 year old age bracket;
- Approximately three quarters of the population do not have a personal income;
- Approximately $^{2}/_{3}^{rd}$ of households have water inside their yards;
- About 75% of the population in the ward has flush toilets;
- 80% of the population have electricity for lighting; and
- The water demand exceeds capacity.

4.2.4 Visual

The study area for the placement of the CCGT power plant is located in the Amersfoort region of the Mpumalanga province and encompasses the town of Amersfoort, the Majuba coal fired power station and two other predominantly agricultural settlements, namely Vlakplaats and Daggakraal.

The Majuba Power Station is the most prominent feature in the area, providing a distinct visual character to the environment. The township areas of Amersfoort and eZamokuhle, as well as the agricultural holdings Daggakraal and Vlakplaats, provide for a concentration of potential sensitive viewers

The study area has a rural character with dry-land agriculture and cattle and game farming as primary economic activities. It is situated within the grassland biome and the terrain morphological description is strongly undulating plains and hills and lowlands with mountains towards the south-west of the study area.

The N11 national road and the R23 arterial road affords access to the study area. Standerton and Volksrust are the two major towns in closest proximity to Amersfoort.

4.2.5 Heritage

- Stone Age

No information about Stone Age habitation of the area is available. There might be two reasons for this. Firstly, it is unlikely that Stone Age people would have occupied the area, as it would have been too cold and no shelters or caves are known to exist in the area. Secondly, no systematic survey of the area has been done and, as a result, no sites have been reported. However, it is quite likely that a detailed survey would reveal traces of these early people's occupation of the area.

- Iron Age

Iron Age people started to settle in southern Africa c. AD 300, with one of the oldest known sites at Silver Leaves, south east of Tzaneen dating to AD 270. However, Iron Age occupation of the eastern highveld area (including the study area) did not start much before the 1500s. Occupation of these areas became possible due to wide-scale climatic changes, as well as the introduction, from the east coast, of cereal crops such as maize. Some sites dating to the Late Iron Age are know to exist to the north-west of the study area, as well as approximately 15 km due south. These are typically stone walled sites. They were occupied by a number of related people, varying in size from twenty to as many as a few hundred individuals. The people cultivated various crops and kept large herds of cattle.

- Historic period

The historical period in this area started with the arrival of early explorers, hunters and traders, followed later by the Voortrekkers, who settled permanently and started to farm in the area and developed a number of towns. During the Anglo Boer War (1899-1902), some skirmishes took place in the region.

Apart form urban areas, such as Amersfoort, which have origin dates to the late 1880s, most heritage resources in this part of the world would be related to farming and infra-structural development. Most farmsteads were burned down by the British during the Anglo-Boer War, but were later rebuilt. Typically, these consist of the main house, outbuildings, stock enclosures and cemeteries. The housing of labourers were much more informal and once abandoned, quickly disintegrated.

4.2.6 Risk

The main hazards of the project would be exposure to toxic fumes of carbon monoxide and the thermal radiation of the fuel containing carbon monoxide and hydrogen. Carbon monoxide is an odourless and colourless gas having the same density of air. It is extremely flammable and mixes well with air easily forming an explosion hazard. When burnt, carbon monoxide produces carbon dioxide a less toxic material that is considered a simple asphyxiant.

In the presence of finely dispersed metal powders the substance forms toxic and flammable carbonyls. Carbon monoxide may react vigorously with oxygen, acetylene, chlorine, fluorine, nitrous oxide. In the presence of finely dispersed metal powders the substance forms toxic and flammable carbonyls. Carbon monoxide is absorbed into the body by inhalation and acts a chemical asphyxiant by combining with the haemoglobin in the blood displacing the oxygen. Short-term exposure may cause effects on the blood, cardiovascular system and central nervous system. Exposure to concentrations of over 1.3% may result in lowering of consciousness and death. Long-term exposure may have effects on the nervous system and the cardiovascular system, resulting in neurological and cardiac disorders.

Hydrogen is a colourless, odourless gas that is flammable over a wide range of vapour/air concentrations. Hydrogen vapour forms an explosive mixture with air. Vapours or gases may travel considerable distances to ignition source and flash back. Leaking hydrogen may ignite in the absence of any normally apparent source of ignition and if so, burns with a practically invisible flame that can instantly injure anyone coming in contact with it. Hydrogen gas is very light and rises rapidly in the air; concentrations may collect in the upper portions of buildings. Liquid hydrogen can solidify air and may create an explosion hazard.

4.2.7 Traffic

There are a number of major roads and secondary roads servicing the study area. These include:

i) National Road N11, which links Amersfoort to Volksrust is aligned in a north-south direction through the eastern sector of the study area.

ii) Road P48/2 (Route R35), which links Amersfoort to Morgenzon, is aligned in an east-west direction through the north-eastern sector of the study area.

iii) Road P97/1 which links Amersfoort to Perdekop, is aligned in a north-east to south-west direction through the western sector of the study area. It passes 4 kilometres to the north-west of the Majuba power station.

iv) Road D2514, which links from Road P97/1 to National Road N11, is aligned in a north-west to south-east direction through the central portion of the study area. It is the main access road to Majuba power station.

v) Road D284, which links from Road D2514 to National Road N11, is aligned in a south-west to north-east direction through the central portion of the study area. It is the main access road to Majuba Colliery (no longer in operation).

5 SITE SELECTION SUMMARY

5.1 Sensitivity Mapping and Selection of Sites

A sensitivity mapping exercise was undertaken for the study area in order to establish the best possible sites to evaluate during the Scoping phase of the project. The study area was demarcated using a 10 km radius around the UCG plant, off coal resources. The purpose of such an exercise was to identify suitable areas within the study area that could accommodate the CCGT plant and associated infrastructure and to pro-actively identify sensitive areas that should be avoided (refer to Appendix H for the Screening Report).

The qualitative sensitivity mapping exercise divided the study area into three sensitivity categories *viz.* ideal, acceptable and sensitive. A site sensitivity map for the study area, indicating sensitive areas, acceptable areas (areas with medium or average sensitivity) and ideal areas (least sensitive areas), was requested from each of the following specialist fields:

Biophysical

- Groundwater
- Surface Water
- Ecology

Social

- Air
- Noise
- Social
- Heritage
- Visual
- Risk
- Traffic

The social specialist did not provide a map as their sensitivity map was largely informed by the presence of farmhouses and the visual sensitivity map (Figures 6 and 7, respectively, in Appendix I). No sensitivity maps were received from the heritage, risk and traffic specialist fields as it was indicated that the entire study was acceptable for the development of the CCGT power plant. Moreover, no sensitivity maps were received from the Soils and Agricultural Potential, Wetlands as well as the Micro-economic specialists as these specialist fields were only identified during the public participation process for the initial Scoping Study.

Table 5.1 provides a description of the various categories used in the sensitivity mapping of the various specialists.

Table 5.1 Description of the various categories used in the sensitivity mapping

Study Component	Category	Description
Hydrogeology	Sensitive	Shallow coal, average borehole yields > 0.8 l/s, average groundwater levels < 10 m.
	Acceptable	Deep coal, average borehole yields 0.3 to 0.8 l/s, average groundwater levels 10 -20 m.
	Ideal	Average borehole yields <0.3 l/s, average groundwater levels > 20 m.
Hydrology	Sensitive	Within 100 m of water bodies and on slopes steeper than 5%.
	Acceptable	Over 100 m from water bodies and on slopes of less than 5%.
	Ideal	Over 200 m from water bodies on slopes of less than 2%.
Ecology	Sensitive	Wetlands, rivers, streams, marshes, rocky outcrops, pristine grassland, Red Data habitat.
	Acceptable	Agricultural lands, degraded grassland.
	Ideal	Transformed habitat, areas of extensive degradation, existing infrastructure.
Air Quality	Sensitive	Zone containing potentially expanding and permanent residential settlements.
	Acceptable	Zone within wind dispersion field with potentially sensitive receptors but whose land if purchased by Eskom would be relocated and would no longer be considered sensitive.
	Ideal	Zone within wind dispersion field and with no potentially sensitive receptors.
Noise	Sensitive	Zone 3: • The new facility should be closer than 4 km to urban areas (the town of Amersfoort) and any informal settlement. • Areas east of National Road N11.
	Less acceptable	Zone 2: Areas where construction is possible, but less desirable than in Zone 1.

Study Component	Category	Description
	Most acceptable	Zone 1: Area at or within a 10 km radius of the Majuba Power Station. Subject to consideration of isolated noise sensitive sites. Proviso that if the CCGT power plant is at or within three (3) kilometers of the Majuba Power Station, special consideration is to be given to the acceptability of the cumulative affects at affected noise sensitive sites.
Social **a. Demographic**	Sensitive	Displacement and resettlement of people are necessary. Inhabitants of houses in close proximity to the proposed CCGT do not have the choice to resettle elsewhere (distance informed by visual, noise and risk specialist study).
	Acceptable	Visual, noise, air quality and traffic impacts on affected parties are highly significant during construction, but acceptable during operation (to be informed by the relevant specialists).
	Ideal	No displacement and resettlement of people are necessary. Houses are not in close proximity to the proposed CCGT (distance informed by visual, noise and risk specialist study).
b. Economic and Land Use	Sensitive	Land use is affected in such a way that those who are dependent on the land to make a living are affected, and mitigation measures cannot neutralise the impacts. Good agricultural land is lost. Potential mining land is lost.
	Acceptable	Land use is affected in such a way that those who are dependent on the land to make a living are affected, but mitigation measures can neutralise the impacts. Land that was mined and which are stable, not potentially putting people's safety at risk.
	Ideal	Land use activities can carry on, and people who are dependent on the land to make a living can carry on with their activities. Good agricultural land is not affected. Potential mining land is not affected.

Study Component	Category	Description
c. Socio-cultural	Sensitive	Socio-cultural activities cannot carry on, and sense of place is irrevocably changed.
	Acceptable	Socio-cultural activities and sense of place are affected but can be mitigated.
	Ideal	Socio-cultural activities are not affected and the sense of place is not disturbed.
d. Institutional	Sensitive	New services and infrastructure is necessary, and not clustered in the vicinity of similar activities.
	Acceptable	Although new services and infrastructure will be necessary, the proposed project is placed in the vicinity of similar activities.
	Ideal	As far as possible, link up with existing services and infrastructure.
Heritage	Sensitive	Heritage resources with qualities so exceptional that they are of special national significance.
	Acceptable	Heritage resources which, although forming part of the national state, can be considered to have special qualities which make them significant within the context of a province or a region.
	Ideal	Other heritage resources worthy of conservation, and which prescribes heritage resources assessment criteria, consistent with the criteria set out in section 3(3) of the National Heritage Resources Act (Act No 25 of 1999), which must be used by a heritage resources authority or a local authority to assess the intrinsic, comparative and contextual significance of a heritage resource and the relative benefits and costs of its protection, so that the appropriate level of grading of the resource and the consequent responsibility for its management may be allocated in terms of section 8 of the said Act.

Study Component	Category	Description
Visual	Sensitive	Areas within a 2 km buffer from populated places (Amersfoort, Vlakplaats and Daggakraal). Areas within a 500 m buffer zone of major roads. Areas that fall within elevated topographical units (e.g. ridges, crests, hills, etc.).
	Acceptable	Areas not falling within the *Ideal* or the *Sensitive* categories.
	Ideal	Areas within a 2 km buffer zone from already vertically disturbed industrial or mining land.
Risk **a. Toxics**	Sensitive	Not applicable
	Acceptable	Not applicable
	Ideal	1 % fatality
b. Flash Fires	Sensitive	½ Lower Flammable Limit
	Acceptable	Not applicable
	Ideal	Not applicable

Refer to Appendix I for individual specialist maps.

5.2 Sensitivity Indexes

Each of the sensitivity maps from each specialist discipline was then overlaid in order to calculate a total sensitivity of the study area. The sensitivity index indicates the least sensitive areas (green – yellow areas) for the CCGT power plant and highlights the sensitive areas (red to maroon areas) that should be avoided. The sensitivity analysis is based on the individual specialist input, where:

- Sensitive areas were awarded a value of **-1**
- Acceptable areas were awarded a value of **0**
- Ideal areas were awarded a value of **+1**.

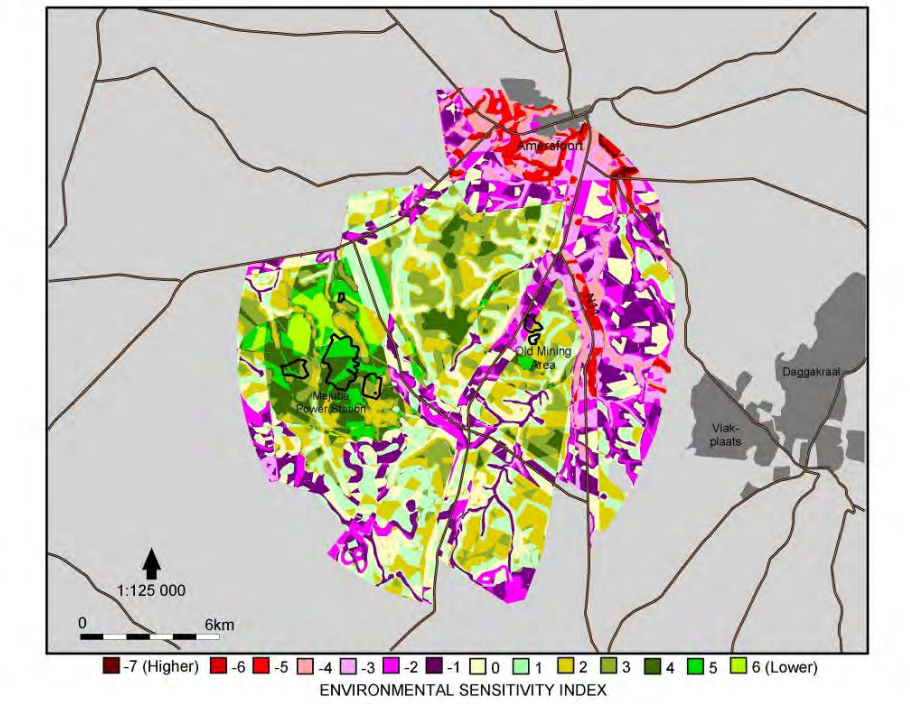


Figure 5.1 Environmental sensitivity index

Figure 5.1 is the result of merging the seven specialist inputs and is expressed as an index indicating higher or lower environmental sensitivity. An area with the most sensitive value (-7), for instance, indicates areas that where awarded -1 by all the specialists. The value of 6, at the other end of the index, represents the most ideal areas.

5.3 Sensitivity Zoning

Figure 5.2 is a simplification of the index into three zones representing the negative (sensitive - red), zero (acceptable - yellow) and positive (ideal - green) zones. It must be borne in mind that a zero area could be the result of a -1 and +1 cancelling each other out. The negative may be a critical factor and therefore Figure 5.3 has been generated to illustrate Ideal areas for development. This map (Figure 5.3) is based on the environmental sensitivity areas but excludes all areas that received a negative rating by any specialist. It may be that not all the specialists consider their negatives to be critical, in which case that area may be removed from the exclusion zone. The result of Figure 5.3, however, is a risk-averse approach, where all the negatives are considered to carry the same weight.

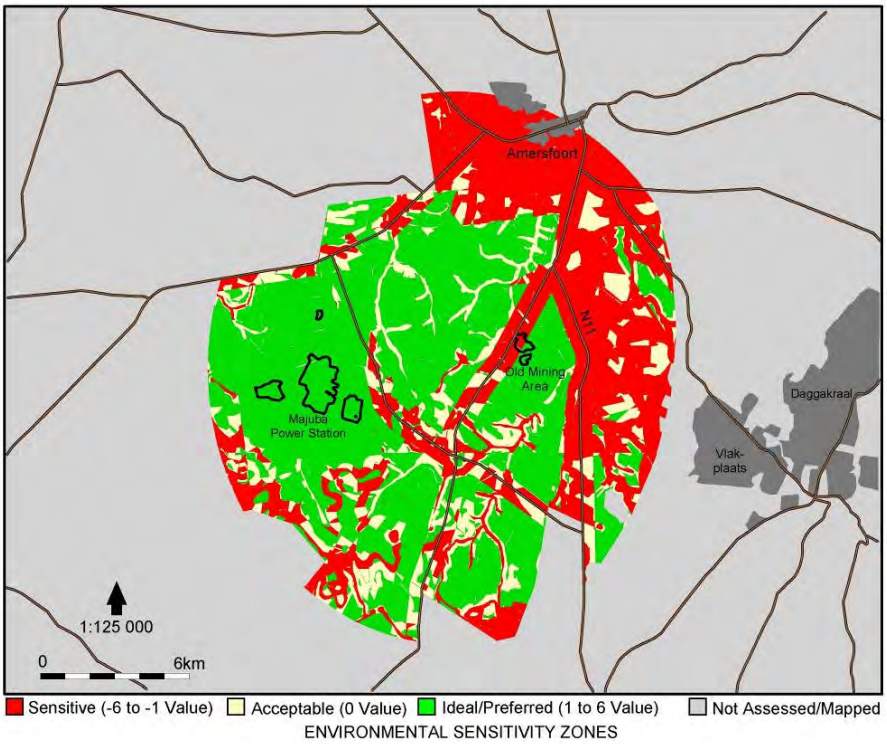


Figure 5.2 Environmental Sensitivity Zones

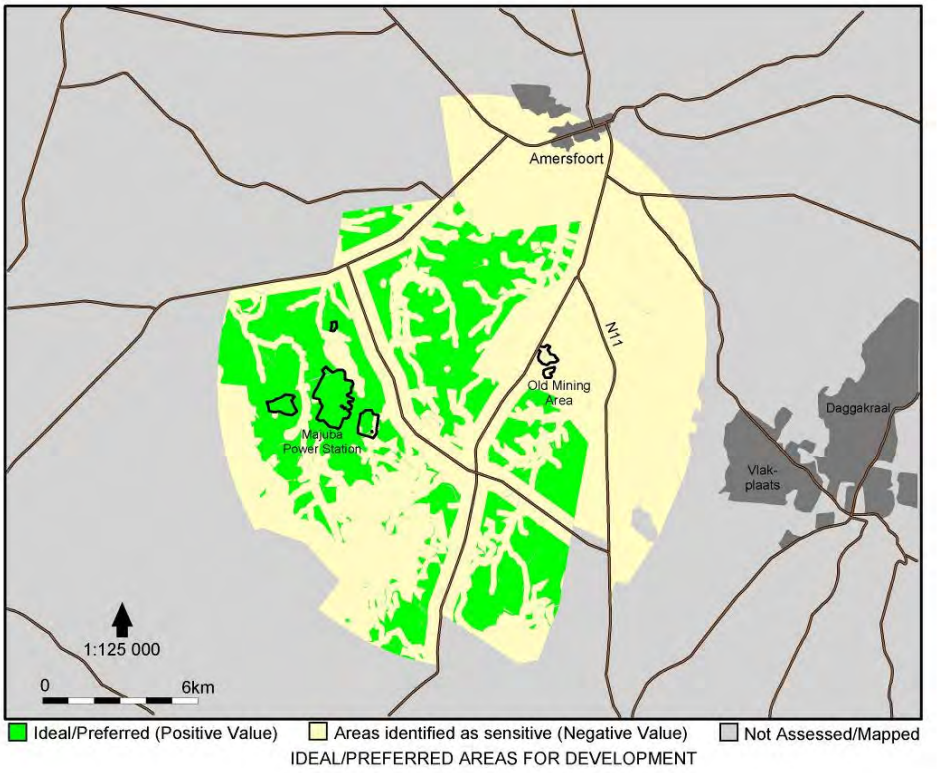


Figure 5.3 Ideal/preferred areas for development

By utilising the Figures 5.1 – 5.3 the broader farms were identified were potentially feasible alternative sites can be located and therefore assessed within the Environmental Scoping Study. These farms include:

- Roodekopjes 67 HS
- Bergvliet 65 HS
- Werda 116 HS
- Rietpoort 83 HS
- Welgedacht 82 HS
- Palmietspruit 68 HS
- Strydkraal 53 HS
- Witkoppies 81 HS

Figure 5.4 shows the areas in which potentially feasible alternative sites can be located.

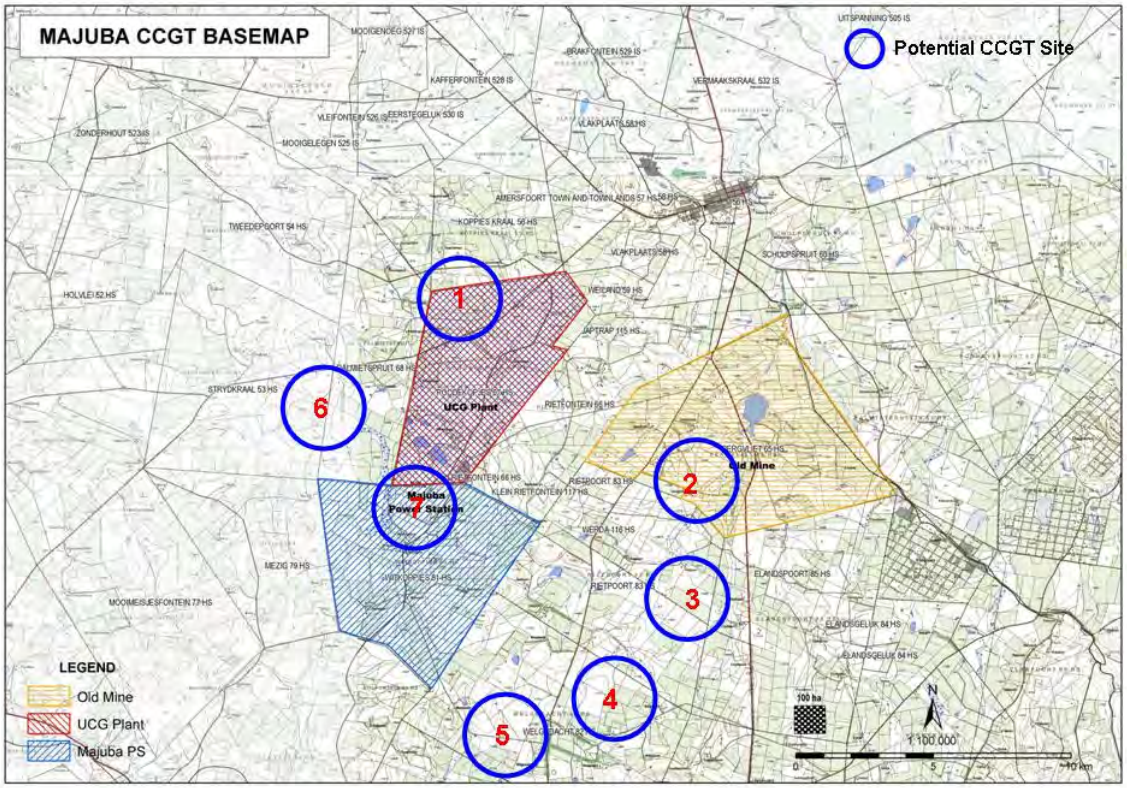


Figure 5.4 Broader farms in which alternatives sites can be located

By utilising the Figures 5.1 – 5.4 in the previous section, the following sites within the broader area / farms were identified (with the aid of a site visit):

SITE	FARM	PORTION
1	Roodekopjes 67 HS	Portions 3 and 4
2A	Bergvliet 65 HS Rietpoort 83 HS Werda 116 HS	Portion 7 Portion 4 Portion 29 of Bergvliet 65 HS and Remainder of the farm Rietpoort 83 HS
2B	Rietpoort 83 HS Werda 116 HS	Portions 3 and 4 Portion 29 of Bergvliet 65 HS and Remainder of the farm Rietpoort 83 HS
3	Rietpoort 83 HS	Portions 3 and 4
4	Rietpoort 83 HS Welgedacht 82 HS	Portion 1 Portions 2, 6 and 7
5	Welgedacht 82 HS	Portions 4, 5 and 8
6	Palmietspruit 68 HS Strydkraal 53 HS Roodekopjes 67 HS	Portions 1, 3 and 7 Portion 6 Portion 1
7A	Witkoppies 81 HS	Portions 1, 2, 6, 10 and 11
7B	Witkoppies 81 HS	Portions 1, 5 and 6
7C	Witkoppies 81 HS	Portions 4, 5, 8, 9, 12, 13 and 14

These sites (refer to Figure 5.5) were deemed **environmentally feasible** and were therefore nominated for assessment in the original Environmental Scoping Study by the Environmental Specialist Team.

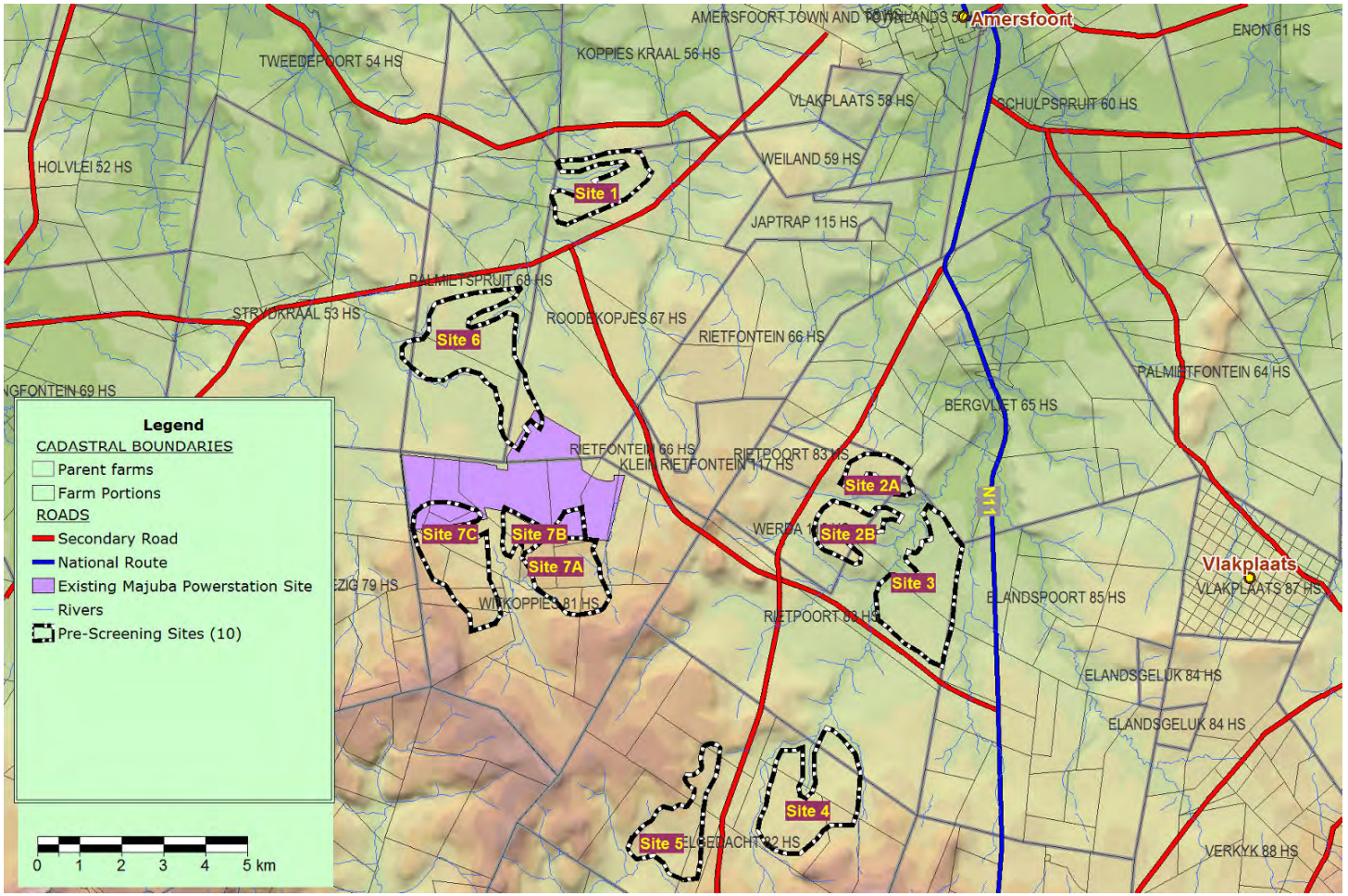


Figure 5.5 Ten alternative environmentally feasible sites identified in the Screening Study for the development of the CCGT power plant

After workshops and discussions with the Project Technical Team, Site 1; 3; 4 and 5 listed above were eliminated as they occur in the area earmarked for the future expansion of UCG operations. The following six (6) sites were then proposed for further assessment during the original Scoping Study (refer to Figure 5.6):

ORIGINAL SITE NUMBER	NEW SITE NUMBER	FARM	PORTION
6	**1**	Palmietspruit 68 HS Strydkraal 53 HS Roodekopjes 67 HS	Portions 1, 3 and 7 Portion 6 Portion 1
2A	**2A**	Bergvliet 65 HS Rietpoort 83 HS Werda 116 HS	Portion 7 Portion 4 Portion 29 of Bergvliet 65 HS and Remainder of the farm Rietpoort 83 HS
2B	**2B**	Rietpoort 83 HS Werda 116 HS	Portions 3 and 4 Portion 29 of Bergvliet 65 HS and Remainder of the farm Rietpoort 83 HS
7A	**3A**	Witkoppies 81 HS	Portions 1, 2, 6, 10 and 11
7B	**3B**	Witkoppies 81 HS	Portions 1, 5 and 6
7C	**3C**	Witkoppies 81 HS	Portions 4, 5, 8, 9, 12, 13 and 14

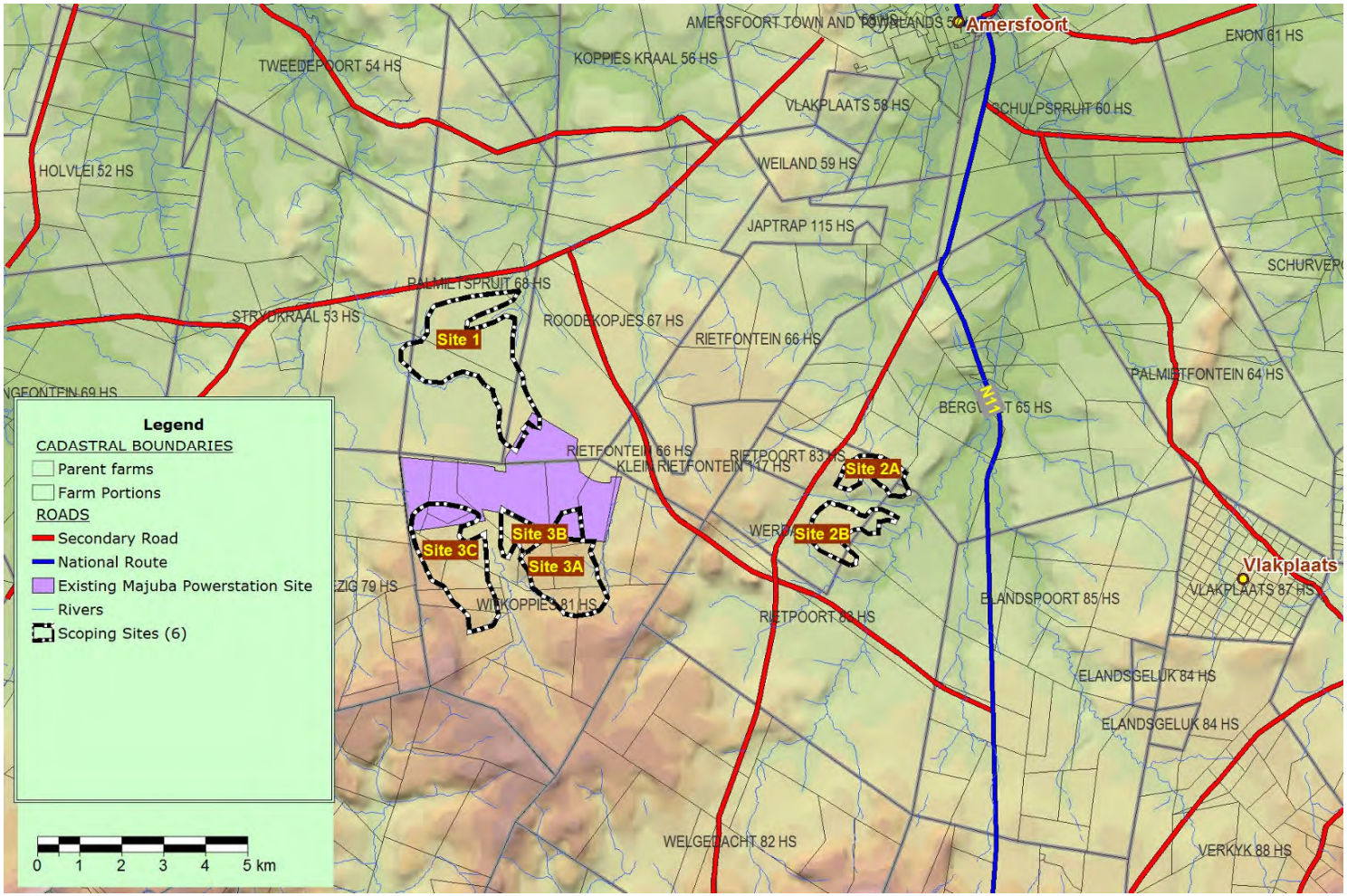


Figure 5.6 Six alternative environmentally and technically feasible sites identified for further assessment in the initial Scoping Study

The six sites presented in the table and figure above were further assessed in terms of preference by the Environmental and Technical specialist team, in the original Scoping phase. Sites 1, 3A and 3B were identified as being the most preferred sites for further assessment in the EIA phase of the study.

Following further workshops and discussions with the Project Technical Team, it became evident that the site identification process required a re-assessment of the sites nominated for further assessment in the Scoping Phase of the project. The motivation for the re-assessment was that:

The 3 sites that were initially identified were mainly based on proximity to the UCG operation as a selection criterion. The main objectives of the UCG selection criteria was to locate the new power station as close as possible to the gas field, but off usable coal reserves that can be used in the future. The close proximity was mainly driven by the cost of the gas pipelines - estimated at approximately R20m per km at the time. Sites close to the Majuba power station were preferred by UCG operation as there were already plans to build pipelines to Majuba for co-firing.

Other factors that provided fatal flaws (for some sites) included suitability of the selected sites for the greater Eskom divisions' (Generation, Transmission and Distribution Divisions) processes, as discussed per site below.

Site 1 (New site number) - The location of the site had two fatal flaws. Firstly, it was located in a position that is in the main wind direction towards Majuba's ACC's. This would have negative thermal impacts on performance of both Majuba power station and the CCGT depending on wind direction. Secondly, it was located in a position where Transmission would not be able to evacuate the power due to major restrictions in constructing new transmission lines.

Sites 3A and 3B (New site numbers) - These sites also had two fatal flaws. Firstly, they are downwind of the existing Majuba power station's dry ash dam. Although Majuba power station uses dust suppression measures, there is still a very high dust emission from this dump site during windy conditions, which would create significant problems on the air filtration systems for the CCGT plant. The dust would also create problems during maintenance etc. as it is not ideal to work in dusty environments when opening up turbines. Secondly, **Site 3B** was destined for future expansion of the Majuba power station ash dam, which means that the above mentioned problem would become more significant over time.

Investigations on the coal qualities at the sites earmarked for expansion of the UCG operation revealed that **Site 4** is not suitable for the expansion as the coal is devolatilised. This site was thus available as a feasible site for location of the CCGT plant.

In light of this, the following potentially (environmentally and technically) feasible sites have been identified as suitable for location of the CCGT plant, and were recommended for assessment during the revised Scoping Study (refer to Figure 5.7).

SITE NUMBER	FARM	PORTION
Revised site 2A (which includes the mine)	Bergvliet 65 HS Rietpoort 83 HS Werda 116 HS	Portion 7 Portion 4 Portion 29 of Bergvliet 65 HS and Remainder of the farm Rietpoort 83 HS
2B	Rietpoort 83 HS Werda 116 HS	Portions 3 and 4 Portion 29 of Bergvliet 65 HS and Remainder of the farm Rietpoort 83 HS
4	Rietpoort 83 HS Welgedacht 82 HS	Portion 1 Portions 2, 6 and 7

This revised Environmental Scoping Study evaluated **Sites 2A, 2B and 4**.