February 2009
Impact Assessment Phase

ENVIRONMENTAL IMPACT ASSESSMENT

Bravo Integration Project – Bravo 4: Construction of two 400 kV Power Lines from Kendal Power Station to Zeus Substation

DEAT REF NO: 12/12/20/1094

Proponent: Eskom Transmission

DRAFT ENVIRONMENTAL IMPACT REPORT

Project 10637

PURPOSE OF THIS DOCUMENT

The growing demand for electricity is placing increasing pressure on Eskom's existing power generation and transmission capacity. Eskom is committed to implementing a Sustainable Energy Strategy that complements the policies and strategies of National Government. Eskom aims to improve the reliability of electricity supply to the country, and in particular to provide for the growth in electricity demand in the Gauteng and Mpumalanga provinces. For this reason, Eskom obtained environmental authorisation to construct the new 400 kV Bravo (Kusile) coal-fired Power Station between Bronkhorstspruit and Witbank in 2007. Construction of this power station has already commenced.

Due to this construction, the new Bravo power station needs to be integrated with the existing Eskom electricity infrastructure. This proposed project is to construct two new 400 kV overhead power lines from the Kendal power station to the Zeus substation. Each of these lines is approximately 100 km in length.

Eskom Transmission has appointed Zitholele Consulting (Pty) Ltd, an independent company, to conduct an EIA to evaluate the potential environmental and social impacts of the proposed project.

The first phase of the EIA (Scoping Phase) has been completed. The second phase of an EIA is the Impact Assessment Phase. In the Scoping Phase public issues, concerns and suggestions were identified and these were used to shape the terms of references for the specialist studies that were conducted. The findings of the specialists are being reported on in this document – the culmination of the second phase (Impact Assessment Phase) of the EIA.

An Environmental Impact Assessment (EIA) must show the authorities, the stakeholders and the proponent what the impact of the proposal on a particular alternative will be in environmental, economical and social terms and provide informed findings of the specialist investigations.

In accordance with the EIA Regulations, Interested and Affected Parties (I&APs) must be given the opportunity to verify that all the issues mentioned during the stakeholder engagement process, have been addressed in the Impact Assessment. This is the main purpose of this Draft Environmental Impact Report (DEIR).

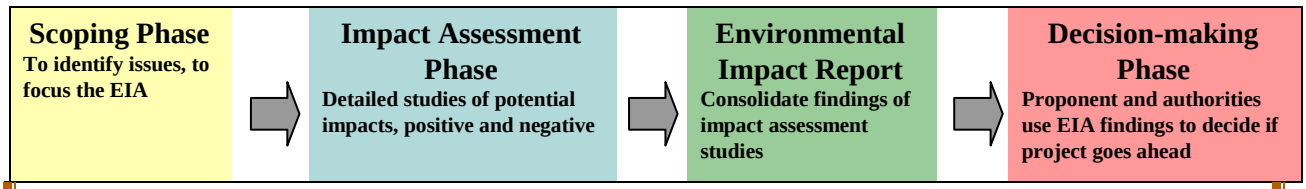
After public review, the Draft EIR will be updated and submitted to the lead authority, the National Department of Environmental Affairs and Tourism (DEAT) for a decision about the project.

Summary of what the Draft Environmental Impact Report Contains

This report contains the following for comment by stakeholders:

- A complete overview of the proposed project;
- An overview of the EIA process followed;
- A complete summary of the Public Participation (PP) Process followed;
- Project alternatives including the "No-go" (no development) option;
- An overview of the baseline receiving environment;
- The assessment by specialists of the potential environmental impacts of the proposed project along with the mitigation measures to reduce the negative impacts and enhance the positive impacts; and
- An Environmental Management Plan (EMP).

AN EIA CONSISTS OF SEVERAL PHASES



YOUR COMMENT ON THE DRAFT ENVIRONMENTAL IMPACT REPORT

The Draft Environmental Impact Report is available for comment from Monday, 16 February 2009 to Monday, 16 March 2009 (4 weeks). This Draft Environmental Impact Report has been distributed to the authorities, all key stakeholders and all those that have requested a copy. Copies of the report are available at strategic public places in the project area (see below).

List of public places where the Draft Environmental Impact Report is available:

PLACE	CONTACT PERSON	TELEPHONE
Blue Valley Golf and Country Estate, HALFWAY HOUSE	Bothma, Lise	(011) 512 0538
City of Johannesburg: Human Development, HALFWAY HOUSE	Kubheka, Kaiser	(011) 203 3419
Delmas Public Library, DELMAS	Mehlape, Lydia	(013) 665 2425
Kungwini Public Library, BRONKHORSTSPRUIT	Smith, Brenda	(013) 665 2425
Leandra Public Library, LEANDRA	Potgieter, A M	(017) 683 0055
Lebogang Public Library, LESLIE	Mosako, Rosina	(017) 683 3000
Midfield Homeowners Association, MIDSTREAM ESTATES	Du Preez, Tarynlee	(012) 661 0456
Midlands Homeowners Association, MIDSTREAM ESTATES	De Wet, Lizette	087 805 3610
Midstream Homeowners Association, MIDSTREAM ESTATES	van der Westhuizen, Durette	(012) 661 0915
Olievenhoutbosch Library, OLIVENHOUTBOSCH	Nkonki, Bongi	(012) 652 1001
Phola Public Library, OGIES	Mabena, Agnes	(013) 645 0094
Secunda Public Library, SECUNDA	Griesel, Tertia	(017) 620 6183

The reports are also available electronically from the Public Participation office.

You may comment on the Draft Environmental Impact Report by:

- Completing the comment sheet enclosed with the report;
- Writing a letter, or producing additional written submissions; or
- By email or telephone to the public participation office.

DUE DATE FOR COMMENT ON THE DRAFT ENVIRONMENTAL IMPACT REPORT

Monday, 16 March 2009 to the Public Participation Office:

Anelle Odendaal
Public Participation Office
Zitholele Consulting (Pty) Ltd
P O Box 6002
HALFWAY HOUSE, 1685
Tel: (011) 254-4855
Fax: (011) 805-2100
Email: aodendaal@zitholele.co.za

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1.1 Background Information

1.1.1 Eskom Holdings

Eskom Holdings is South African utility that generates, transmits and distributes electricity. Eskom supplies approximately 95% of the country's electricity, and approximately 60% of the total electricity consumed on the African continent. Eskom's' vision *"Together building the powerbase for sustainable growth and development."* [1] places a responsibility on the company to ensure that sustainable development in the country becomes a reality. Eskom further plays a major role in accelerating growth in the South African economy by providing a high-quality supply of electricity. Eskom's vision means: [1]

TABLE 1: ESKOM'S VISION.

Together	One Eskom, unified, working together in partnership with others
Building	Planning for the future, building South Africa's economy
Powerbase	Providing the electricity foundation for positive sustainable development
Sustainable	Ensuring continued delivery on economic, environmental and social outcomes
Growth	Empowering South Africa, its people and the economy
Development	Securing a brighter future for all and integrating the first and second economy

The details of the proponent are as follows:

Company: Eskom Transmission: Land and Rights

Contact: Project Manager: Mr Vuledzani Thanyani

Address: Eskom Transmission, Mega Watt Park, Maxwell Drive, Sunninghill

Landline: 011 800 5601

Fax: 011 800 3917

For more information regarding Eskom please refer to the Eskom website at www.eskom.co.za

[1] Taken from the Eskom website, 27 August 2008 (http://www.eskom.co.za/live/content.php?Category_ID=58)

1.2 Purpose and Motivation for the Proposed Project

In South Africa, our most abundant source of energy is coal. Eskom therefore relies on coal-fired power stations to produce approximately 90% of its electricity. Coal mining in South Africa is relatively cheap compared to the rest of the world. In Europe, by contrast, costs are almost four times higher.

In order for the electricity generated by these power stations to be transmitted safely and efficiently, it must be at a high voltage (Typically 400 kilo Volts [kV]) and a low current. The transmission system carries the electricity from source (power stations) to consumption areas.

Electricity delivered by transmission circuits is then stepped down in facilities called substations to voltages more suitable for use. At distribution substations electricity is stepped down to 11 kV for local distribution and then further reduced according to need, for example, 220 volts for domestic use. Substations are used to transform power from one voltage level to another; interconnect alternative sources of power; connect generators, transmission or distribution lines and loads to each other, as well as provide switching for alternate connections and isolation of failed or overloaded lines and equipment. Substations are also used to interconnect adjacent power systems for mutual assistance in case of emergency.

1.2.1 Increased Electricity Supply Plan

For many years Eskom has operated in an environment of surplus capacity. However, this surplus capacity has now been exhausted with increased consumer demand. Eskom's power system will remain tight over the next five years with an increased likelihood of power interruptions. This trend is set to continue at least until the first new coal-fired base load power station (Medupi power station) is commissioned in 2011.

During the Integrated Strategic Electricity Planning (ISEP) process Eskom identified long-term options regarding both the supply and demand sides of electricity provision in South Africa. The ISEP is informed by the White Paper on the Energy Policy of the Republic of South Africa (1998), the Integrated Energy Plan (2003) and the National Integrated Resource Plan (2003/ 2004).

The latest ISEP (October 2005) has identified the need for increased base load electricity supply by the year 2010, while peaking generation is being attended to in the shorter term. The National Energy Regulator of South Africa (NERSA) is the regulatory authority responsible for the electricity supply industry in South Africa. In its National Integrated Resource Plan (NIRP), NERSA has determined that, while various alternative and renewable electricity generation options should be continually investigated, coal should still provide the main fuel source in South Africa. Accordingly, coal-fired power stations will be required for the expansion of generation capacity during the next 20 years.

On 29 February 2008 Eskom awarded contracts for its "Bravo Project", a coal-fired power station to be built near Emalahleni in Mpumalanga by 2017. Site clearance for this station has already started. The first unit is planned to be online by 2013.

The proposed Bravo Integration Project is necessary to integrate and connect Bravo power station (which will aid in the delivery of additional electricity supply) into the existing Eskom electricity network.

For additional information on the Eskom build programme, or increased electricity supply plan, please visit the Eskom website: http://www.eskom.co.za/live/content.php?Item_ID=5981&Revision=en/2.

1.2.2 Bravo Integration Project

The Bravo Integration project consists of the following five components ():

Phase 1: Sol – Camden By-Pass Power Line

The intention of Bravo 1 is to build two 400 kV by-pass lines for Zeus substation, the two 400 kV lines from Sol Substation and the two 400 kV power lines from Camden power station will be disconnected from Zeus substation and joined to each other to form two Camden- Sol 400 kV power lines. The location of the two by-pass lines is planned to be within approximately 10 km radius of the Zeus substation. The project is located within the Govan Mbeki District Municipality.

Phase 2: Apollo and Kendal loop in and loop out lines

Eskom propose to construct four new 400 kV overhead power lines, located within the Emalahleni Local Municipality in Mpumalanga, to loop in and out of Bravo Power Station. The existing Kendal-Apollo line will be looped in and out of Bravo to form the Bravo-Apollo and Bravo-Kendal lines. In addition, the existing Duvha-Minerva 400 kV overhead power line will be looped in and out of Bravo Power Station, to form the Bravo-Duvha and Bravo-Minerva lines. The study area in which the alternatives were selected is within the 10 km radius surrounding the new Bravo Power Station and each of the alternative 400 kV power lines will be not exceed 10 km in length.

Phase 3: Construction of a 400 kV power line from Bravo Power Station to Lulamisa Substation

In order for the Bravo power station to be integrated within the existing Eskom infrastructure, Eskom propose to construct a new 400 kV power line from the new Bravo Power Station to the existing Lulamisa substation, near Diepsloot. This line will be approximately 150 km in length. The construction of this proposed 400kV power line is aimed to ensure sufficient electricity supply to the Diepsloot and Johannesburg North areas, where currently frequent electricity shortages are experienced. The alternative Bravo power line corridors are located on the eastern Highveld of Southern Africa. The corridors cover an area from Witbank in the east, to Diepsloot in the west.

Phase 4: Two new 70 km Kendal –Zeus 400 kV Power Lines

Eskom propose to construct two new 400 kV power lines, one from Bravo to Zeus and the other one from the Kendal Power Station (near Ogies) to the Zeus substation (near Secunda), Mpumalanga. These lines will run parallel to each other and will be approximately 70 km's in length. The three

alternative route corridors will be 5 km's wide. These three alternative corridors merge into two corridors approximately 30 km's from the Zeus substation.

Phase 5: New 10 km Bravo-Vulcan Power Line

Eskom propose to construct a 400 kV overhead power line, by-passing the existing Duvha substation, to form a new Bravo-Vulcan line near Emahlahleni, Mpumalanga. This by-pass line is planned to be approximately 10 km in length. The area to be investigated for this by-pass line is a 10 km radius surrounding the existing Duvha substation.

1.2.3 Context of this Report

This report constitutes the Draft Environmental Impact Report, a key component of the Environmental Authorisation Process for Phase 4 Construction of new Kendal to Zeus 400 kV power lines.

1.3 The Project Team

The project team for the proposed Kendal - Zeus power line is divided into various role players as follows:

- The Applicant / Proponent;
- The Environmental Assessment Practitioner (EAP); and
- The Decision Making Authority.

1.3.1 The Applicant / Proponent

Eskom Holdings, the *"Proponent" is* applying for the Environmental Authorisation from the Department of Environmental Affairs and Tourism (DEAT). As the land owner and operator of the proposed Kendal - Zeus power lines Eskom will remain the responsible legal entity and will carry the environmental liability for the proposed project.

1.3.2 The Environment Assessment Practitioner (EAP)

In terms of the EIA Regulations, the Proponent has appointed the following independent environmental consultants to undertake the detailed EIA Phase of this project:

ZITHOLELE CONSULTING
PO Box 6002, Halfway House, 1685
Tel: +27 (11) 254 4982
Fax: +27 (11) 011 805 2100
email : jacquih@zitholele.co.za

CYMBIAN ENVIRO-SOCIAL CONSULTING SERVICES PTY (LTD) 2006/022502/07
PO Box 1676, Cresta, 2118
Tel: +27 (11) 678 6680
Fax: +27 (11) 476 4108
email : warren@cymbian.co.za

FIGURE 1: ENVIRONMENTAL ASSESSMENT PRACTITIONERS.

The environmental consultants were selected on the basis of their experience in environmental management and assessment, their familiarity with EIA requirements specifically for projects related to the industry, and their knowledge of the project area. Neither Zitholele Consulting (Pty) Ltd (ZC) nor Cymbian Enviro-Social Consulting Services (Pty) Ltd (Cymbian) have any vested interest in the proposed project.

1.3.3 The Decision Making Authority

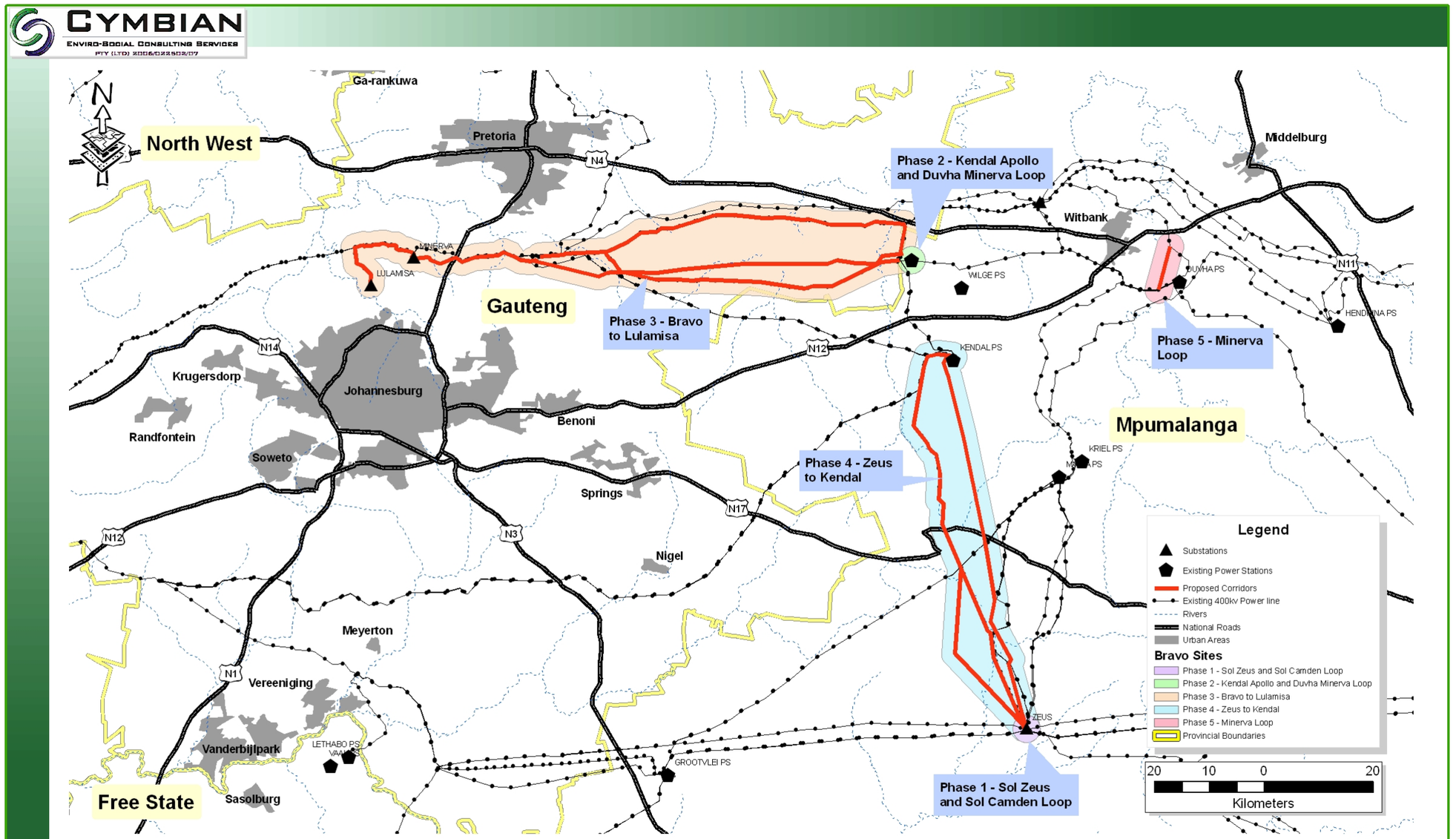
The Department of Environmental Affairs and Tourism (DEAT) is the delegated lead authority responsible for authorising this project. However, in the spirit of co-operative governance, the following government departments will be consulted before making a decision:

- Department of Water Affairs and Forestry (DWAF);
- Mpumalanga Department of Agriculture and Land Administration (MDALA);
- Gauteng Department of Agriculture, Conservation, and Environment (GDACE);
- Emalahleni Local Municipality; and
- Nkgangala District Municipality.

1.4 Project Progress

To date the following has been completed by the Environmental consulting team.

- Pre-application consultation with relevant stakeholders and authorities;
- Completion and submission of the relevant Screening / EIA Application documentation;
- Compilation, submission, and approval of the Plan of Study for Scoping;
- Placement of advertisements;
- Compilation and distribution of a Background Information Document;
- Hosting a public meeting;
- Compilation of a Draft Scoping Report; and
- Compilation, submission and approval of the Final Scoping Report and Plan of Study for EIA;
- Specialist Studies.



CLIENT CODE:	PROJ CODE:	REF NO:	DATE DRAWN: 2008/03/27	PROJECTION:	SCALE:	DATA SOURCES:
ZIT001	228	01	AUTHOR: K. Kruger	WGS 84 Hartebeesthoek	1:650,000	Surveyor General's Office Eskom SANBI Vegmap CSIR Land Cover Database

FIGURE 2: OVERVIEW OF THE BRAVO INTEGRATION PROJECT.

2 LEGAL CONTEXT

2.1 National Environmental Management Act (No 107 of 1998)

The EIA for this proposed project will be conducted in terms of the EIA Regulations that were promulgated in terms of Section 24 (5) of the National Environmental Management Act (NEMA). The National Department of Environmental Affairs and Tourism (DEAT) is the competent authority responsible for issuing environmental authorisation for the proposed project.

A full EIA is applicable to all projects likely to have significant environmental impacts due to their nature or extent, activities associated with potentially high levels of environmental degradation, or activities for which the impacts cannot be easily predicted.

In terms of Government Notice Regulation (GNR) 387, activity 1(l), a full Environmental Impact Assessment comprising both Scoping and Impact Assessment, is necessary for the proposed new 400 kV overhead power lines. This activity is listed as follows:

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

The following activities in accordance with Regulation GNR 386 are also included in the EIA application, to provide for supporting infrastructure associated with the proposed power lines construction:

- *Activity 1 (p): The temporary storage of hazardous waste;*
- *Activity 12: The transformation or removal of indigenous vegetation of three hectares or more, or of any size where the transformation or removal would occur within a critically endangered ecosystem listed in terms of section 52 of the National Environmental Management: Biodiversity Act, 2004 (Act No 10 of 2004);*
- *Activity 14: The construction of masts of any material of type and of any height, including those used for telecommunications, broadcasting and radio transmission, but excluding (a) masts of 15m and lower exclusively used by (i) radio amateurs; or (ii) for lighting purposes, (b) flagpoles; and (c) lightning conductor poles;*
- *Activity 15: The construction of a road that is wider than four metres or that has a reserve wider than six 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 for residential, industrial or institutional use where such development does not constitute infill and where the total area to be transformed is bigger than one hectare; and*
- *Activity 23: The decommissioning of existing facilities or infrastructure, other than facilities or infrastructure that commenced under an environmental authorization issued in terms of the Environmental Impact Assessment Regulations 2006 made under*

section 24(5) of the Act and published in Government Notice No. R. 385 of 2006, for -. (a) electricity generation

The NEMA can be regarded as the most important piece of general environmental legislation. It provides a framework for environmental law reform and covers three areas, namely:

- Land, planning and development;
- Natural and cultural resources, use and conservation; and
- Pollution control and waste management.

The law is based on the concept of sustainable development. The objective of the NEMA is to provide for co-operative environmental governance through a series of principles relating to:

- The procedures for state decision-making on the environment; and
- The institutions of state which make those decisions.

The NEMA principles serve as:

- A general framework for environmental planning;
- Guidelines according to which the state must exercise its environmental functions; and
- A guide to the interpretation of NEMA itself and of any other law relating to the environment.

2.1.1 What are the NEMA principles?

Some of the most important principles contained in NEMA are that:

- Environmental management must put people and their needs first;
- Development must be socially, environmentally and economically sustainable;
- There should be equal access to environmental resources, benefits and services to meet basic human needs;
- Government should promote public participation when making decisions about the environment;
- Communities must be given environmental education;
- Workers have the right to refuse to do work that is harmful to their health or to the environment;
- Decisions must be taken in an open and transparent manner and there must be access to information;
- The role of youth and women in environmental management must be recognised;
- The person or company who pollutes the environment must pay to clean it up;

- The environment is held in trust by the state for the benefit of all South Africans; and
- The utmost caution should be used when permission for new developments is granted.

2.1.2 Department of Environmental Affairs and Tourism Integrated Environmental Management Information Series

The Department of Environmental Affairs and Tourism (DEAT) Information Series of 2002 and 2004 comprise 20 information documents. The documents were drafted as sources of information about concepts and approaches to Integrated Environmental Management (IEM). The IEM is a key instrument of NEMA and provides the overarching framework for the integration of environmental assessment and management principles into environmental decision-making. The aim of the information series is to provide general guidance on techniques, tools and processes for environmental assessment and management.

2.2 Environmental Conservation Act (Act No 73 of 1989)

The Environment Conservation Act (ECA) is a law that relates specifically to the environment. Although most of this Act has been replaced by the NEMA there are still some important sections that remain in operation. These sections relate to:

- Protected natural environments;
- Littering;
- Special nature reserves;
- Waste management;
- Limited development areas;
- Regulations on noise, vibration and shock and
- Environmental impact assessment (EIA).

Perhaps the most important sections are the ones that deal with EIA. The government has made certain Regulations under the EIA sections so that anyone who wants to undertake a development (e.g. erect a hotel, or build a factory) must first put together a report about how the development will affect the environment. This report is then used by government to decide whether permission for the development will be granted, and whether there will be any limits placed on the development.

2.3 Additional Legal Requirements and Frameworks

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

Development within the energy sector in South Africa is guided 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 energy demand and resource availability, whilst taking into account health, safety and environmental aspects. 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.

2.3.2 Integrated Energy Plan (IEP) – 2003

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 security of supply and minimizing 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 concluded that, based on energy resources available in South Africa, coal will be the primary fuel source for the current expansion period.

2.3.3 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 NIRP. The objectives of the NIRP are 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. They 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.

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

2.3.4 The National Heritage Resources Act (No. 25 of 1999)

The proposed overhead power lines comprise certain activities (e.g. changing the nature of a site exceeding 5 000 m^2 and linear developments in excess of 300 m) that require authorisation in terms of Section 38 (1) of the Act. 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. The requirements of the National Heritage Resources Act have thus been addressed as an element of the EIA process, specifically by the inclusion of a Heritage Assessment.

2.3.5 Expropriation Act (No. 63 of 1975)

Eskom has a policy of "willing buyer, willing seller", and therefore endeavours to purchase land where ever possible or necessary. However, the State and State-owned-enterprises can acquire the rights to use or possess the requisite land through the Expropriation Act (No 63 of 1975). The Expropriation Act requires the determination of compensation based on the principle of market value (i.e. what would the value be in the event of both a willing buyer and a willing seller trading the land). There is a suite of additional legislation, which, in conjunction with the Expropriation Act, would be used to determine the compensation value.

2.3.6 Occupational Health and Safety Act (Act No 85 of 1993)

This Act makes provisions that address the health and safety of persons working at the proposed plant. The Act addresses amongst others the:

- Safety requirements for the operation of plant machinery;
- Protection of persons other than persons at work against hazards to health and safety, arising out of or in connection with the activities of persons at work;
- Establishment of an advisory council for occupational health and safety; and
- Provision for matters connected therewith.

The law states that any person undertaking upgrades or developments for use at work or on any premises shall ensure as far as is reasonably practicable that nothing about the manner in which it is erected or installed makes it unsafe or creates a risk to health when properly used.

3 ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

3.1 Study Approach and Progress to Date

The EIA Process being followed for this project complies with the new EIA Regulations as amended and administered by the DEAT and promulgated in April 2006 in terms of the Section 24 (5) of the National Environmental Management Act (NEMA) (Act 107 of 1998). The technical and public participation process undertaken for this EIA is summarised below and schematically represented in Figure 3.

3.1.1 Pre-Application Consultation

On notification and receipt of the appointment letter from Eskom, a project inception meeting was held on 13 November 2007 between Eskom and Zitholele Consulting Project Team. During this project kick-off meeting the following was discussed:

- Project Scope and Requirements;
- Project Schedule;
- Identification of key stakeholders and role players; and
- Analyse the preliminary Kendal - Zeus power line route alignments.

A pre-application consultation with Mr. Wayne Hector of the DEAT was held on 21 April 2008. During this meeting the proposed project was presented to the authorising authority and the project-specific requirements for environmental authorisation were discussed and finalised.

3.1.2 Submission of an Application for Authorisation

The EIA application form (Appendix A) for the proposed project was submitted to the DEAT on 7 January 2008. The potentially affected landowners are attached as Appendix C to this report.

3.1.3 Site Visit

A site visit was conducted by Mr Johan Hayes and Mr Andre Joubert from Zitholele Consulting on 24 April 2008. The objective of this site visit was to familiarise the project team with the area.

3.1.4 Draft Scoping Report and Terms of Reference for Specialist Studies

This Draft Scoping Report (DSR) was prepared on the basis of information and issues identified during the Scoping Phase of this EIA. The Terms of Reference (ToR) for the envisaged specialist studies during the Environmental Impact Assessment Phase and a Plan of Study for EIA were compiled. The DSR was later updated based on public review and comments obtained from the I&APs. After the public review period, the Final Scoping Report was submitted to the DEAT for approval to commence the Environmental Impact Phase.

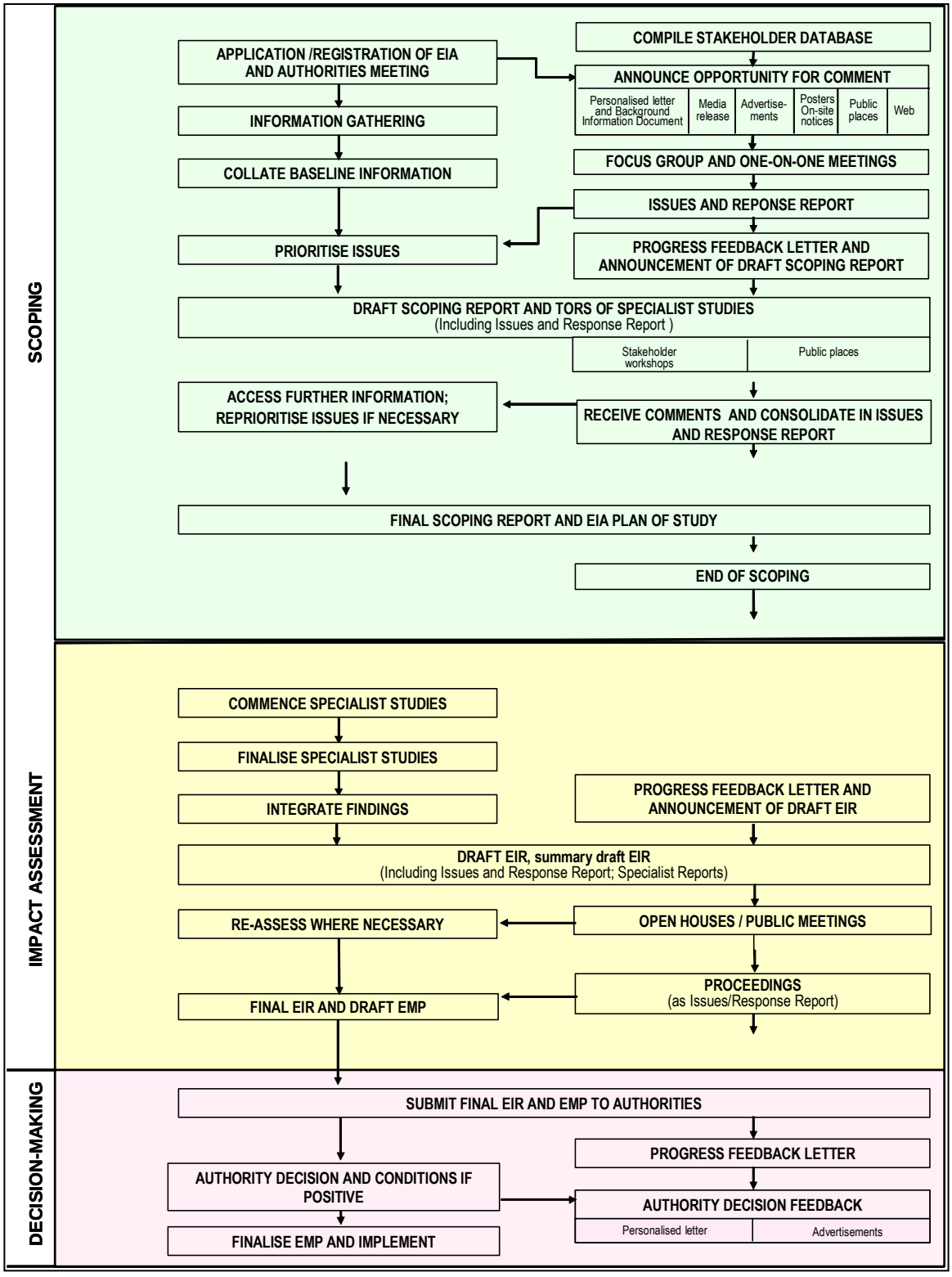


FIGURE 3: TECHNICAL AND PUBLIC PARTICIPATION PROCESS AND ACTIVITIES THAT COMPRISE THE ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED CONSTRUCTION OF TWO NEW 400 KV POWER LINES FROM KENDAL POWER STATION TO ZEUS SUBSTATION.

3.1.5 Public Participation Process

Public participation is an essential and legislative requirement for environmental authorisation. The principles that demand communication with society at large are best embodied in the principles of the National Environmental Management Act (Act 107 of 1998, Chapter 1), South Africa's overarching environmental law. In addition, Section 24 (5), Regulation 56 of GN R385 under the National Environmental Management Act, guides the public participation process that is required for an Environmental Impact Assessment (EIA).

The public participation process for the proposed loop-in and loop-out overhead power lines has been designed to satisfy the requirements laid down in the above legislation and guidelines. Figure 3 provides an overview of the EIA technical and public participation processes, and illustrates how issues and concerns raised by the public are used to inform the technical investigations of the EIA at various milestones during the process. This section of the report highlights the key elements of the public participation process followed.

Objectives of Public Participation in an EIA

The objectives of public participation in an EIA are to provide sufficient and accessible information to I&APs in an objective manner to assist them to:

During Scoping:

- Identify issues of concern, and provide suggestions for enhanced benefits and alternatives.
- Contribute local knowledge and experience.
- Verify that their issues have been considered.

During Impact Assessment:

- Verify that their issues have been considered either by the EIA Specialist Studies, or elsewhere.
- Comment on the findings of the EIA, including the measures that have been proposed to enhance positive impacts and reduce or avoid negative ones.

Identification of interested and affected parties

The identification of stakeholders is an ongoing process, refined throughout the process as on-the-ground understanding of affected stakeholders improves through interaction with various stakeholders in the area. The identification of key stakeholders and community representatives (land owners and occupiers) for this project is important and was done in collaboration with the local municipalities and other organisations in the study area.

Stakeholders' details are captured on Maximiser 9, an electronic database management software programme that automatically categorises every mail to stakeholders, thus providing an ongoing record of communications - an important requirement by the authorities for public participation. In addition, comments and contributions received from stakeholders are recorded, linking each comment to the name of the person who made it.

According to the new EIA Regulations under Section 24(5) of NEMA, a register of I&APs must be kept by the public participation practitioner. Such a register has been compiled and is being kept updated with the details of involved I&APs throughout the process (See Appendix F).

Announcement of opportunity to become involved

The opportunity to participate in the EIA was announced in April 2008 as follows:

- Distribution of a letter of invitation to become involved, addressed to individuals and organisations by name, accompanied by a Background Information Document containing details of the proposed project, including maps of the project area and the alternative routes, and a registration sheet (Appendix G);
- Advertisements were placed in the following newspapers (Appendix I):

TABLE 2: ADVERTISEMENTS PLACED DURING THE ANNOUNCEMENT PHASE.

NEWSPAPER	DATE
City Press	27 April 2008
Pretoria News	22 April 2008
Beeld	23 April 2008
The Star	24 April 2008
Citizen	25 April 2008
Pretoria Record Central	25 April 2008
Tshwane Sun West	30 April 2008
Tembisan	25 April 2008
Middelburg Herald	25 April 2008
Witbank News	25 April 2008
Springs Advertiser	23 April 2008
Streeknuus	23 April 2008
Ekasi News	25 April 2008
Ridge Times	25 April 2008
The Echo	25 April 2008

- Notice boards were placed at prominent localities at each alternative route during May and June 2008 at conspicuous places at various public places and on route (Appendix H). Site notices were placed prominently to invite stakeholder participation.

3.1.6 Draft Scoping Report

The purpose of the DSR was to enable I&APs to verify that their contributions have been captured, understood and correctly interpreted, and to raise further issues. At the end of Scoping, the issues identified by the I&APs and by the environmental technical specialists, were used to define the Terms of Reference for the Specialist Studies that will be conducted during this Impact Assessment Phase of the EIA. A period of four weeks was available for public review of the DSR (from Monday 21 July to Thursday, 21 August 2008).

In addition to media advertisements and site notices that announced the opportunity to participate in the EIA, the opportunity for public review was announced as follows:

- In the Background Information Document (April 2008).
- In advertisements published (see table above and Appendix I) to advertise the public review period;
- In a letter sent out on 7 July 2008, and addressed personally to all individuals and organisations on the stakeholder database.

The Draft Scoping Report, including the Issues and Response Report Version 1, was distributed for comment as follows:

- Left in public places in the project area. The public places where documents were available are listed in the table below:
- Mailed to key stakeholders.
- Mailed to I&APs who requested the report.

- Copies were made available at the public meetings (see table 3 above) where stakeholders had the opportunity to comment on the Scoping Report.

TABLE 3: LIST OF STAKEHOLDER MEETINGS THAT WERE ADVERTISED AND HELD AS PART OF THE PUBLIC REVIEW PERIOD OF THE DRAFT SCOPING REPORT.

DATE	VENUE
Monday, 28 July 2008 at 18:00	Midrand
Tuesday, 29 July 2008 at 18:00	Bronkhorstspruit
Wednesday, 30 July 2008 at 18:00	Kendal
Thursday, 31 July 2008 at 18:00	Leandra

The minutes of the public meetings are attached as Appendix L.

I&APs could comment on the report in various ways, such as completing the comment sheet accompanying the report, and submitting individual comments in writing or by email.

TABLE 4: LIST OF PUBLIC PLACES WHERE THE DRAFT SCOPING REPORT WAS AVAILABLE

PLACE	CONTACT PERSON	TELEPHONE
Blue Valley Golf and Country Estate, HALFWAY HOUSE	Bothma, Lise	(011) 512 0538
City of Johannesburg: Human Development, HALFWAY HOUSE	Kubheka, Kaiser	(011) 203 3419
Delmas Public Library, DELMAS	Mehlape, Lydia	(013) 665 2425
Kungwini Public Library, BRONKHORSTSPRUIT	Smith, Brenda	(013) 665 2425
Leandra Public Library, LEANDRA	Potgieter, A M	(017) 683 0055
Lebogang Public Library, LESLIE	Mosako, Rosina	(017) 683 3000
Midfield Homeowners Association, MIDSTREAM ESTATES	Du Preez, Tarynlee	(012) 661 0456
Midlands Homeowners Association, MIDSTREAM ESTATES	De Wet, Lizette	087 805 3610
Midstream Homeowners Association, MIDSTREAM ESTATES	van der Westhuizen, Durette	(012) 661 0915

Olievenhoutbosch Library, OLIVENHOUTBOSCH	Nkonki, Bongi	(012) 652 1001
Phola Public Library, OGIES	Mabena, Agnes	(013) 645 0094
Secunda Public Library, SECUNDA	Griesel, Tertia	(017) 620 6183

3.1.7 Final Scoping Report

The Final Scoping Report was updated with additional issues raised by I&APs and contained new information that was generated as a result of this process. The FSR was distributed to the Authorities (DEAT) and key I&APs, and to those individuals who specifically requested a copy. I&APs were notified of the availability of the report.

3.1.8 Public participation during the Impact Assessment

The purpose of the public participation process during the Impact Assessment Phase is to ensure that the Draft Environmental Impact Assessment Report is made available to the public for comments. I&APs will be requested to comment on the findings of the EIA, including the measures that have been proposed to enhance positive impacts and reduce or avoid negative ones. Once the review is completed, the authority may decide to request additional information on matters that may not be clear from the report, authorise the application with certain conditions to be complied with by the applicant or reject the application. An Environmental Authorisation reflecting the decision of the authority as well as any conditions that may apply will be issued to the applicant.

Public participation during the impact assessment phase of the EIA mainly involves a review of the findings of the EIA, presented in this Draft Environmental Impact Report and the volume of Specialist Studies.

I&APs were advised of the availability of these reports, how to obtain them, and the dates and venues of public review places where the reports will be for review.

3.2 Draft Environmental Impact Assessment Report and Environmental Management Plan

Findings of the environmental investigations were integrated by the environmental consultants and captured in a Draft Environmental Impact Assessment Report. The report includes the Issues/Response Report (Version 2), which listed every issue raised with an indication of where the issue was dealt with in the technical evaluations, and the relevant findings. It also includes a full description of the EIA process, including the necessary appendices.

3.3 Announcement of opportunity to comment on findings

The availability of the Draft Environmental Impact Assessment Report and Environmental Management Plan as well as the comment period and the deadline for comment, was announced by the following methods:

- Personalised letters to all individuals and organisations on the mailing list (see notification as part of Appendix J)
- Posters at the public places to announce the opportunity to comment (Table 4 – the same public places were used throughout the project to ensure consistency)
- Paid advertisements in the local and regional media (See below)

TABLE 5: ADVERTISEMENTS AND ANNOUNCEMENTS TO ANNOUNCE THE AVAILABILITY OF THE DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT AND THE OPPORTUNITY TO COMMENT ON THE FINDINGS OF THE EIA

NEWSPAPER	DATE
City Press	25 February 2009
Pretoria News	25 February 2009
Beeld	25 February 2009
The Star	25 February 2009
Citizen	25 February 2009
Pretoria Record Central	25 February 2009
Tshwane Sun West	25 February 2009
Tembisan	25 February 2009
Middelburg Herald	25 February 2009
Witbank News	25 February 2009
Springs Advertiser	25 February 2009
Streeknuus	25 February 2009
Ekasi News	25 February 2009
Ridge Times	25 February 2009
The Echo	25 February 2009

3.4 Distribution

The full Draft Environmental Impact Assessment Report and Environmental Management Plan, Issues and Response Report and the volume of Specialist Studies, were left in public places (see Table 4 – same as the public places used for the Draft Scoping Report) in the study areas where the broader public had access to it, and was on display at meetings with stakeholders. The Draft Environmental Impact Assessment Report and Environmental Management plans are on public review from 16 February 2009 to 16 March 2009.

In special cases, such as the decision-making and commenting authorities, the full sets of reports were distributed. The Draft Environmental Impact Assessment Report alone, and individual Specialist Studies were, however, distributed to stakeholders that specifically request them.

3.5 Methods of public review and obtaining comments

Public review of the Draft Environmental Impact Assessment Report and Environmental Management Plan was done by the following methods:

- Written comment, including email – a comment sheet asking I&APs to respond to particular questions accompanied the report; while further written submissions are encouraged
- Verbal comment during public meetings
- One-on-one discussions with the EIA team members subsequent to the public meetings.

I&APs were asked to keep the following in mind when reviewing the findings of the EIA:

- Verify that the issue(s) they have raised during the Scoping Phase have been considered in the report
- If the issue was not specifically considered in the report, verify that an indication has been provided of where and when it will be addressed
- Indicate which of the findings they agree with, and which not
- For those of the findings that they do not agree with, they have been asked to provide reasons and supporting information, or at least the sources where such information can be obtained. They were also welcome not to agree because of personal preference.

3.5.1 Public meetings

Four public meetings (Table 6) are to be convened to assist stakeholders to comment on the findings of the investigations. The details of the meetings are as follows:

TABLE 6: PUBLIC MEETINGS TO COMMENT ON THE DRAFT SCOPING REPORT

DATE	VENUE
Monday, 2 March 2009 at 18:00	Midrand
Tuesday, 3 March 2009 at 18:00	Bronkhorstspruit
Wednesday, 4 March 2009 at 18:00	Kendal
Thursday, 5 March 2009 at 18:00	Leandra

3.6 Issues and Response Report and acknowledgements

Issues raised thus far, are captured in an Issues and Response Report Version 2, appended to this Draft Environmental Impact Report (Appendix J: Personalised letters to all individuals and organisations on the mailing list

Appendix K). This report will be updated to include any additional I&AP contributions that may be received as the EIA process proceeds. Issues and comments raised during the public review period of the Final Scoping Report were added to the report as Version 2 of the Issues and Response Report.

The contributions made by I&APs are acknowledged in writing.

3.6.1 Environmental Impact Assessment

The EIA culminates in the compilation of this Environmental Impact Report (EIR). The EIR contain an evaluation of feasible alternatives including a comparative assessment of the environmental impacts associated with these alternatives, determination of the significance of identified impacts, as well as proposed mitigation measures to reduce, avoid or prevent the negative impacts and enhance the positive aspects of the activity. This report also contains a summary of specialist investigations undertaken as well as an interpretation of the relevance of the results to the study.

Like the Scoping Report, the EIR has been made available for public review. Stakeholders have an opportunity to comment on the findings of any specialist studies completed and to review the evaluation of impacts and determination of significance. Once the final EIR (including all stakeholder feedback) is submitted to the Regulator, the EIR will be assessed to determine if the impact assessment is adequate for decision-making, whether all the key issues raised during scoping have been investigated and whether the procedures followed comply with the EIA Regulations. The Regulator may either request additional information or clarification, or proceed with decision-making based on the contents of the EIR. The application to undertake the proposed activity could either be authorised with or without conditions, or the application could be rejected. An Environmental Authorisation reflecting the decision of the authority, as well as any conditions that may apply, will then be issued to the Applicant.

3.6.2 Notice of Environmental Authorisation

Within 7 days of the Environmental Authorisation being received, all stakeholders registered on the database will be notified of the outcome of the authority decision-making process. Stakeholders will also be informed of their rights to appeal.

3.6.3 Appeal

An appeal on the Environmental Authorisation can be lodged with the National Minister of Environmental Affairs by either the Proponent or a stakeholder within 30 days following issue of the Environmental Authorisation. The appeal should describe the grounds for appeal and must be substantiated with evidence.

4 ISSUES AND CONCERNS RAISED

Issues and concerns raised during the EIA have been documented in the Issues and Response Report for the Construction of two new 400 kV power lines from Kendal power station to Zeus substation attached in Appendix J: Personalised letters to all individuals and organisations on the mailing list

Appendix K.

4.1 Authorities

To date the following Authorities have raised issues and concerns regarding the proposed routes:

- Gauteng Provincial Department; and
- Kungwini Local Municipality (Bravo 3).

4.2 Stakeholders

The issues and concerns documented to date have been tabulated in the Issues and Response Report (Appendix J: Personalised letters to all individuals and organisations on the mailing list

Appendix K) and have been summarised into the following board categories:

- Socio-economic;
- Noise;
- Air quality
- Information requirements;
- Alternatives / corridor selection / proposed route of transmission lines
- Construction and servitude related comments;
- Construction time frames
- Land capability (chicken farms).

5 DESCRIPTION OF DEVELOPMENT ACTIVITIES

5.1 Activity to be undertaken

Eskom propose to construct two new 400 kV overhead power lines, located between Ogies (Kendal power station) and Secunda (Zeus substation). The purpose of this line is to integrate the new Bravo power station into the Eskom. The study area will include three route alternatives each route is approximately 70 kms in length.

5.2 Location

The proposed Kendal - Zeus power line will be located half way between Ogies and Secunda.

The proposed routes are located between Kendal power station and the Zeus substation. A list of the farms that the alternative routes intersect are attached to this report as Appendix C. For the location of proposed routes refer to Figure 4.

5.3 Description of the Development Activities

5.3.1 The Pre-Construction Phase

Appointment of Contractor

After a tendering process, Eskom will appoint the construction contractor. The anticipated appointment date is mid-2009.

Construction Schedule

The primary milestones for the construction of the Kendal - Zeus power lines are described in Table 7 below.

TABLE 7: CONSTRUCTION SCHEDULE FOR THE KENDAL - ZEUS 400 KV OVERHEAD POWER LINES.

MILESTONES	DATE
Appointment of Construction Contractor	August 2009
Pegging of bend tower by a Transmission surveyor	March 2009
Site preparation and clearance for contractor's camp	September 2009
Erection of camp sites for the Contractors' workforce	October 2009
Vegetation clearing to facilitate access, construction and the safe operation of the lines	November 2009
Establishing of access roads on the servitude where required as per design parameters in TRMSCAAC1 rev 3	January 2010
Pegging of tower positions for construction by the contractor	February 2010
Transportation of equipment, materials and personnel to site and stores	March 2010
Installation of foundations for the towers	March – April 2010

MILESTONES	DATE
Tower assembly and erection	May – June 2010
Conductor stringing and regulation	July 2010
Taking over the line from the contractor for commissioning	November 2010

5.3.2 The Construction Phase

If a positive Environmental Authorisation is obtained, the construction of the power line will be undertaken over a period of XX months. The construction phase of the development will involve the following aspects:

- Pegging of bend tower by a Transmission surveyor;
- Site preparation and clearance for contractor's camp;
- Erection of camp sites for the Contractors' workforce;
- Servitude gate installation to facilitate access to the servitude;
- Vegetation clearing to facilitate access, construction and the safe operation of the lines;
- Establishing of access roads on the servitude where required as per design parameters in TRMSCAAC1 rev 3;
- Pegging of tower positions for construction by the contractor;
- Transportation of equipment, materials and personnel to site and stores;
- Installation of foundations for the towers;
- Tower assembly and erection;
- Conductor stringing and regulation; and
- Taking over the line from the contractor for commissioning.

Pegging of bend tower by a Transmission surveyor

A transmission surveyor will be required to pin-point all the bend tower positions with the aid of a Geographical Positioning System (GPS). This may take place during site clearance or prior to site clearance.

Site preparation and clearance for contractor's camp

An area will be cleared for the siting of a contractor's camp. This area will be chosen to have the least environmental impacts which are easily mitigated and will be rehabilitated as per the Environmental Management Plan (EMP) requirements post construction.

Erection of camp sites for the Contractors' workforce

The contractor's camp will be fenced and the contractor will maintain in good order all fencing for the duration of the construction activities. Site establishment shall take place in an orderly manner and all amenities shall be installed at Camp sites before the main workforce move onto site.

Servitude gate installation to facilitate access to the servitude

A servitude gate will be installed to ensure secure access to the site. This gate must be maintained throughout the construction phase in a working order in accordance with the EMP by the contractor.

Vegetation clearing to facilitate access, construction and the safe operation of the line

Vegetation must be cleared to facilitate access, construction and safe operation of the line. Where indigenous vegetation has been removed it must be replanted so as to minimise impacts to the environment. Search and rescue activities may be required for any endangered species if found on site during clearing.

Establishing of access roads on the servitude where required as per design parameters in TRMSCAAC1 rev 3

All access roads on the servitude must be in accordance to Transmission Specifications – Transmission Line and Towers and Line Construction (TRMSCAA1).

Pegging of tower positions for construction by the contractor

All in-line towers must be pin-pointed with the aid of a Geographical Positioning System (GPS). This may take place during the pegging of the bend tower either by the contractor or the transmission surveyor.

Transportation of equipment, materials and personnel to site and stores

All transportation must be in accordance with the EMP (see Section 11).

Installation of foundations for the towers

Foundations will be approximately 1.5 m x 1.5 m each. The number of foundations will be dependent on the type of tower chosen. The installation of the foundations must take place under supervised conditions.

Tower assembly and erection

All towers will be assembled simultaneously in stages, that is bottom structures will be assembled for all towers in the first phase1, middle structures for all towers will be assembled simultaneously in the second phase 2 and so on.

Conductor stringing and regulation

Stringing will be undertaken in accordance with Eskom's stringing procedure.

Taking over the line from the contractor for commissioning

Transmission engineers will take over the line from the contractor on the completion of construction.

5.3.3 Rehabilitation Phase

The rehabilitation phase of the development will involve the following aspects:

- Rehabilitation of disturbed areas; and
- Signing off of all Landowners upon completion of the construction and rehabilitation.

Rehabilitation of disturbed areas

Once construction of the power line is completed rehabilitation of affected areas will be undertaken to obtain the following objectives:

1.) A sustainable topographic profile, tied into the adjacent vegetation in such a manner that erosion is controlled.

2.) A sustainable vegetation layer, free of alien invasive species.

3.) A litter free environment where all construction waste has been suitably removed to a licensed facility.

4.) All power lines will be constructed to the highest standards such that residual impacts are controlled to their maximum extent.

Signing off of all Landowners upon completion of the construction and rehabilitation

Once rehabilitation has been completed sign off will be obtained from all landowners affected.

5.3.4 The Decommissioning and Operational Phase

The decommissioning and operational phase of the development will involve the following aspects:

- Final inspection of the line, commissioning and hand over to the Grid Line and Servitude Manager for operation.
- Handing over and taking over of the servitude by the Grid Environmental Manager.
- Operation and maintenance of the line by the Grid.

Final inspection of the line, commissioning and hand over to the Grid Line and Servitude Manager for operation.

Final inspection of the line will be carried out by the Grid line and servitude manager.

Handing over and taking over of the servitude by the Grid Environmental Manager.

The site file will be handed over by the servitude manager to grid environmental manager

Operation and maintenance of the line by the Grid.

Bi-annual maintenance checks will be undertaken by Transmission by means of helicopter and on land to ensure that the lines are fully operational. In the event that a problem is identified Transmission will be instructed undertake maintenance on the power lines, however depending on the severity of the problem Transmission may appoint a contractor.

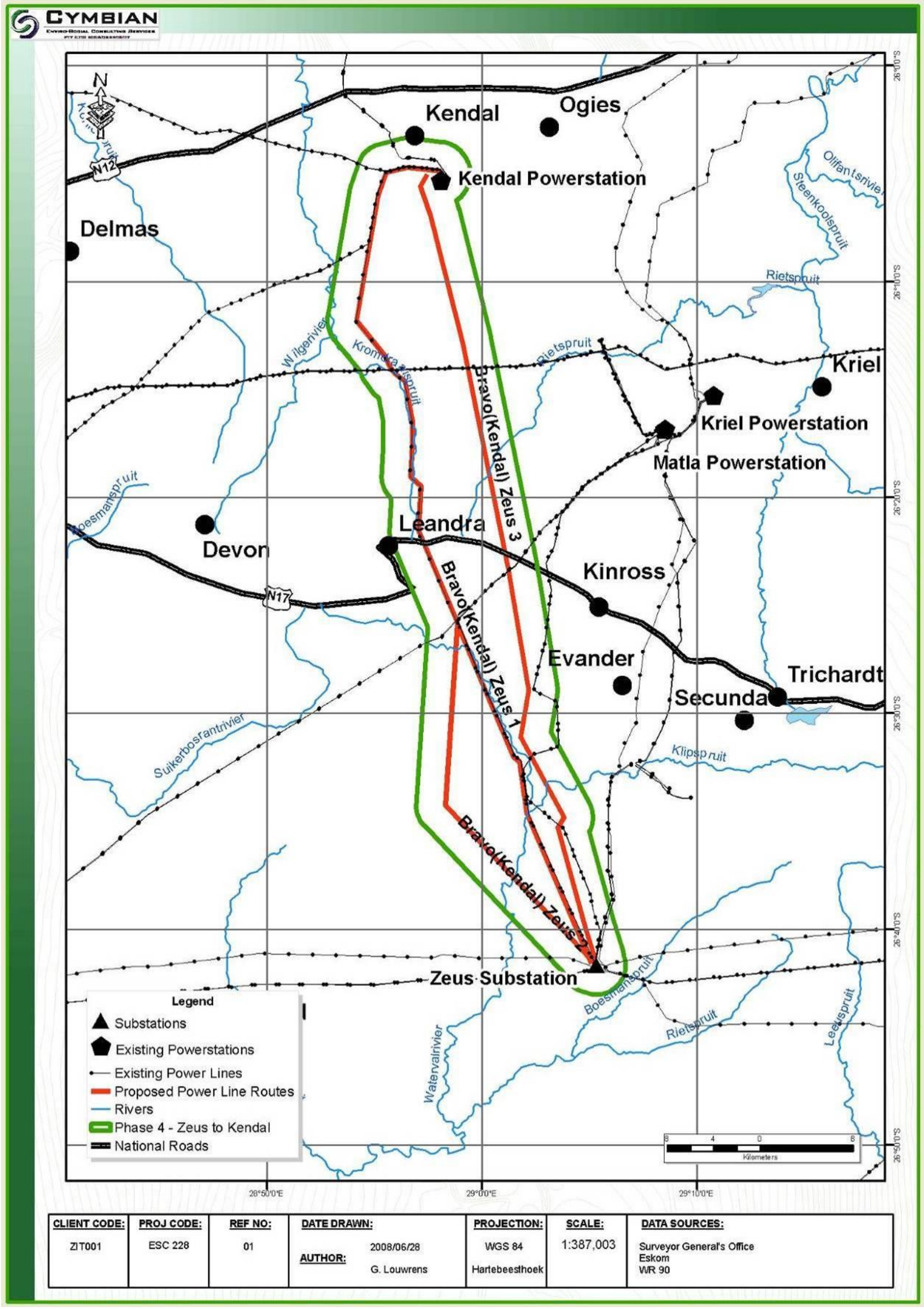


FIGURE 4: PROPOSED ALTERNATIVE ROUTES FOR THE KENDAL - ZEUS POWER LINES.

6 TECHNOLOGY REVIEW / ALTERNATIVES INVESTIGATED

The IEM Guidelines on Scoping (Department of Environment Affairs and Tourism) state that information on reasonable alternatives should be given during the Scoping Phase. The following alternatives have been considered and are discussed in more detail below:

- Project alternatives;
- Site alternatives;
- Design alternatives; and
- "No-go" alternative.

The 'no-go' alternative is the option of not establishing the new Kendal - Zeus power lines. As described in detail in the Scoping Report, the electricity demand in South Africa is placing increasing demand on the country's existing power generation capacity. South Africa is expected to require additional baseload generating capacity by 2010 and beyond. The 'no-go' alternative is likely to result in these electricity requirements not being met, with concomitant potentially significant impacts from an economic and social perspective for South Africa. This alternative will not be explicitly assessed in this EIR, but it represents the baseline against which all of the potential impacts are assessed.

6.1 Project Alternatives

Several strategic alternatives were considered at the conceptual phase of the Bravo Power Station EIA. This strategic information was again revisited during the planning phase of the Bravo Integration Project. The following project alternatives were excluded during the planning phase due to the significant cost implications:

1) Two new power lines from Bravo Power Station to Kendal substation and from Bravo to Apollo were replaced with:

    a) A loop in line from Apollo substation to Bravo substation;

    b) A loop in line to Kendal Power Station;

    c) Two new lines from Kendal Power Station to Apollo Substation.

These alternatives were selected as they represent a total cost saving of R30 million.

6.2 Route Alternatives

The various route alternative corridors of approximately 5 km were analysed and will be assessed during this EIA. These three alternative corridors have been selected considering existing environmental information; engineering feasibilities as well as existing Eskom servitudes power lines.

The following 3 alternatives were identified (Figure 4). The 3 alternative routes merge into 2 corridors 30 km from the Zeus substation, since there is and existing 400 kV Eskom servitude present.

6.2.1 Alternative Route 1

Alternative 1 is to construct the two proposed 400 kV power lines, running parallel, approximately 76 km from Zeus Substation to Kendal Power Station. This proposed line will run furthest to the west as illustrated in Figure 4. This alternative is the longest alternative, and will be along an existing power line servitude.

6.2.2 Alternative Route 2

Alternative 2 is to construct the two proposed 400 kV power lines, running parallel, approximately 70 km from Zeus Substation to Kendal Power Station. The line will follow the same corridor as alternative 1 for the first 60 km's and later divert south before heading east towards the Zeus substation for 30 kms.

6.2.3 Alternative Route 3 (The Preferred Route)

Alternative 3 is to construct the two proposed 400 kV power lines, running parallel, approximately 63 km from Zeus Substation to Kendal Power Station. This alternative will lead to a shorter power line length and is the alternative furthest to the east of the area as illustrated in Figure 4. This alternative is currently the preferred alternative.

6.2.4 Route Evaluation

Alternative 1 is the shortest alternative however it intersects the least sensitive environments such as wetlands, ridges etc. In conclusion Alternative 3 is the preferred rout alternative.

6.3 Design Alternatives

The primary motivating factors behind the selection below ground power lines include the following:

1) Areas prone to significant infrastructure damage due to extreme weather conditions, on an annual basis, usually consider underground power lines. The cost of power line replacement over the life of the infrastructure is usually more cost effective in such areas;

2) The visual impact of underground power lines is much less than those of overhead power lines, and are usually considered in highly sensitive visual landscapes, such as wide open wilderness spaces and tourism facilities e.g. game farms and nature reserves.

The primary motivating factors behind the selection overhead power lines include the following:

1) The cost of overhead lines is between 250% and 400% less. Eskom have a responsibility to provide cost effective and reliable energy resources;

2) Overhead circuits can often be worked on while they are still energized. Nearly all work on underground circuits is performed while things are de-energized and grounded.

3) Underground cables need a larger conductor to handle the same amperage as a smaller overhead conductor. This is due to the difficulty of dissipating heat to the earth. Larger conductors means higher cost.

4) Overhead distribution circuits are much easier to modify to serve customers or make other changes. A simple set of fuses on an overhead circuit might cost ~R2 000.00, yet the underground equivalent costs over ~R10 000,00.

5) An overhead line can generally span and not disturb sensitive features such as cultural resources sites, streams, most wetlands, isolated steep slopes, or a sensitive species location to mention a few. Underground lines however require the construction of a trench and results in a disturbed area of approximately 15m in width for the entire length of the line.

As none of the areas affected by the proposed Bravo Integration Project are annually affected by extremely damaging environmental events, or fall within highly sensitive visual environments it was decided to implement the more cost effective overhead power line alternative.

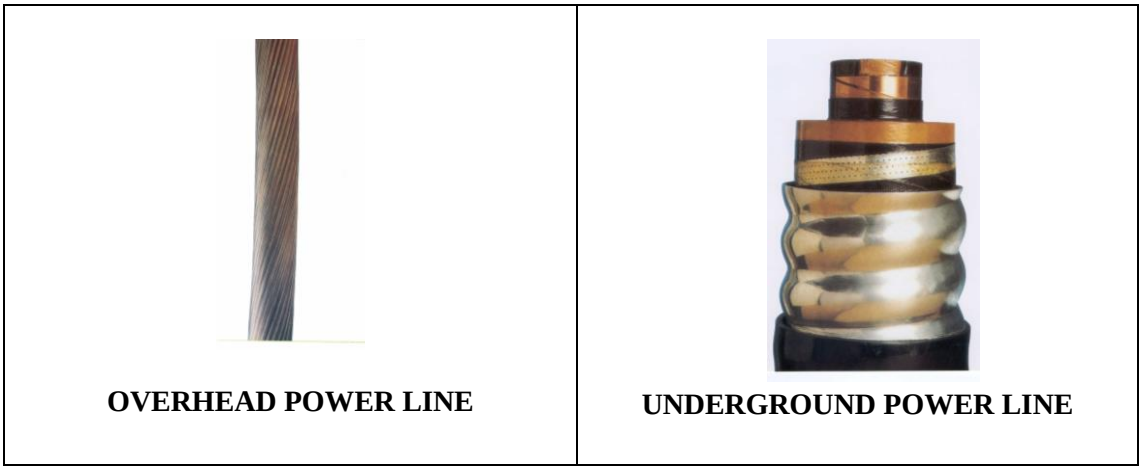


FIGURE 5: OVERHEAD VERSUS UNDERGROUND POWER LINES.

6.3.1 Tower Designs

The following types of towers may be used on this project:

- Cross rope suspension tower;
- Compact cross rope suspension tower;

- Guyed-V suspension tower;
- Self-supporting suspension tower;
- Self-supporting strain tower.

The following will be taken into consideration during the tower selection process.

- Environmental Issues;
- Visual Impacts;
- Financial Implications;

6.4 The No-Go Alternative

The No-Go alternative will also be assessed further in the EIA. In the case that none of the three alternatives is suitable for the proposed power lines, the recommendation would be that the proposed power line not be constructed and further alternative alignments, or project solutions be generated.

6.4.1 The Applicant

Should the construction and operation of the proposed project not take place it is definite that the electricity from the new Bravo Power Station will not be able to be integrated into the Eskom infrastructure grid.

6.4.2 The Community

Should the construction and operation of the proposed project not take place the community will not have sufficient electricity in the near future.

6.4.3 The Local Economy

Should the construction and operation of the proposed project not take place; the economy of the country at large will be negatively affected, resulting in the decrease of low-cost options for electricity. The capital investment and employment opportunities will also not be realised and the potential multiplier effect on the local economy will be lost.

6.4.4 The Environment

Should the construction and operation of the proposed project not take place; the local environment will not be impacted upon. The Bravo power station has however impacted upon a large section of the local environment, and these impacts will persist.

7 BASELINE RECEIVING ENVIRONMENT

Zitholele Consulting (Pty) Ltd appointed Cymbian Enviro-Social Consulting Services to undertake the Biophysical Specialist Studies for this project, including:

- Vegetation Assessment;
- Soil and Land Capability Assessment;
- Wetland Delineation;
- Geology;
- Visual; and
- Avifauna.

The Heritage Impact Assessment was conducted by Julius Pistorius and the Social Assessment was undertaken by Master Q Research (Pty) Ltd.

7.1 Bio-Physical Environment

This section details the bio-physical receiving environment at the project location. Although the aim of this section is to detail the vegetation, wetlands, soil and land capability, certain factors have been included as they provide perspective to the soil and vegetation sections.

For more information on this section please refer to Appendix R.

7.1.1 Geology

Data Collection

The geological analysis was undertaken through the desktop evaluation using a Geographic Information System (GIS) and the relevant data sources. The geological data was taken from the Environmental Potential Atlas Data from the Department of Environmental Affairs and Tourism. Data was supplemented with on site observation during site visits conducted on the 8th – 12th September 2008 and the 3rd – 7th November 2008.

Regional Description

The lithology of the area comprises several geological sequences as illustrated in Figure 6. From the Figure it is clear that the study area is dominated by Dolerite flows along with Arenite. These main two geologies are prevalent for more than 80% of the study area. Several small sections of Granite, Shale and Tillite also occur within the study area.

The Arenite (sandstone) overlies the majority of the Mpumalanga coal fields and has been extensively disturbed by opencast mining operations all over the study area. This geology weathers to form the main agricultural red and brown soils of the province.

The Dolerite originates from lave intrusions throughout the area and can be distinguished by the “dinosaur egg” weathering of the rock. The Dolerite in the region weathers to a dark clayey soil that is not ideal for cultivation and is mostly used for grazing.

FIGURE 6: DOLERITE (LEFT) AND SANDSTONE (RIGHT) ARE THE TWO MAIN GEOLOGIES FOUND ON SITE

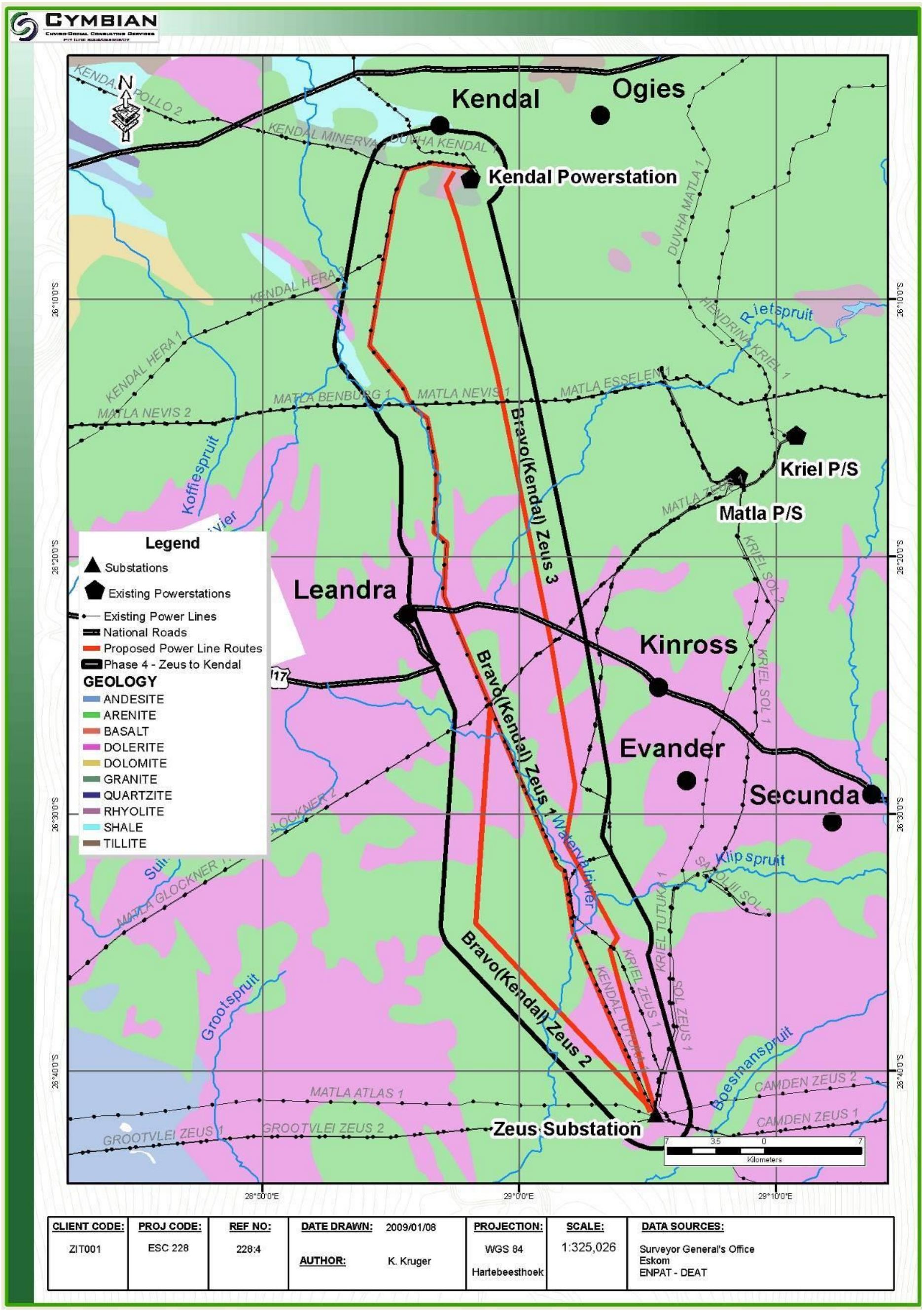


FIGURE 7: REGIONAL GEOLOGY

7.1.2 Climate

Data Collection

Climate information was attained using the climate of South Africa database, as well as from Air Quality Impact Assessment for the Proposed New Coal-Fired Power Station (Kendal North) in the Witbank Area undertaken by Airshed Planning Professionals[2].

Regional Description

The study area displays warm summers and cold winters typical of the Highveld climate. The region falls within the summer rainfall region of South Africa, rainfall occurs mainly as thunderstorms (Mean Annual Precipitation 662 mm) and drought conditions occur in approximately 12% of all years. Mean annual potential evaporation of 2 060 mm indicates a loss of water out of the system.

The region experiences frequent frosts, with mean frost days of 41 days, winds are usually light to moderate, with the prevailing wind direction north-westerly during the summer and easterly during winter. In addition to frost the area is prone to hail storms during the summer time. Such a storm was experienced during the site visits and the hail stones are illustrated in Figure 8 below.

FIGURE 8: HAIL STONES FROM A STORM EVENT IN NOVEMBER 2008 (SECUNDA)

Ambient Temperature

Air temperature is important, both for determining the effect of plume buoyancy (the larger the temperature difference between the plume and the ambient air, the higher the plume is able to rise), and determining the development of the mixing and inversion layers. Long-term average (2003) maximum, mean and minimum temperatures for Kendal 2 is given in Table 8.

[2] *Air Quality Impact Assessment for the Proposed New Coal-fired Power Station (Kendal North) in the Witbank Area. Report No.: APP/06/NMS-01 Rev 0.2, 2006.*

TABLE 8: LONG TERM TEMPERATURE DATA FOR KENDAL (AIRSHED, 2006)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Maximum	31	32	32	29	24	20	22	24	29	30	30	32
Mean	21	22	20	18	13	10	10	12	18	20	21	22
Minimum	15	15	12	11	6	4	3	4	10	13	14	15

Annual maximum, minimum and mean temperatures for Kendal 2 are given as 32°C, 3°C and 17°C, respectively, based on the 2003 record. Average daily maximum temperatures range from 32°C in December to 20°C in July, with daily minima ranging from 15°C in January to 3°C in July.

7.1.3 Surface Water

Data Collection

The surface water data was obtained from the WR90 database from the Water Research Council. The data used included catchments, river alignments and river names. In addition water body data was obtained from the CSIR land cover database (1990) to show water bodies and wetlands.

Site Description

The study area falls within the Olifants River (Catchment B) and Vaal River (Catchment C) Primary Catchments as shown in Figure 9 (Northern section) and Figure 10 (Southern section).

The main river in the northern section of the site is the Wilge River along with the Kromdraai Spruit and the Riet Spruit. All these watercourses drain primarily northwards towards the Olifants River. Several non-perennial streams and drainage lines also occur throughout the area, draining towards the main rivers.

The southern section of the site drains towards the Vaal River and the main tributaries are the Waterval River, The Klip Spruit and the Boesman Spruit. The main drainage direction is southeast towards the Vaal River.

The streams and their associated dams support a number of faunal and floral species uniquely adapted to these aquatic ecosystems and therefore all surface water bodies are earmarked as sensitive features and should be avoided as far as possible.

As illustrated in the Figures below, it is evident that the Alternative 1 route is aligned along several streams, while Alternative 2 crosses very close to Leeupan. Alternative 3 does not traverse along any streams, but it does cross several. It should be noted that a large number of the existing power lines in the area are aligned along streams and drainage lines. The reasoning behind this was not to interfere with the farming activities that take place in all the surrounding areas. The recent emphasis on environmental impact limitation has however changed this perception, and it is now preferred that power lines avoid water courses. The streams support sensitive fauna and flora species which are described in more detail in the sections below. On the basis of the above it would be best to utilise Alternative 3, as this alternative avoids the most of the streams.

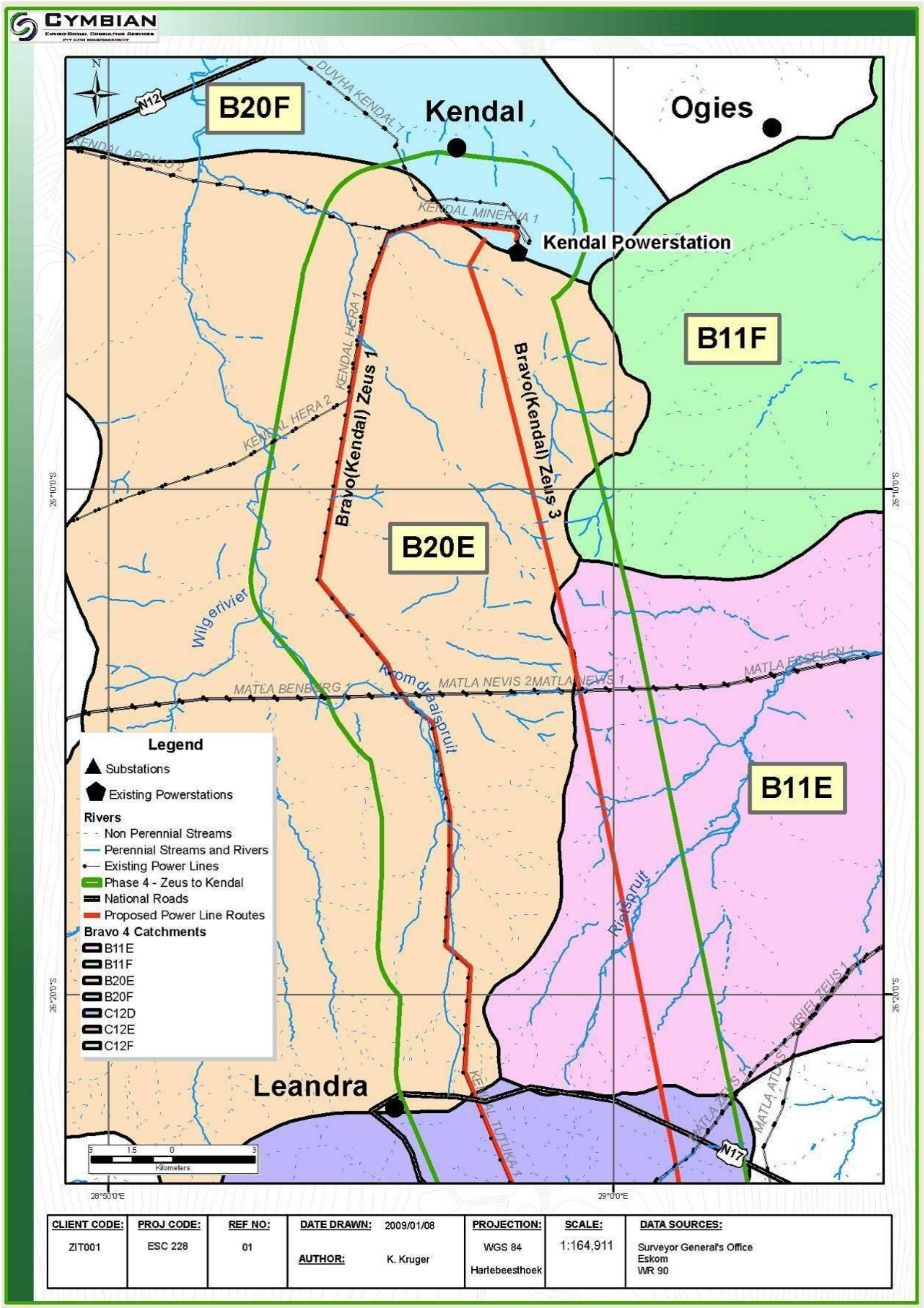


FIGURE 9: SURFACE WATER AND DRAINAGE FEATURES OF THE NORTHERN SECTION OF THE SITE

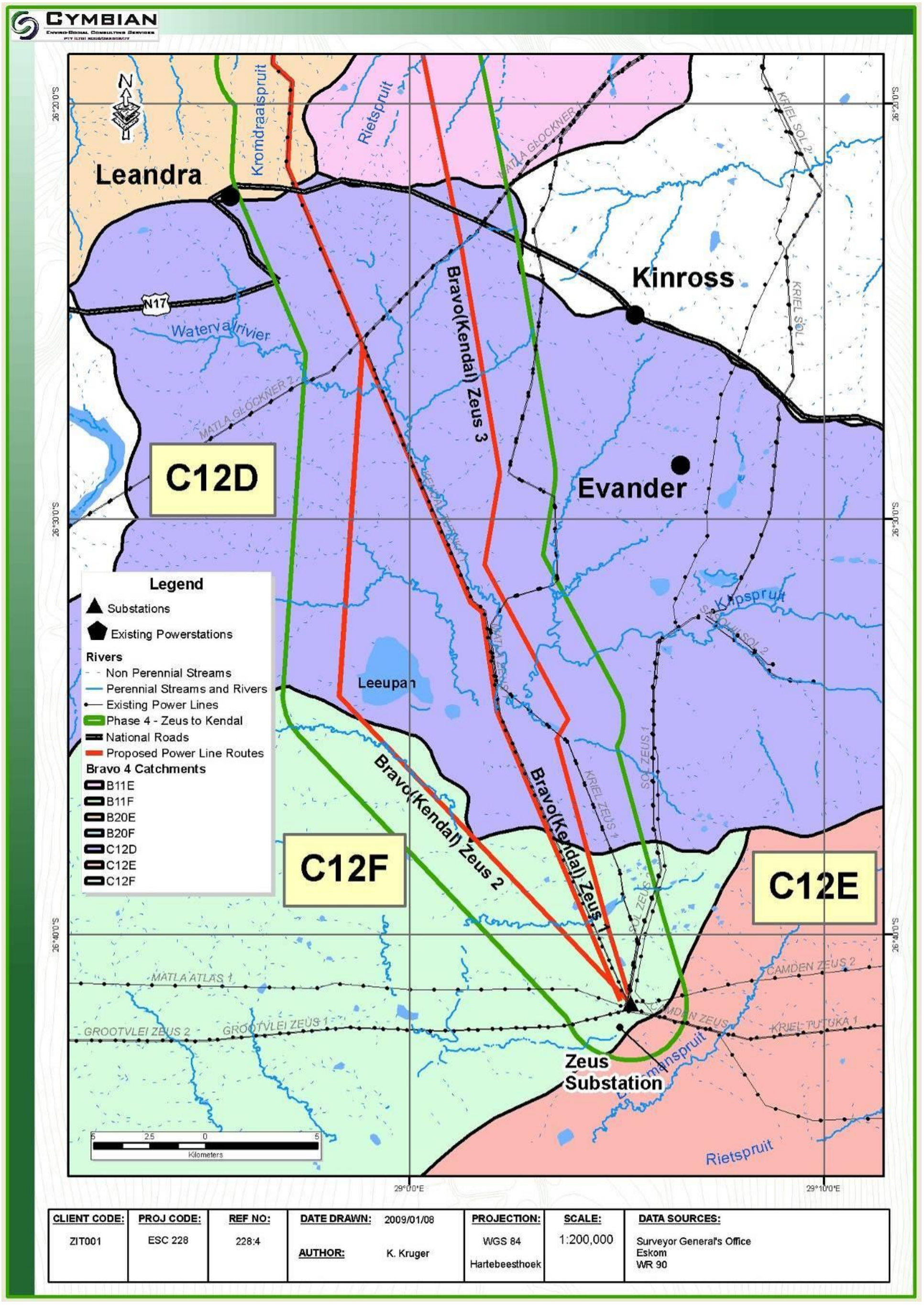


FIGURE 10: SURFACE WATER AND DRAINAGE FEATURES OF THE SOUTHERN SECTION OF THE SITE

The Waterval River along which a significant section of Alternative 1 is aligned.

Leeupan, a significant water body found along the Alternative 2 alignment. Note Secunda in the background (left) and the angling club (right).

Waterval River showing existing power line crossings

Kromdraai Spruit, another stream that is traversed by the Alternative 1 alignment for a considerable distance.

FIGURE 11: PHOTOGRAPHS OF THE SURFACE WATER RESOURCES ENCOUNTERED ON SITE

7.1.4 Topography

Data Collection

The topography data was obtained from the Surveyor General's 1:50 000 toposheet data for the region, namely 2628 BB, BD, DB and 2629 AA, AC and CA. Contours were combined from the topo mapsheets to form a combined contour layer. Using the Arcview GIS software the contour information was used to develop a digital elevation model of the region as shown in Figure 12 below.

Regional Description

The topography of the region is gently undulating to moderately undulating landscape of the Highveld plateau. Some small scattered wetlands and pans occur in the area, rocky outcrops and ridges also form part of significant landscape features in the area. Altitude ranges between 1420-1800 metres above mean sea level (mamsl).

Site Description

The study area's topography is representative of the region, that being gently undulating grassland of the Highveld plateau. This undulating topography gives rise to the number of streams and rivers in the area, which form at the bottom of the gently rolling hills. Elevations range from 1480 metres above mean sea level (mamsl) in the north to 1760 mamsl in the central parts of the site.

Figure 12 below illustrates the digital elevation model created from the contours of the region. The low lying areas are clearly visible in light blue while the higher areas are shown in brown. The watershed along the N17 highway is clearly visible in the centre of the site, from which the water drains either northwards or southwards.

Although the height difference is clear on the map, the higher lying areas in this region are not classified as ridges.

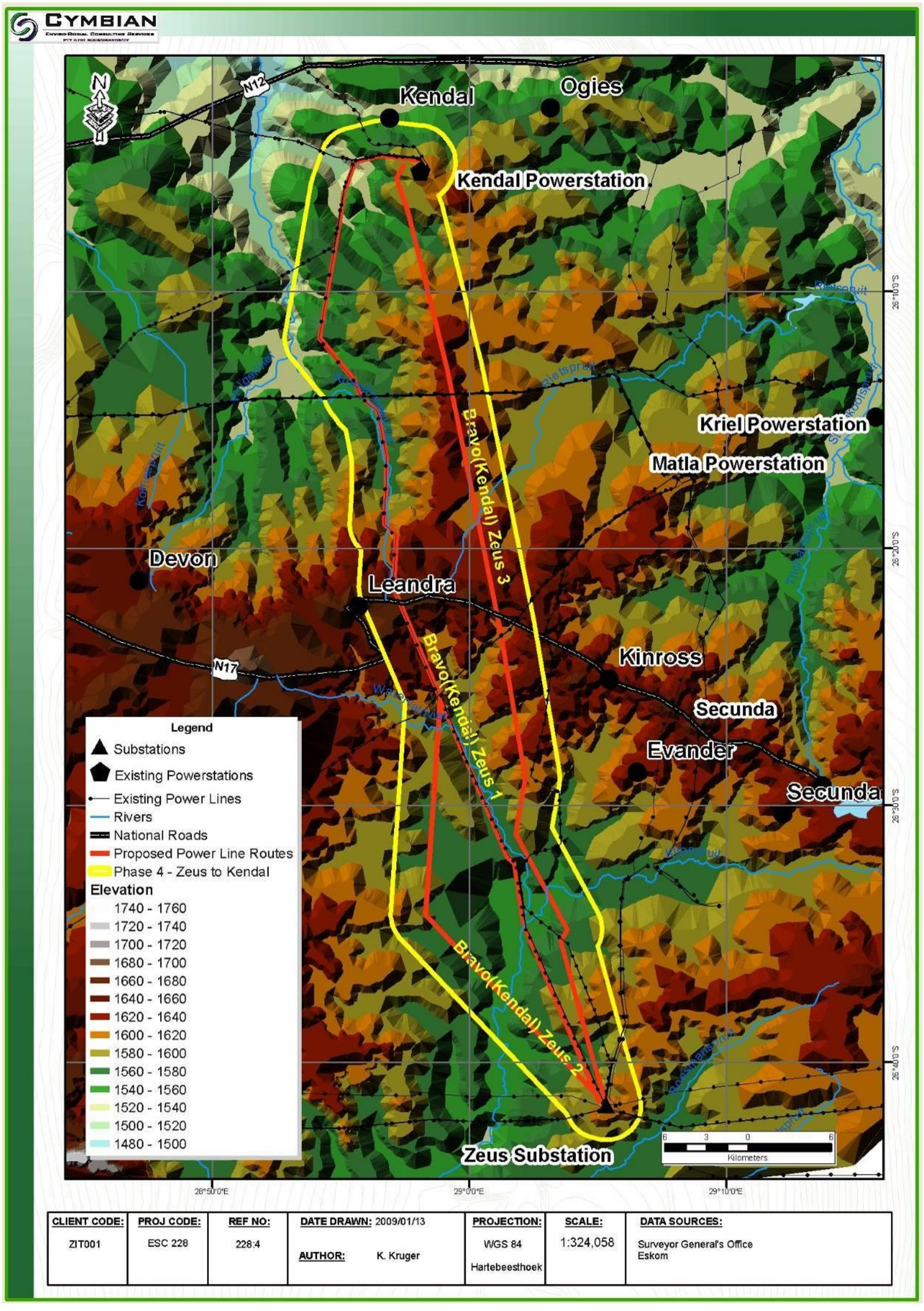


FIGURE 12: TOPOGRAPHY OF SITE

7.1.5 Soils

Data Collection

The site visits were conducted on the 8th – 12th September 2008 and the 3rd – 7th November 2008. Soils were augered at 300 m intervals along the proposed power line routes using a 150 mm bucket auger, up to refusal or 1.2 m. Soils were identified according to Soil Classification; a taxonomic system for South Africa (Memoirs on the Natural Resources of South Africa, no. 15, 1991). The following soil characteristics were documented:

- Soil horizons;
- Soil colour;
- Soil depth;
- Soil texture (Field determination)
- Wetness;
- Occurrence of concretions or rocks; and
- Underlying material (if possible).

Regional Description

The soils in the region are mostly derived from the geology of the region namely, predominantly shale, sandstone or mudstone of the Madzaringwe Formation (Karoo Supergroup), or the intrusive Karoo Suite dolerites which feature prominently in the area. The soils on the sandstones are generally deep with a brown colour, while the dolerites generally form dark clay soils.

Site Description

During the site visit several soil forms were identified including Mispah, Avalon, Clovelly, Katspruit, Longlands, Wasbank, Rensburg, Arcadia, Willowbrook, Steendal, Milkwood, Inhoek, Kroonstad, Westleigh, Dresden, Glencoe, Bainsvlei, Shortlands, Sterkspruit and Witbank. In order to simplify the assessment, the soil forms have been grouped into management units that have similar characteristics, and therefore would require similar management. These units are agricultural soils, disturbed soils, rocky soils, wetlands soils and transitional soils. Each of the soil management units are described in detail in the sections below and Figure 13 and Figure 14 illustrates the location of the soil units. The land capability (agricultural potential) of the abovementioned soils are described in more detail in Section 7.1.6.

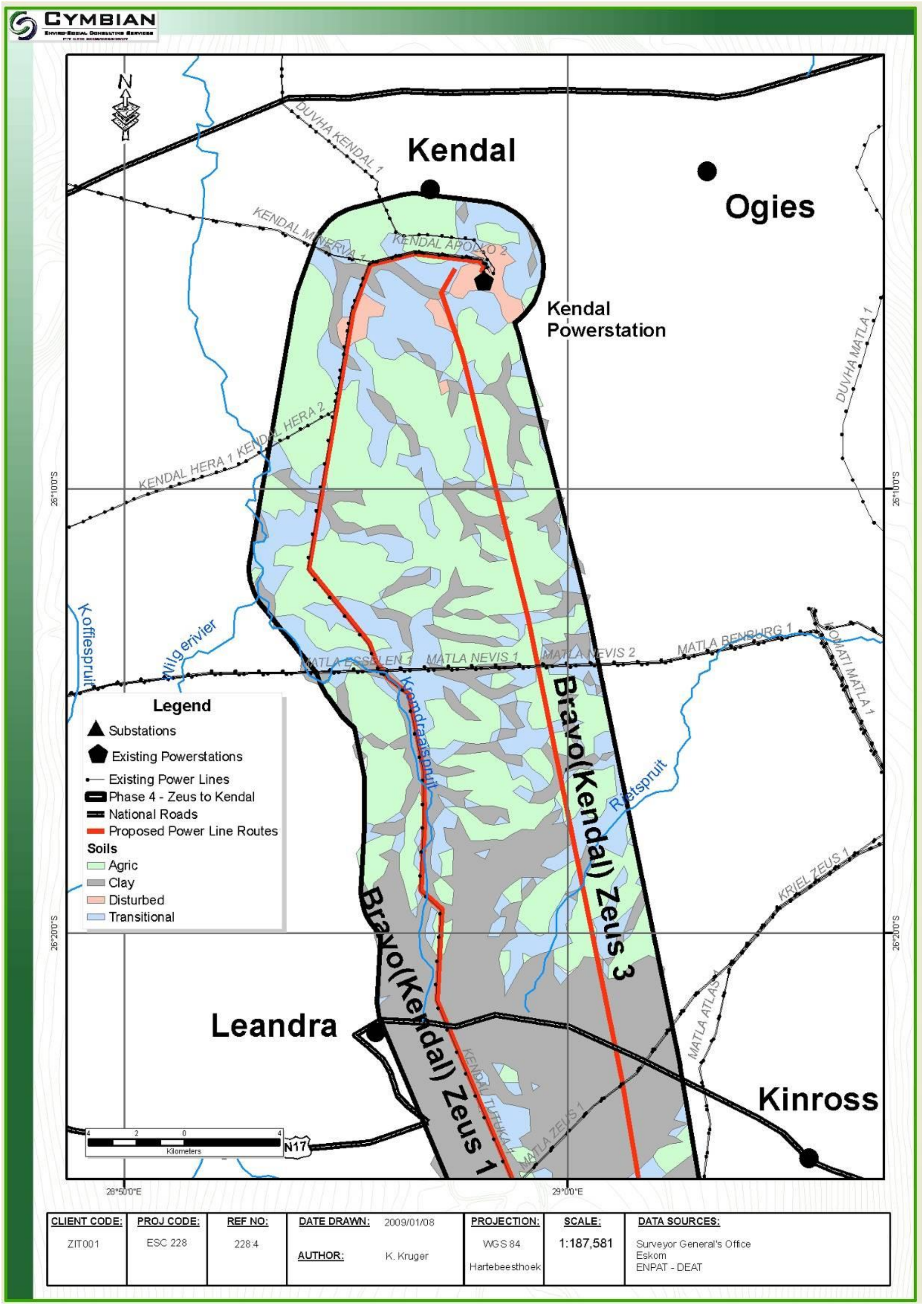


FIGURE 13: SOIL TYPE MAP OF THE NORTHERN SECTION OF THE SITE

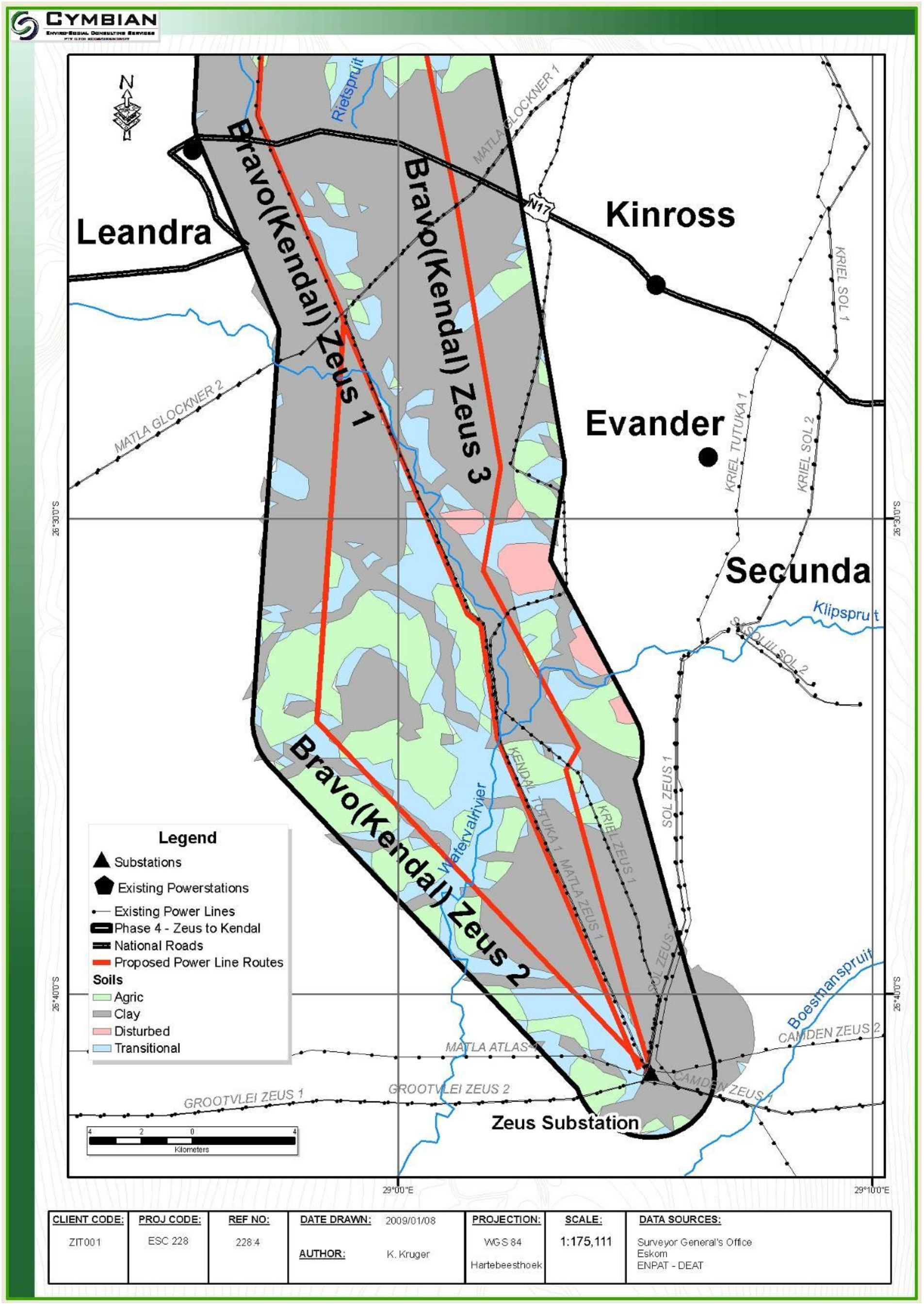


FIGURE 14: SOIL TYPE MAP OF THE SOUTHERN SECTION OF THE SITE

Agricultural Soils

The agricultural soils found on site support an industry of commercial maize production. These soils include Hutton, Clovelly, Avalon, Bainsvlei, Glencoe and Shortlands. These soils have deep red or yellow-brown B-horizons with minimal structure, but in the case of Shortlands soils the B-horizon has some degree of structure. These soils drain well and provide excellent to moderate cultivation opportunities. Each of the soils is described in detail below.

Hutton and Clovelly Soil Forms

Hutton's are identified based on the presence of an apedal (structureless) "red" B-horizon and Clovelly's with an apedal "yellow" B-horizon as indicated in Figure 15 below. These soils are the main agricultural soil in the country due to the deep, well-drained nature of these soils.

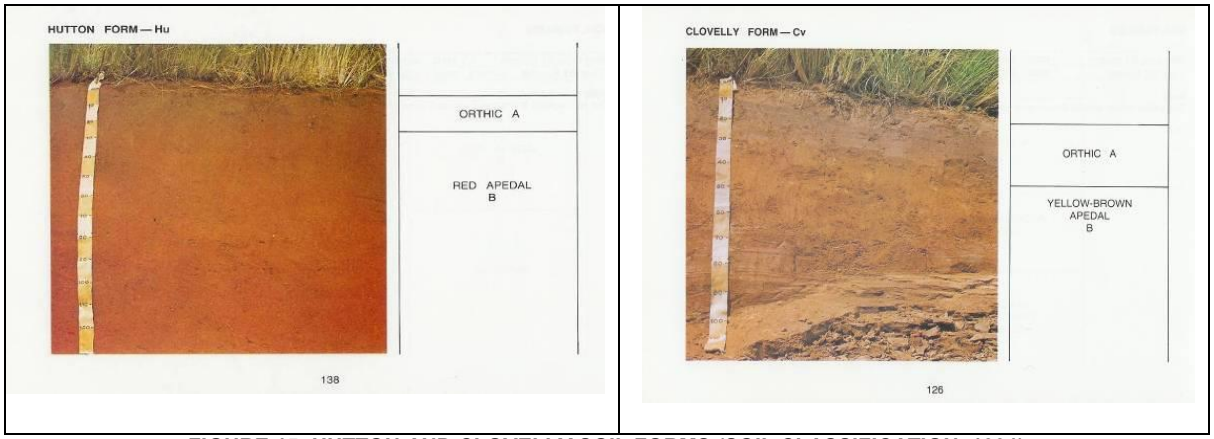


FIGURE 15: HUTTON AND CLOVELLY SOIL FORMS (SOIL CLASSIFICATION, 1991)

Avalon and Bainsvlei Soil Forms

The Avalon and Bainsvlei soil forms are characterised by the occurrence of a soft plinthic B – horizon (See Figure 17). The Avalon has a yellow-brown B-horizon while the Bainsvlei has a red apedal B-horizon. These horizons are the same as described for the Hutton and Clovelly soils above. The plinthic horizon has the following characteristics:

- Has undergone localised accumulation of iron and manganese oxides under conditions of a fluctuating water table with clear red-brown, yellow-brown or black strains in more than 10% of the horizon;
- Has grey colours of gleying in or directly underneath the horizon; and
- Does not qualify as a diagnostic soft carbonate horizon.

These soils are found lower down the slopes than the Clovelly and Hutton soils and indicate the start of the soils with clay accumulation.

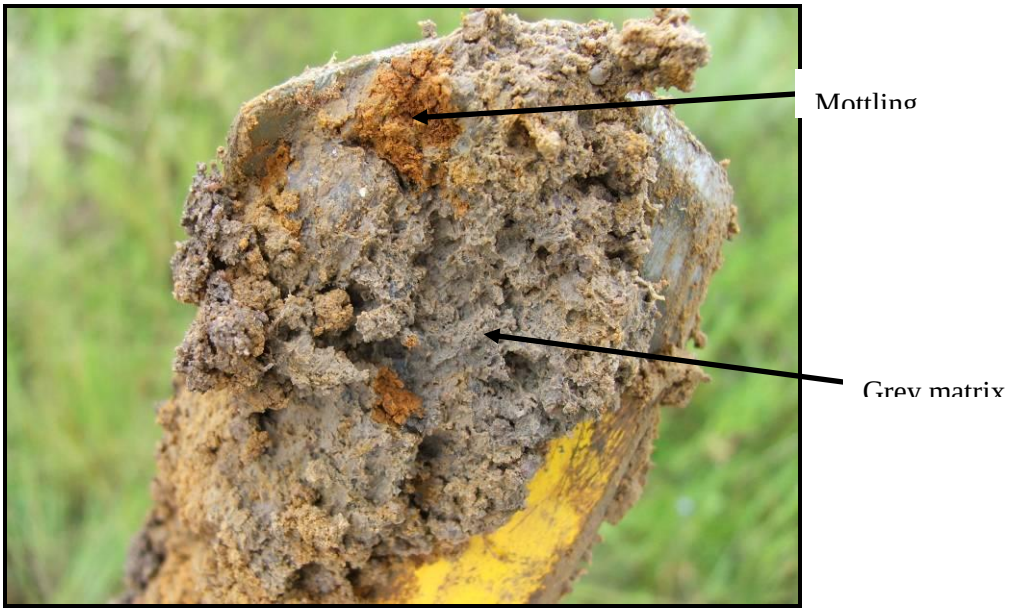


FIGURE 16: SOFT PLINTHIC B-HORIZON.

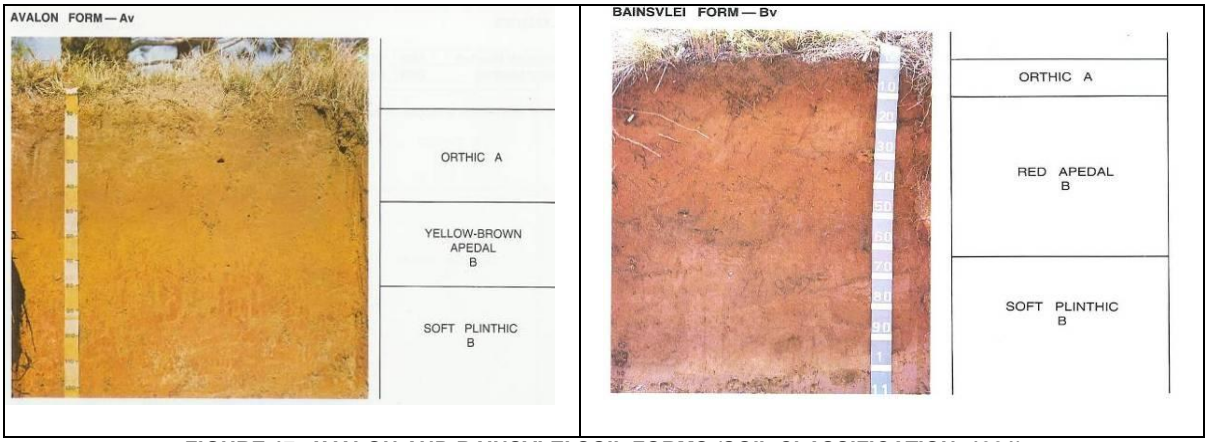


FIGURE 17: AVALON AND BAINSVLEI SOIL FORMS (SOIL CLASSIFICATION, 1991)

Glencoe:

The Glencoe soil form is found in areas where the soft plinthic B-horizon of an Avalon has hardened irreversibly into Hard Plinthite (Ferricrete). Refer to Figure 18 for an illustration of this soil form.

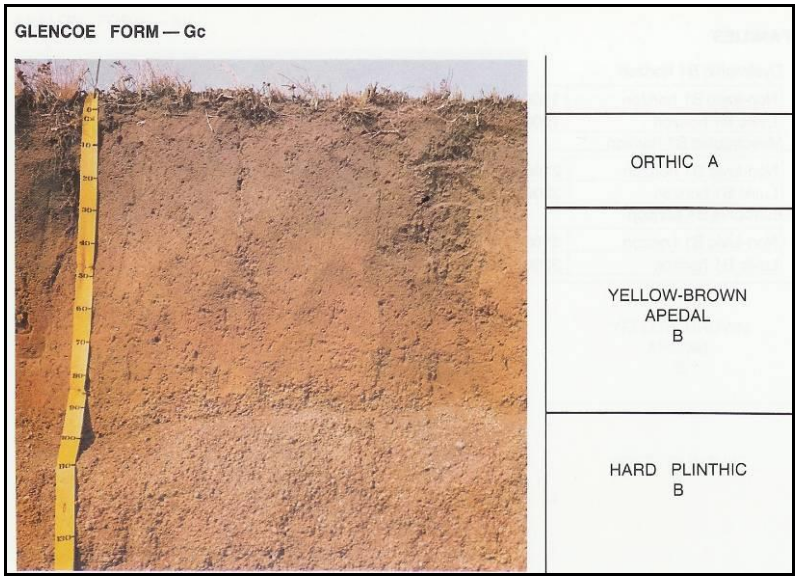


FIGURE 18: GLENCOE SOIL FORM (SOIL CLASSIFICATION, 1991)

Shortlands:

The Shortlands soil form has an Orthic A Horizon over a Red structured B Horizon as illustrated in Figure 19. These soils are very similar to the Hutton soils, the only difference being the formation of a structure in the B-horizon.

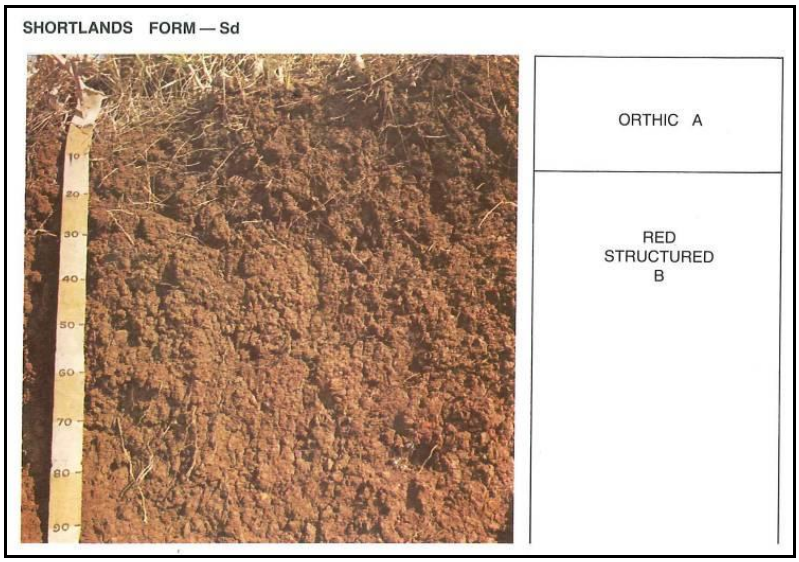


FIGURE 19: SHORTLANDS SOIL FORM (SOIL CLASSIFICATION, 1991)

Rocky Soils

The rocky soil management unit is made up of soils that are generally shallow and that overlie an impeding layer such as hard rock or plinthite. These soils are not suitable for cultivation and in most cases are only usable as light grazing. The unit comprises the following soil forms:

- Mispah (Orthic A horizon over hard rock);
- Milkwood (Melanic A horizon over hard rock);

- Dresden (Orthic over hard plinthic);

Mispah

The Mispah soil form is characterised by an Orthic A – horizon overlying hard rock. These soils are especially prevalent in the northern and central parts of the site and are commonly found on rocky ridges our outcrops. Please refer to Figure 20 for an illustration of a typical Mispah soil form.

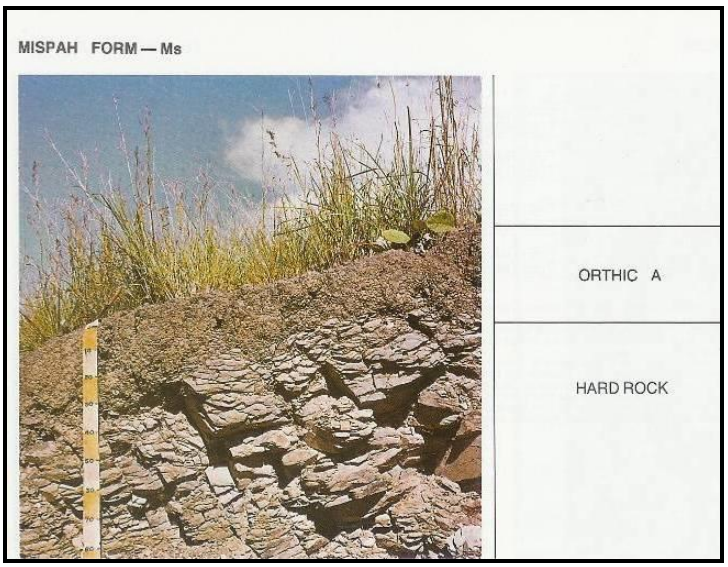


FIGURE 20: MISPAH SOIL FORM (MEMOIRS ON THE NATURAL RESOURCES OF SOUTH AFRICA, NO. 15, 1991).

Milkwood

The Milkwood soil form is characterised by a Melanic A horizon overlying hard rock. These soils dominate the southern parts of the site as they predominantly form from the Dolerite geology. Due to the underlying hard rock, these soils have limited cultivation potential and are most often used for grazing.

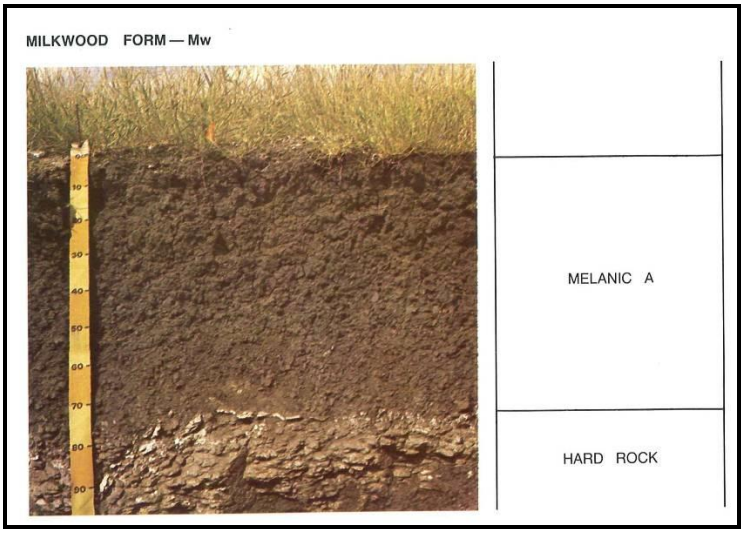


FIGURE 21: MILKWOOD SOIL FORM (SOIL CLASSIFICATION, 1991)

Dresden

The Dresden soil form is characterised by a hard plinthic B-horizon (aka Ferricrete). This horizon develops when a soft plinthic horizon dries out and hardens irreversibly. These shallow soils have very limited potential and are mostly used for light grazing or wildlife.

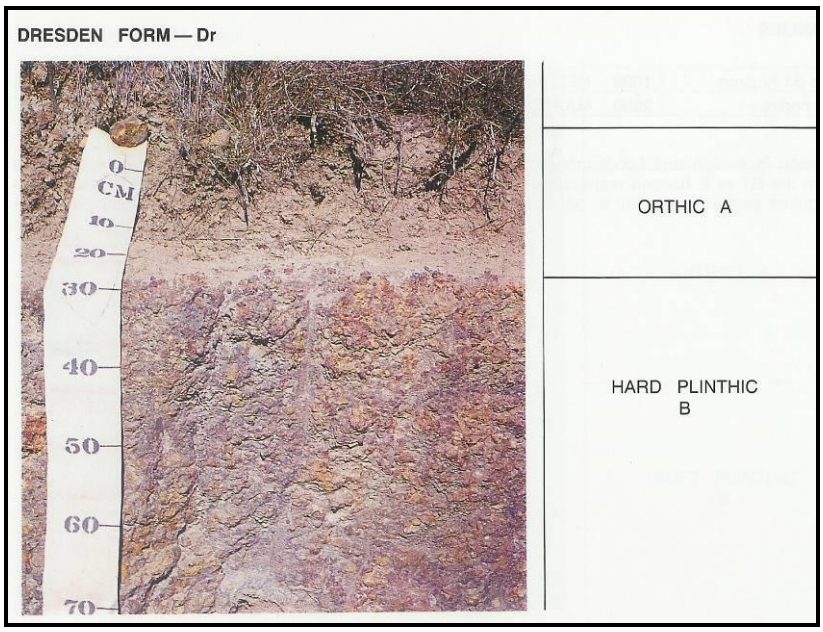


FIGURE 22: DRESDEN SOIL FORM

Transitional Soils

The transitional soil management unit comprises the soils found between clay soils and the agricultural soils. These soils often have signs of clay accumulation or water movement in the lower horizons. These soils are usually indicative of seasonal or temporary wetland conditions. Soil forms in this unit include:

- Longlands;
- Wasbank;
- Kroonstad; and
- Westleigh;

Wasbank, Kroonstad, Longlands and Westleigh Soil Forms

The Wasbank, Kroonstad and Longlands soil forms are all typified by an eluvial horizon, while the Westleigh soil form has a shallow soft plinthic horizon. These are also recognized as potential wetland soils. The E-horizon is a horizon that has been washed clean by excessive water movement through the horizon, while the soft plinthic horizon is formed by the accumulation of clays moving through the soil medium. These soils occur adjacent to the drainage channels found on site. Refer to Figure 23 for an illustration of these soil types.

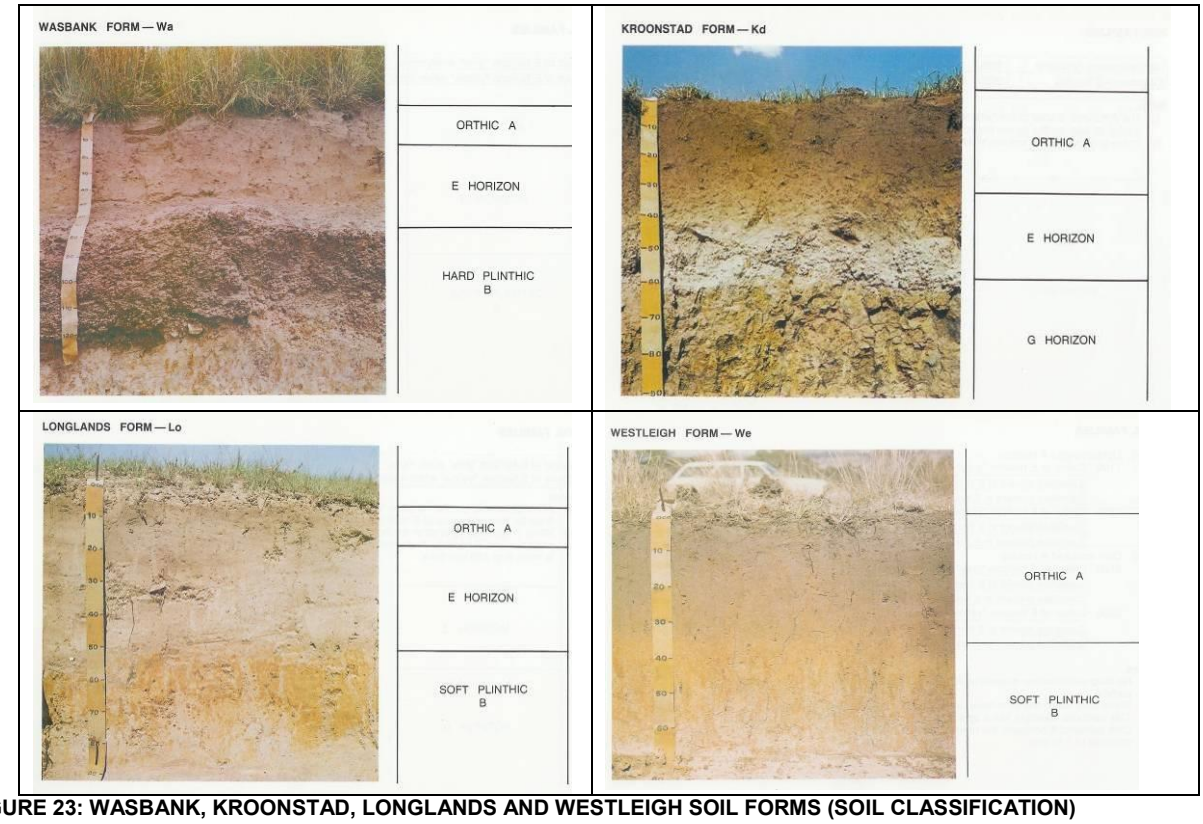


FIGURE 23: WASBANK, KROONSTAD, LONGLANDS AND WESTLEIGH SOIL FORMS (SOIL CLASSIFICATION)

Clay Soils

The clay soil management unit is found in areas where clays have accumulated to such an extent that the majority of the soil matrix is clays. These soils are usually indicative of seasonal or permanent wetland conditions. Soil forms in this unit include:

- Rensburg;
- Arcadia;
- Inhoek;
- Katspruit;
- Willowbrook;
- Sterkspruit ; and
- Steendal;

Katspruit and Willowbrook Soil Forms

The Katspruit and Willowbrook soil forms are found in areas of semi-permanent wetness. These soils are typified by an Orthic A horizon (Katspruit) or a Melanic A horizon (Willowbrook) over a diagnostic G horizon, as indicated in Figure 24. The G horizon has several unique diagnostic criteria as a horizon, including:

- It is saturated with water for long periods unless drained;
- Is dominated by grey, low chroma matrix colours, often with blue or green tints, with or without mottling;
- Has not undergone marked removal of colloid matter, usually accumulation of colloid matter has taken place in the horizon;
- Has a consistency at least one grade firmer than that of the overlying horizon;
- Lacks saprolitic character; and
- Lacks plinthic character.

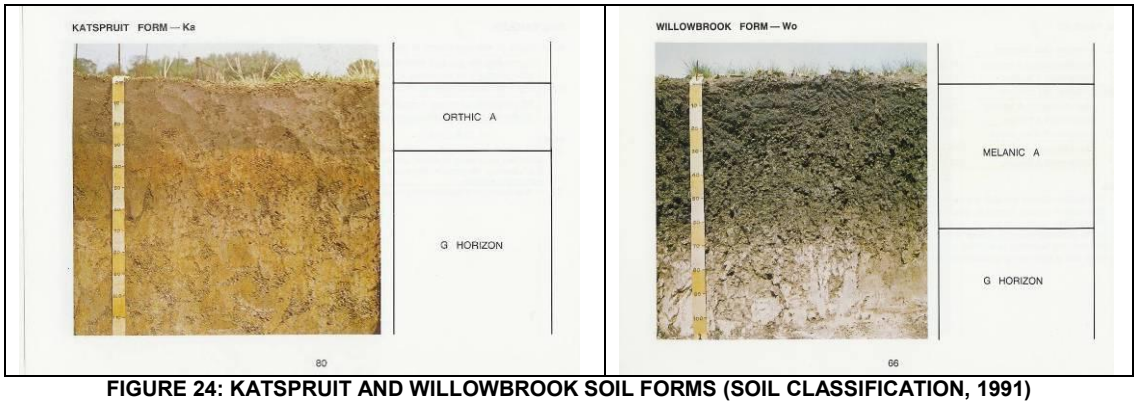


FIGURE 24: KATSPRUIT AND WILLOWBROOK SOIL FORMS (SOIL CLASSIFICATION, 1991)

Rensburg and Arcadia soil forms

Arcadia and Rensburg soils are characterised by a vertic A-horizon. In the Rensburg the Vertic A is underlain by a G-horizon as described above, while the Arcadia is a pure vertic horizon. The Vertic horizon has several unique diagnostic criteria as a horizon, namely:

- Has strong developed structure
- Has at least one of the following:
  - Clearly visible, regularly occurring slicken sides in some part of the horizon or in the transition to an underlying layer
  - A plasticity index greater than 32 (using the SA Standard Casagrande cup to determine liquid limit), or greater than 36 (using the British Standard cone to determine liquid limit).

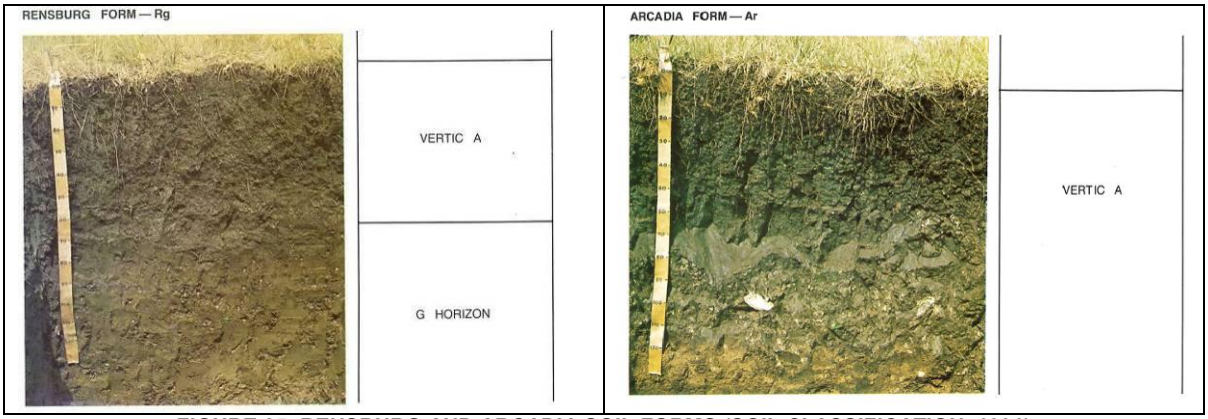


FIGURE 25: RENSBURG AND ARCADIA SOIL FORMS (SOIL CLASSIFICATION, 1991)

Inhoek and Steendal Soil Forms

The Inhoek and Steendal soil forms are typified by a Melanic A horizon. The Melanic horizon is characterised by the following:

- Dark colours in the dry sate with a value and chroma of 3 or less with the exception of 10YR 3/3 and colours redder than 5YR;
- No slickensides present as in the vertic clays;

In the case of the Steendal soil form the Melanic A horizon is underlain by a soft carbonate B horizon. This horizon is formed by the accumulation of carbonates in the horizon to such an extent that it dominates the morphology of the soil form. Please refer to Figure 26 for an illustration of the soil types.

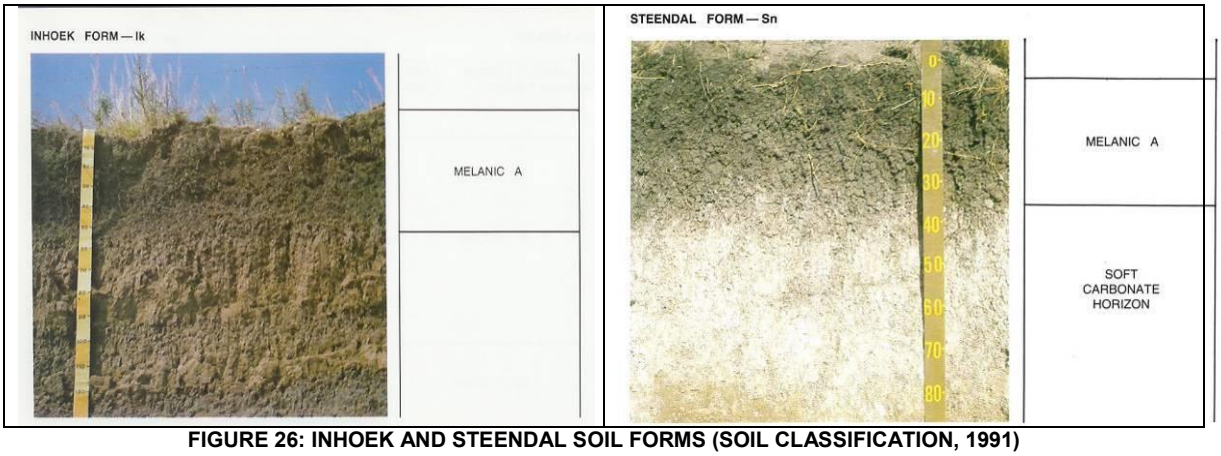


FIGURE 26: INHOEK AND STEENDAL SOIL FORMS (SOIL CLASSIFICATION, 1991)

Sterkspruit:

The Sterkspruit soil form has an Orthic A Horizon over a Prismacutanic B Horizon over Saprolite with calcareous characteristics as illustrated in Figure 27 below. The effective depth is less then 40cm due to the strong clay accumulations. These soils are marginal and suitable only for grazing. These soils were predominantly found along a stream in the central part of the site.

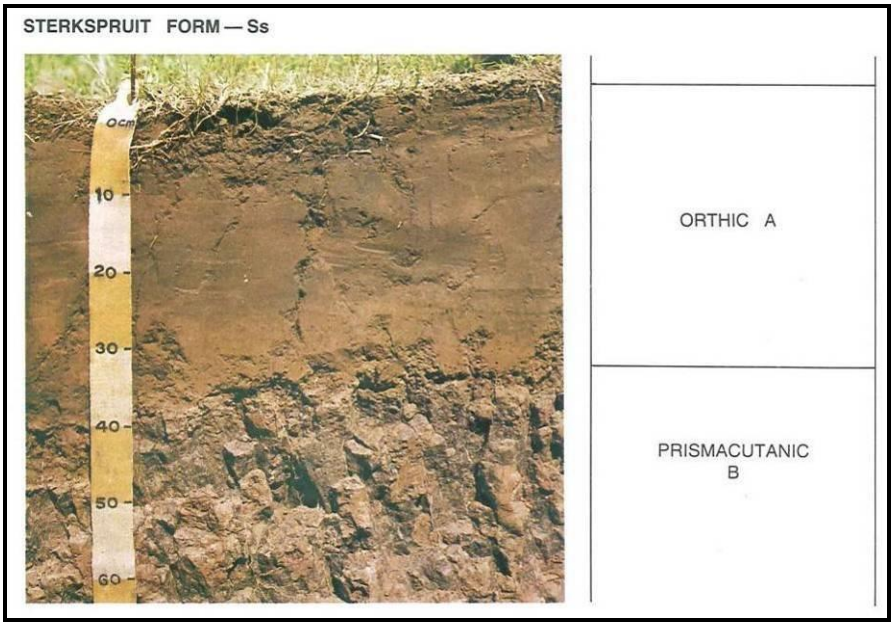


FIGURE 27: STERKSPRUIT SOIL FORM (SOIL CLASSIFICATION, 1991)

7.1.6 Land Capability

Data Collection

A literature review was conducted in order to obtain any relevant information concerning the area, including information from the Environmental Potential Atlas (ENPAT), Weather Bureau and Department of Agriculture. Results from the soil study were taken into account when determining the land capability of the site.

The land capability assessment methodology as outlined by the National Department of Agriculture was used to assess the soil's capability on site.

Regional Description

The regional land capability is mostly class II soils with few limitations. This is evident in the large number of cultivated lands found in the region. In the areas where the soil is too shallow or too wet to cultivate, livestock are grazed.

Site Description

The soils identified on site were classified according to the methodology proposed by the Agricultural Research Council – Institute for Soil, Climate and Water (2002). Factors evaluated are tabled below.

The site is made up of two main land capability classes, namely class II – cultivation and class V and VII – grazing. The class II soils are suitable for cultivation and can be used for a wide range of agricultural applications. The class *VII* soils have continuing limitations that cannot be corrected; in this case rock

complexes, flood hazard, stoniness, and a shallow rooting zone constitute these limitations. Figure 28 illustrates the various land capability units on site.

TABLE 9: LAND CAPABILITY OF THE SOILS ON SITE FOR AGRICULTURAL USE

Management unit	Agricultural	Transitional	Disturbed	Clay
Area (ha)	**20 810**	**114 212**	**1 220**	**30 555**
% of site	**12.5**	**68.5**	**0.7**	**18.3**
Rock Complex		**Yes – hard plinthic**	**Possible**	
Flooding Risk	**F1 – None**	**F2 – Rare**	**F2 – Rare**	**F4 - Common**
Erosion Risk	**E2 – Low to Moderate**	**E5 – Moderate to High**	**E5 – Moderate to High**	**E1 - Low**
Slope %	**2 – 10 %**	**2 – 10 %**	**2 – 20 %**	**0 – 5 %**
Texture	**T1 – 15 – 45% Clay**	**T1 – 15 – 45% Clay**	**T1 – 15 – 45% Clay**	**T3 - >55% Clay**
Depth	**D1 - > 70 cm**	**D2 – 60 – 80 cm**	**D2 – 60 – 80 cm**	**D3 – 40 – 60 cm**
Drainage	**W2-3 Well – Imperfectly drained**	**W4 – Somewhat poorly drained**	**W4 – Somewhat poorly drained**	**W5 – Poorly drained**
Mechanical Limitations	**MB0 - None**	**MB3 – Shallow soils on rock**	**MB3 – Shallow soils on rock**	**MB0 - None**
pH	**pH > 5**	**pH > 5**	**pH > 5**	**pH > 5**
Soil Capability	**II -**	**VII**	**VII**	**V**
Climate Class	**C2**	**C2**	**C2**	**C2**
Land Capability	II – Arable Land	VII – Light Grazing	VII – Light Grazing	V - Grazing

No limitation	Low to Moderate	Moderate	High	Very Limiting

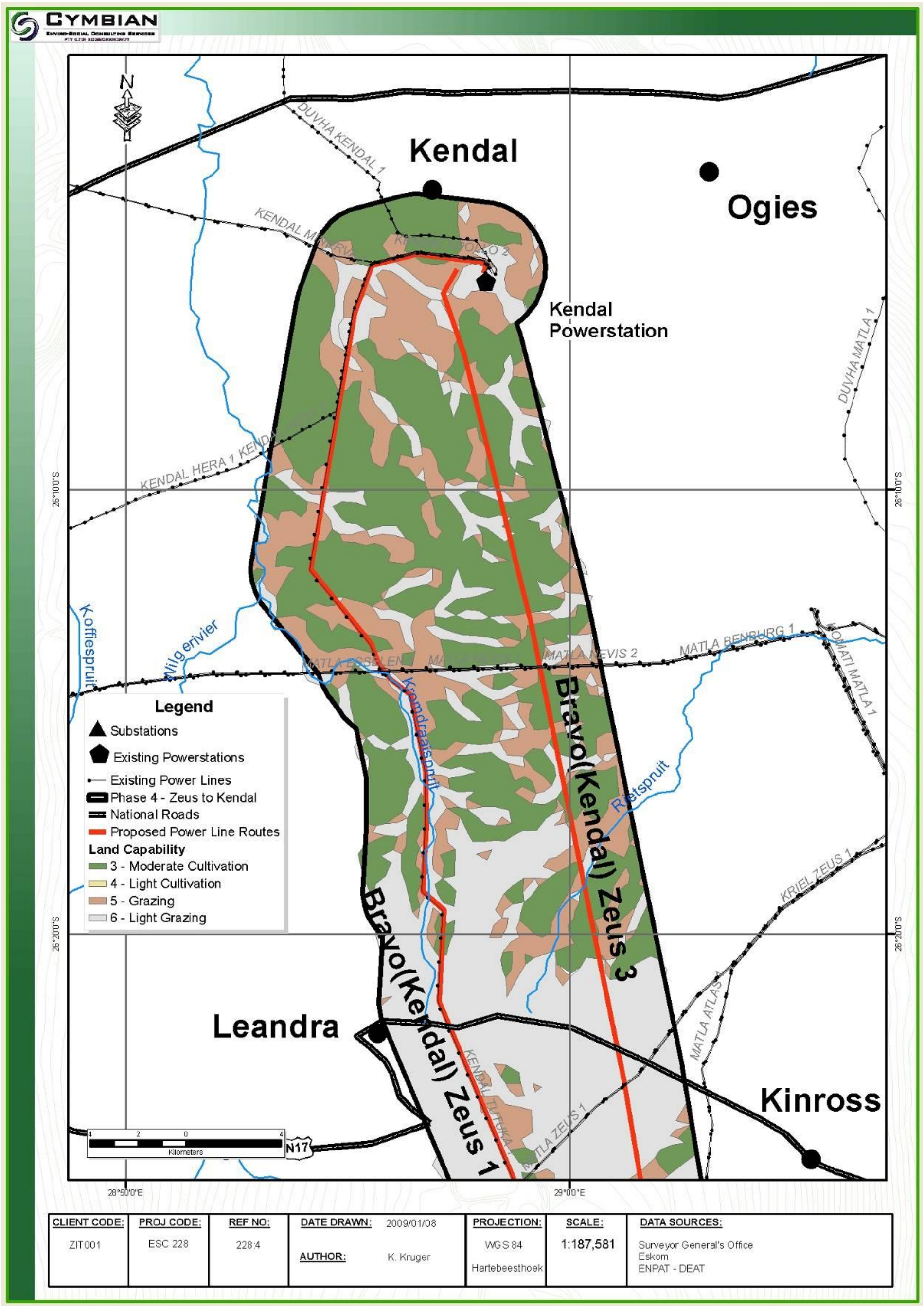


FIGURE 28: LAND CAPABILITY MAP OF THE NORTHERN SECTION

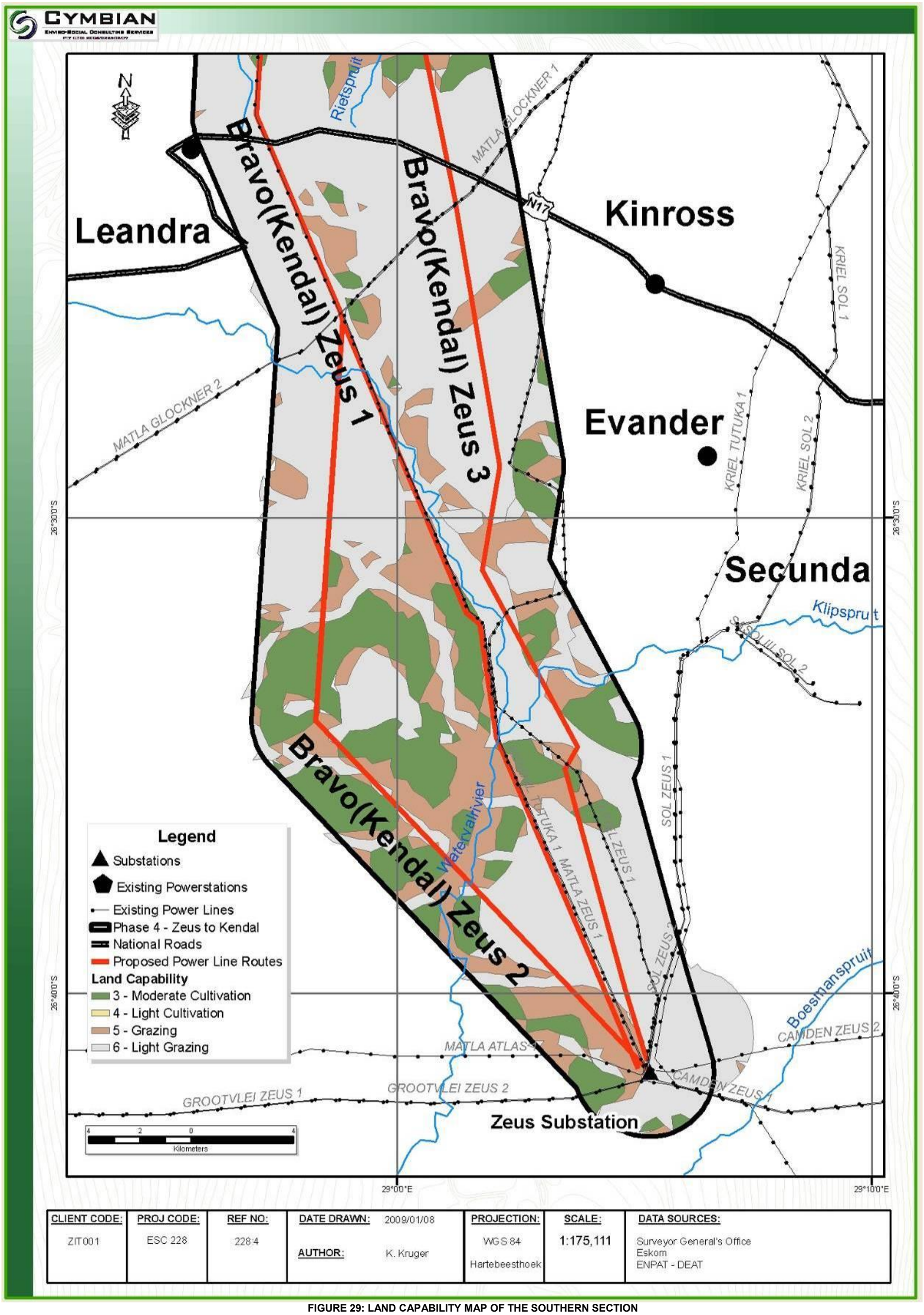


FIGURE 29: LAND CAPABILITY MAP OF THE SOUTHERN SECTION

7.1.7 Land Use

Data Collection

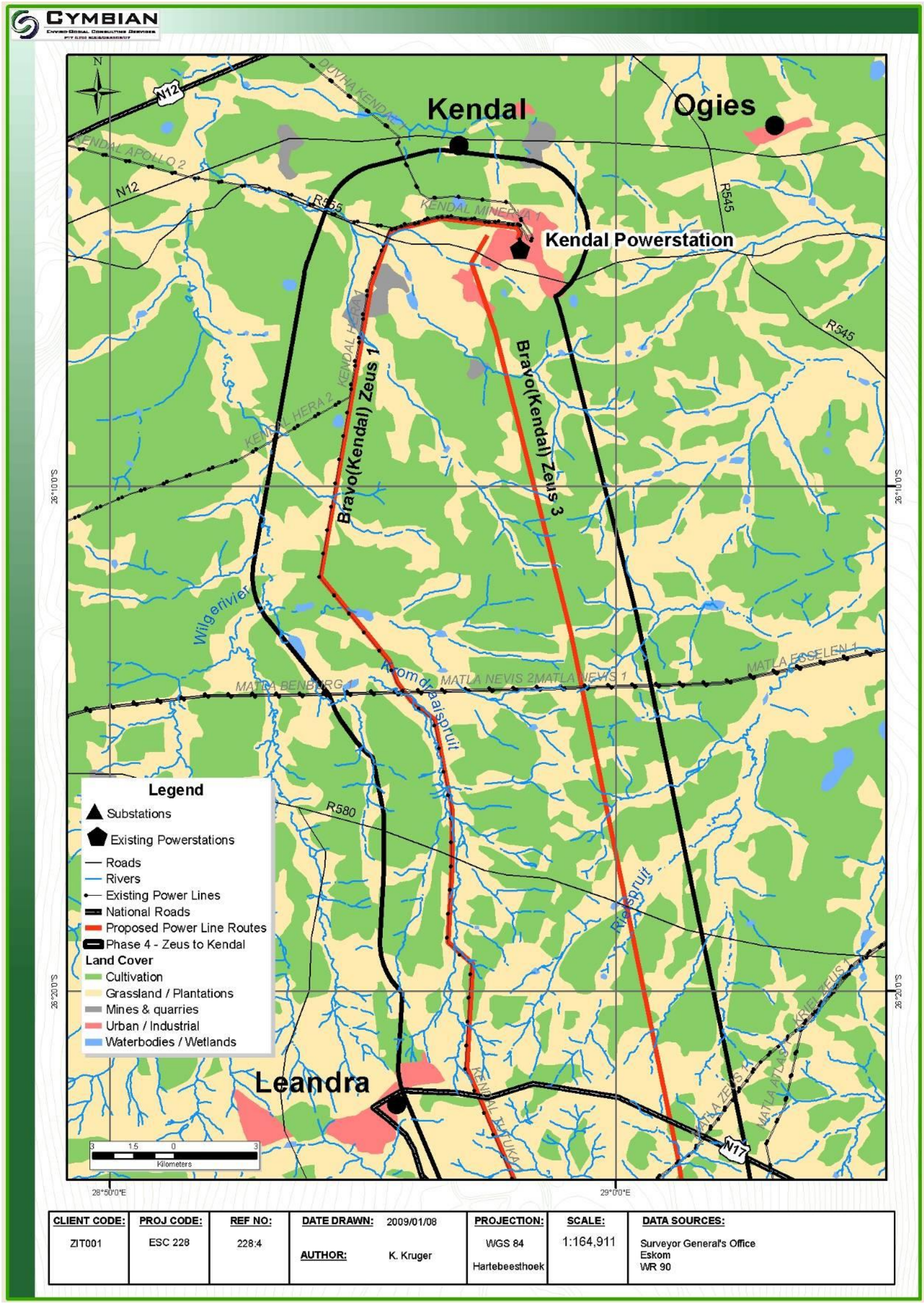
The Land Use data was obtained from the CSIR Land Cover database and supplemented with visual observations on site.

Site Description

The Land-Use is dominated by cultivated fields (maize), grazed grasslands, urban centres, coal mines and power stations. From the pictures (Figure 30) and map below (Figure 31 and Figure 32) it can be seen that the proposed routes traverses the entire spectrum of land uses found. Water bodies are the only land use regarded as sensitive and as such certain mitigatory measures will be outlined in Section 11.

	
Ploughed fields in the foreground with the Kendal power station in the background.	Commercial centre at Roodebank.
	
Grazing land found on grasslands.	Old gold mine dump.

FIGURE 30: LAND USES ENCOUNTERED IN THE STUDY SITE



CLIENT CODE:	PROJ CODE:	REF NO:	DATE DRAWN:	2009/01/08	PROJECTION:	SCALE:	DATA SOURCES:
ZIT001	ESC 228	228:4	AUTHOR:	K. Kruger	WGS 84 Hartebeesthoek	1:164,911	Surveyor General's Office Eskom WR 90

FIGURE 31: LAND USE MAP OF THE NORTHERN SECTION OF THE SITE

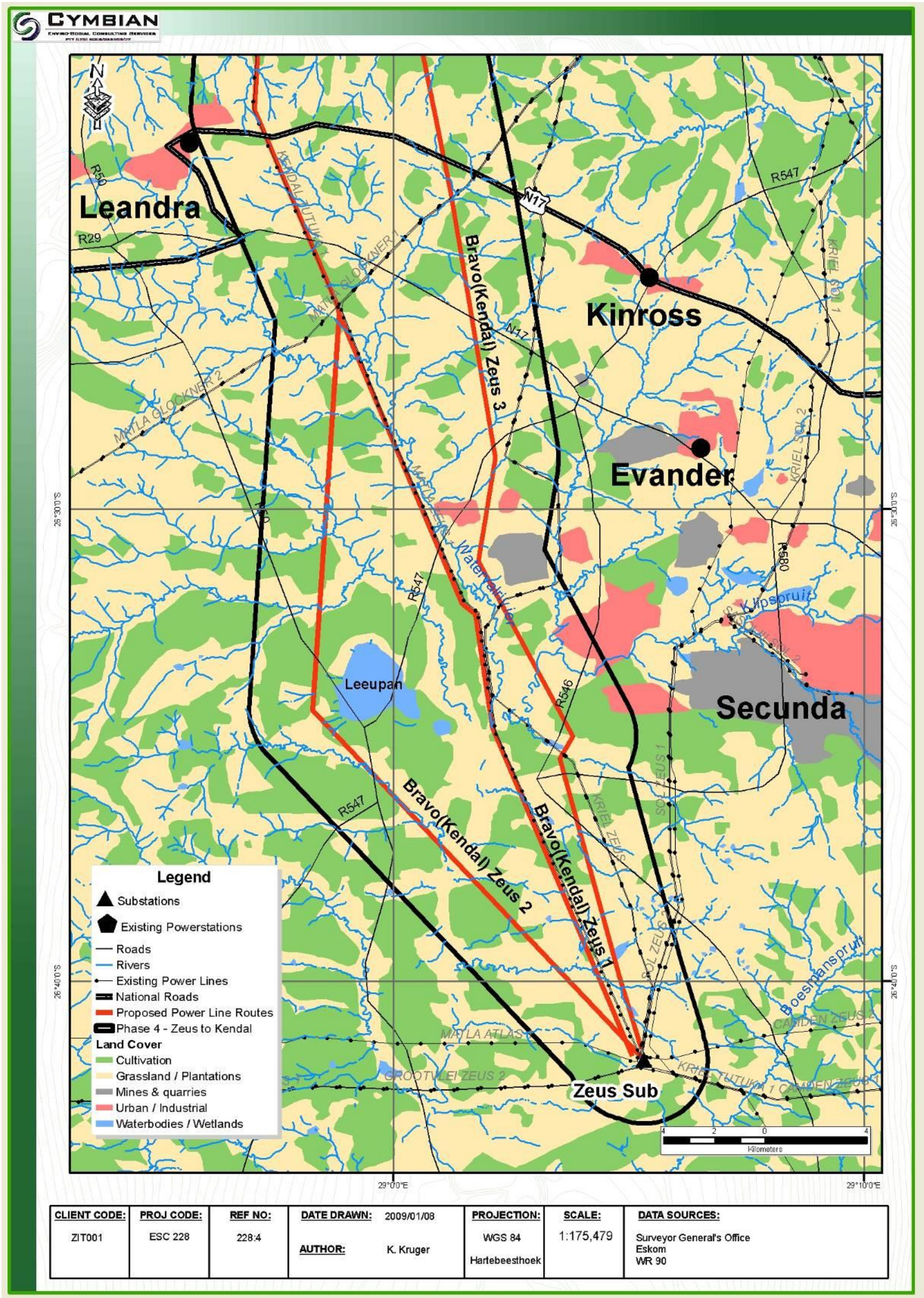


FIGURE 32: LAND USE MAP OF THE SOUTHERN SECTION OF THE SITE

From Figure 31 and Figure 32 above in can be seen that Alternatives 1 and 2 avoid agricultural land by following the drainage lines found in the area. Alternative 3 crosses over agricultural land but in so doing, avoids extensive periods of traversing in drainage lines. As wetlands, rivers and streams are seen as sensitive, it is suggested that the Alternative 3 alignment be utilised from a land use perspective.

7.1.8 Flora

Data Collection

The floral study involved extensive fieldwork, a literature review and a desktop study utilizing GIS. The site was investigated during two site visits conducted on the 8th – 12th September 2008 and the 3rd – 7th November 2008. The area within the servitude was sampled using transects placed at 300m intervals. At random points along the transect, an area of 20m x 20m was surveyed. All species within the 20m x 20m quadrant were identified, photographed and their occurrence noted. Sensitive features such as ridges or wetlands were sampled by walking randomly through the area concerned and identifying all species within the area.

The floral data below is taken from The Vegetation of South Africa, Lesotho and Swaziland (Mucina and Rutherford 2006). Also, while on site, the following field guides were used:

- Guide to Grasses of Southern Africa (Frits van Oudtshoorn, 1999);
- Field Guide to Trees of Southern Africa (Braam van Wyk and Piet van Wyk, 1997);
- Field Guide to the Wild Flowers of the Highveld (Braam van Wyk and Sasa Malan, 1998);
- Problem Plants of South Africa (Clive Bromilow, 2001);
- Medicinal Plants of South Africa (Ben-Erik van Wyk, Bosch van Oudtshoorn and Nigel Gericke, 2002)

The occurrence of the species was described as either:

- Very common (>50 % coverage);
- Common (10 – 50 % coverage);
- Sparse (5 – 10 % coverage); and
- Individuals (< 5 % coverage).

Regional Description

According to the South African National Biodiversity Institute, the study area falls within the Grassland Biome, where most of the county's maize production occurs. The main vegetation types found in the region are the Soweto Highveld Grassland, Rand Highveld Grassland, Eastern Highveld Grassland and Eastern

Temperate Freshwater Wetlands vegetation units as classified by Mucina and Rutherford[3]. Each of these vegetation units are described in more detail below.

Soweto Highveld Grassland

The Soweto Highveld Grassland is found in the Mpumalanga and Gauteng Provinces in a broad band roughly delineated by the N17 Highway in the north, Perdekop in the southeast and the Vaal River in the south. The landscape is typical of the gently undulating Highveld plateau which supports dense tufted grassland dominated by *Themeda triandra, Elionurus muticus, Eragrostis racemosa, Heteropogon contortus and Tristachya leucothrix.* This grassland is only interrupted by wetlands, occasional ridges and agricultural activities.

This vegetation type is endangered as almost no conservation of the vegetation type occurs. An estimated 45% of the vegetation type has already been transformed by cultivation, urban sprawl and mining.

Rand Highveld Grassland

Rand Highveld Grassland is found in the highly variable landscape with extensive sloping plains and ridges in the Gauteng, North-West, Free State and Mpumalanga Provinces. The vegetation type is found in areas between rocky ridges from Pretoria to Witbank, extending onto ridges in the Stoffberg and Roossenekal regions as well as in the vicinity of Derby and Potchefstroom, extending southwards and north-eastwards from there. The vegetation is species rich, sour grassland alternating with low shrubland on rocky outcrops. The most common grasses on the plains belong to the genera *Themeda, Eragrostis, Heteropogon and Elionurus*. High numbers of herbs, especially *Asteraceae* are also found. In rocky areas shrubs and trees also prevail and are mostly *Protea caffra, Acacia caffra, Celtis africana and Rhus spp.*

This vegetation type is poorly conserved (approx 1 %) and has a target of 24 % of the vegetation type to be conserved. Due to the low conservation status this vegetation type is classified as endangered. Almost half of the vegetation type has been transformed by cultivation, plantations, urbanisation or dam-building. Scattered aliens (most prominently *Acacia mearnsii*) are present in the unit.

Eastern Highveld Grassland

The Eastern Highveld Grassland is found in the Mpumalanga and Gauteng Provinces on the plains between Belfast in the east and the eastern side of Johannesburg in the west and extending southwards to Bethal, Ermelo and west of Piet Retief. The landscape is dominated by undulating plains and low hills with short dense grassland dominating belong to the genera *Themeda, Aristida, Digitaria, Eragrostis, Tristachya etc*. Once again woody species are prevalent on the rocky outcrops.

In terms of conservation and disturbance, 44 % of the vegetation type is already transformed by cultivation, plantations, mines, and urbanisation. No serious alien invasion, but *Acacia mearnsii* can dominate in certain areas

[3] *The Vegetation of South Africa, Lesotho and Swaziland*, Mucina and Rutherford 2006.

Eastern Temperate Freshwater Wetlands

Another vegetation type associated with the region is the Eastern Temperate Freshwater Wetlands, found around water bodies and embedded within the Grassland biome. Eastern Temperate Freshwater Wetlands are typically found in flat landscapes or shallow depressions filled with (temporary) water bodies supporting zoned systems of aquatic and hydrophillous (water loving) vegetation of temporarily flooded grasslands and ephemeral herblands. Important species include *Cyperus congestus*, *Phragmites australis*, *Marsilea farinose*, *Rorippa fluviatalis*, *Disa zuluensis*, *Crassula tuberella* and the carnivorous herb *Utricularia inflexa*. These wetlands are one of the most sensitive vegetation units found in the region and have been extensively modified by mining and industrial activities in the region.

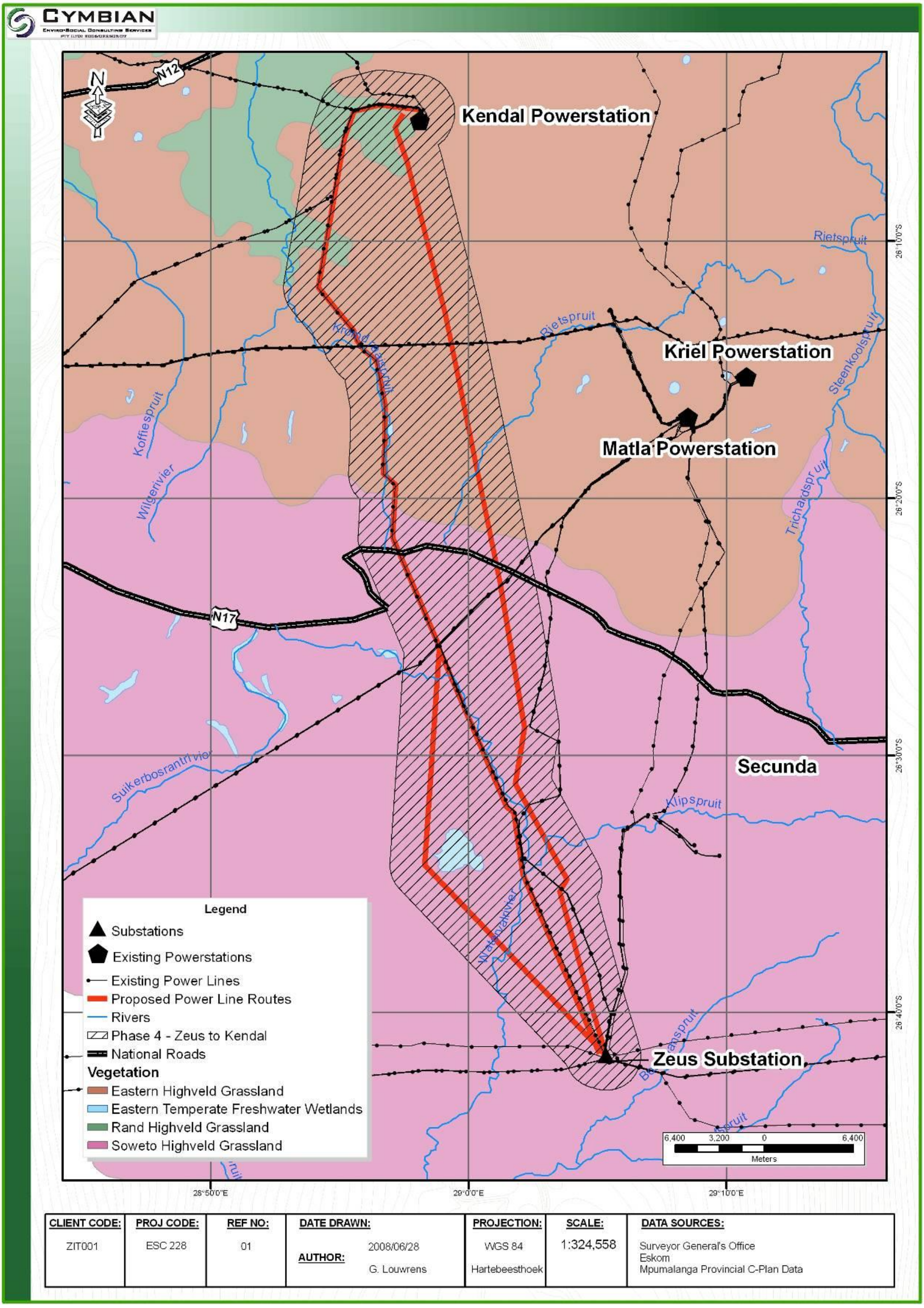


FIGURE 33: MAIN VEGETATION TYPES OF THE REGION

Site Description

Four main vegetation types were identified, namely anthropogenic grassland, moist grassland, riparian vegetation and grazed grassland. Each of these vegetation types are described in more detail below and illustrated in Figure 38 below. The species list for the site is attached in Appendix Q. The species that could occur in the quarter degree grids was obtained from the Plants of Southern Africa (POSA) online database upheld by the South African National Botanical Institute (SANBI) and supplemented with field notes. The list provides species names, common names, as well as notes on which species were observed on site. In total 198 species have been documented in the area with 103 confirmed species under the proposed routes.

Hyparrhenia hirta Anthropogenic Grassland (Grazed and Cultivated Fields)

This tall grassland occurs over vast areas throughout Gauteng and the surrounding highveld. Disturbed grassland or other disturbed areas such as road reserves or fallow fields, not cultivated for some years, are also usually *Hyparrhenia* dominated (Coetzee et al. 1995; Bredenkamp & Brown 2003).

This *Hyparrhenia* – dominated grassland may appear to be quite natural, but they are mostly associated with an anthropogenic influence from recent or even iron-age times. This grassland is characterised by the tall growing dominant Thatch grass (*Hyparrhenia hirta*), and Bankrupt Bush (*Stoebe vulgaris*), an invader dwarf shrub which usually indicates grassland's degraded condition (Bredenkamp & Brown 2003).

This grassland mostly has low species richness, with only a few other species able to establish or survive in the shade of the dense sward of tall grass. Most of these species are relict pioneers or early seral species. The most prominent species include the grasses *Cynodon dactylon*, *Eragrostis plana*, *E. racemosa*, *E. curvula* and *Aristida congesta*. Forbs are rarely encountered, though a few individuals of species such as *Anthospermum rigidum, Conyza podocephala, Crabbea angustifolia* and *Helichrysum rugulosum* are often present (Bredenkamp & Brown 2003).

Figure 34 below provides an illustration of the *Hyparrhenia* grassland unit found among the ploughed fields in this case. In Figure 38 and Figure 39 this vegetation unit is illustrated by the cultivated fields.

FIGURE 34: *HYPARRHENIA* GRASSLAND

Invaded grassland

The invaded grassland unit has arisen from the inherent susceptibility of the natural grassland of the region to be invaded by alien plants. In several places along the route the natural grassland has been invaded to such an extent that the vegetation is dominated by the alien invasive species. The most common aliens are *Acacia mearnsii (Black Wattle), Populus x canescens (Poplar), Tagetes minuta (Khaki bush), Bidens pilosa (Blackjack), Eucalyptus (Blue Gum) and Salix babylonica (Wattle).* This vegetation type is found in small pockets throughout the study site.

FIGURE 35: INVADED GRASSLAND

Moist Grassland

The *Eragrostis plana* Grassland is well represented occurring mainly in high rainfall parts. This grassland type is a moist grassland, usually restricted to flat plains or bottomlands, mostly on moist, deep, clayey and poorly drained, seasonally wet soils, adjacent to wetlands , seasonal as well as perennial rivers. These habitats are often fairly unstable due to seasonal flooding and drying, which, together with frequent overgrazing, cause degradation of the vegetation (Bezuidenhout & Bredenkamp 1990).

FIGURE 36: ERAGROSTIS PLANA MOIST GRASSLAND

Eragrostis plana is conspicuous, often dominant member of this grassland type (Figure 36). *Paspalum dilatatum*, and the rhizomatous *Cynodon dactylon*, often presents in degraded sites, are also diagnostic, as well as the forbs *Crabbea acaulis, Berkheya radula, B. pinnatifida and Trifolium africanum*. Grass species such as *Eragrostis curvula, Themeda triandra, Setaria sphacelata and Digitaria eriantha* are often abundantly present, and may be locally dominant, while forbs are generally quite rare (Coetzee et al. 1995; Bredenkamp & Brown 2003).

Drainage areas and wetland communities

Drainage areas are seasonally wet areas that occur in low-lying drainage lines after rains. These areas are usually covered by hygrophytes such as sedges and reeds. The dominant sedge in the study area is *Juncus rigidus*. Sometimes bulrush (*Typha capensis*) and reeds (*Phragmites australis*) also occurs.

Wetlands are of a more permanent nature and occur in low-lying areas such as tributaries of streams and rivers. Here hydrophytes can be found. Typical plants are the Orange River Lily (*Crinum bulbispermum*), bulrush (*Typha capensis*) and reeds (*Phragmites australis*), sedges of the *Cyperus, Fuirena and Scirpus* genera also occur (Figure 37).

FIGURE 37: SEEPAGE AREA

Grazed Grasslands

In addition to the above vegetation types found on site, a few remaining patches of Soweto Highveld Grassland, Rand Highveld Grassland and Eastern Highveld Grassland are also found in between the cultivated fields and the streams. These grasslands are often used for grazing but the species composition remains as described in Section 7.1.9 above.

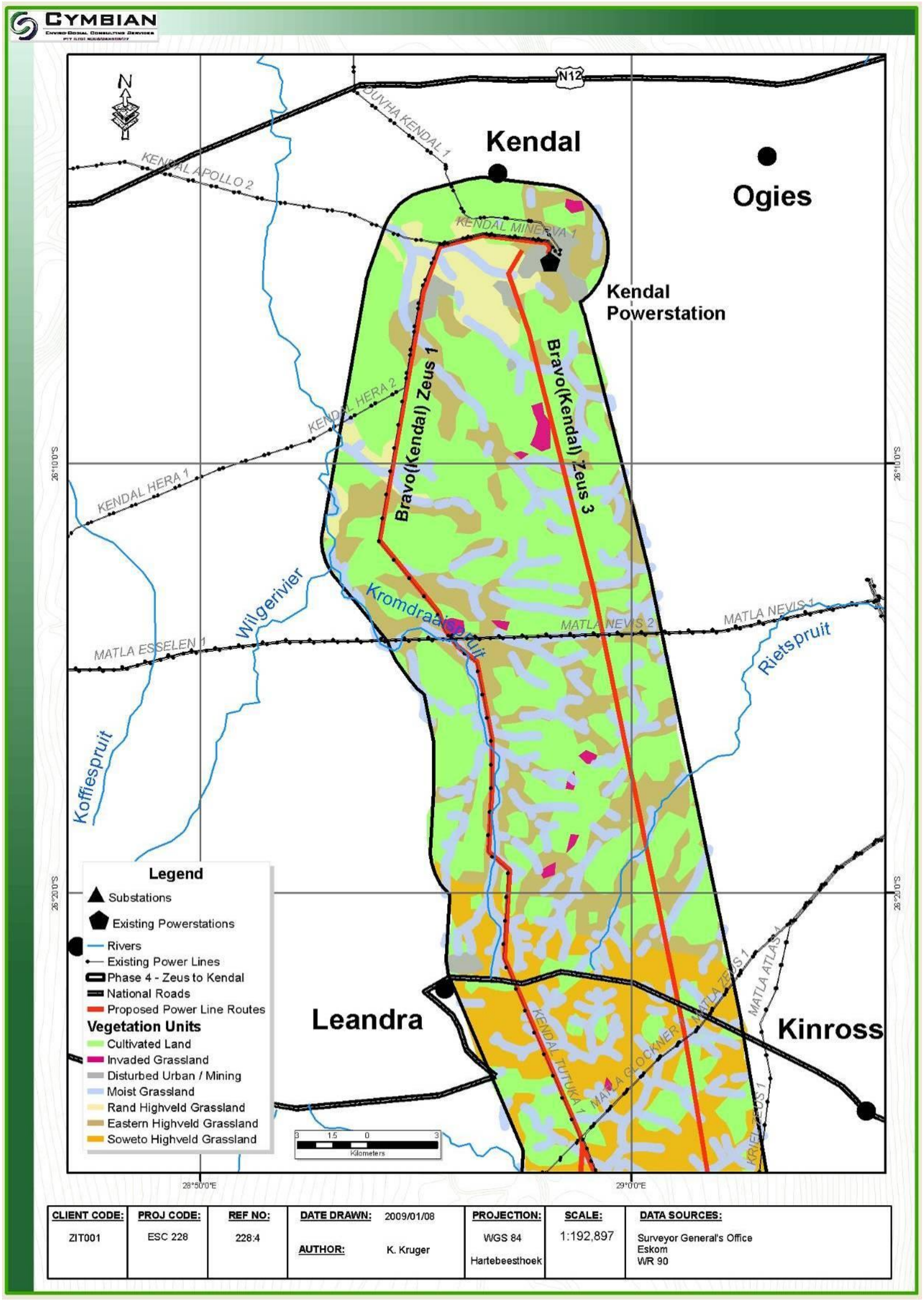


FIGURE 38: VEGETATION UNITS OF THE NORTHERN SECTION OF THE SITE.

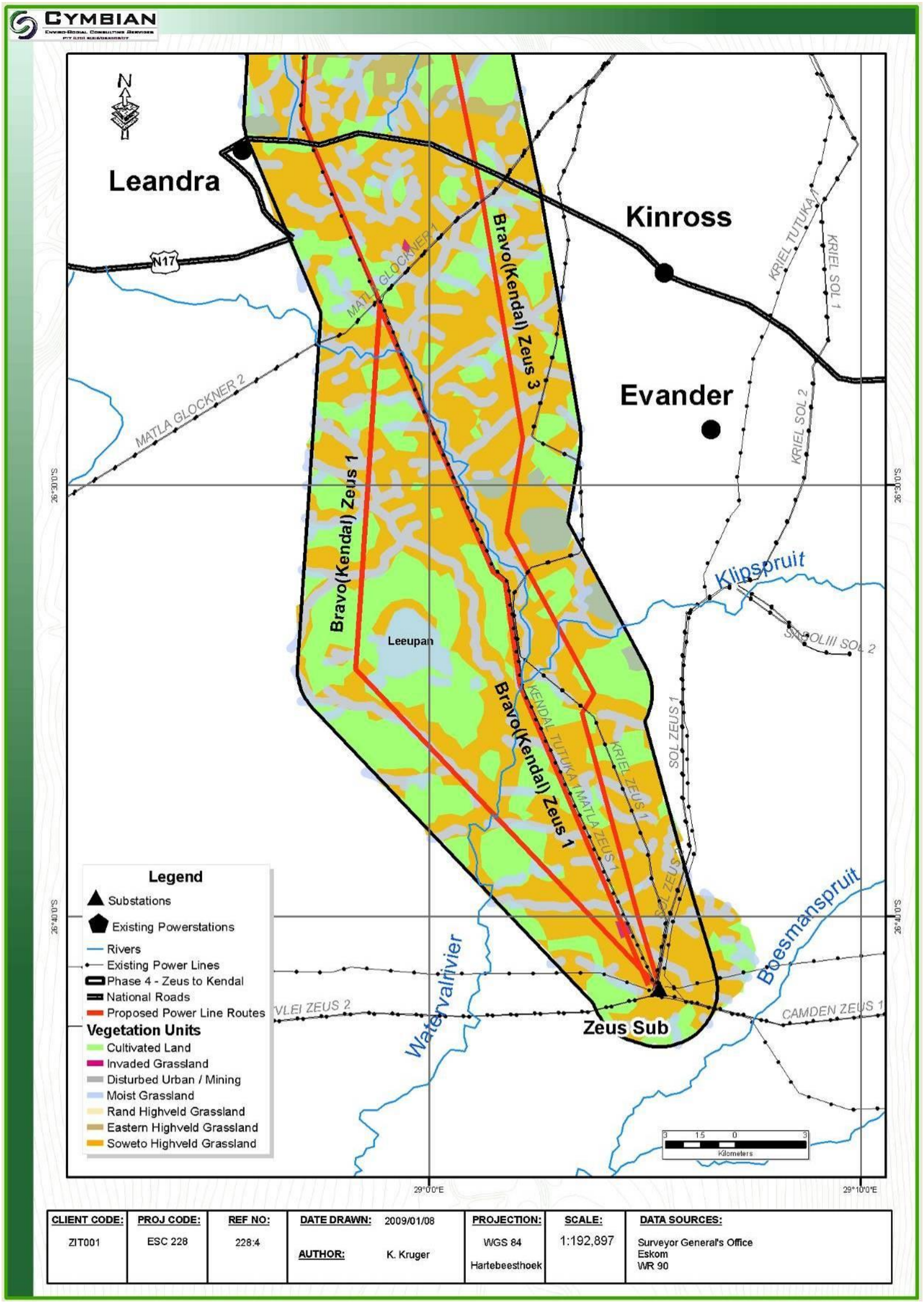


FIGURE 39: VEGETATION UNITS OF THE SOUTHERN SECTION OF THE SITE.

Sensitive Flora

During the site assessment, special efforts were made to identify sensitive or endangered vegetation along the routes. No red data species were found along the routes but that does not exclude the potential for such species to occur. The nature of the vegetation in the area is such that the bulk of the sensitive species are associated with wetlands and streams. Therefore it is suggested that all stream and wetlands be buffered by 100m. This figure is the standard buffer zone required by the Department of Water Affairs and Forestry (DWAF) for areas outside of the urban edge.

7.1.9 Fauna

Data Collection

A literature review of the faunal species that could occur in the area was conducted. C-Plan data provided from the Mpumalanga provincial department was used to conduct a desktop study of the area. This data consists of terrestrial and aquatic components, ratings provide an indication as to the importance of the area with respect to biodiversity. Additionally, all fauna were noted during the site visits conducted on the 8th – 12th September 2008 and the 3rd – 7th November 2008. In addition and specialist avifauna report was compiled by Mr. Chris van Rooyen[4].

Regional Description

As a consequence of mining and farming in the area, it appears that only small animals are to be found at the site. Small mammals known to occur in the area include hedgehog, rabbits, mongoose, meerkat and the ubiquitous rats and mice. Given the habitat, it is likely that korhaans, larks, longclaws, species of Euplectes (bishops and widows), weavers, starlings and sparrows occur in the grassland.

The study area does include areas of terrestrial and aquatic habitats. These areas should be treated as sensitive and should therefore be managed accordingly; if feasible they should be avoided.

Site Description

The scope of work indicated that an avifauna assessment was required. This section details the avifauna assessment as well as the herpetofauna and mammals observed on site.

Habitat

The habitat on site is described in the vegetation site description in Section 7.1.8 above. All of the vegetation types identified have been disturbed to a certain extent, as the main land use in the area is dryland cultivation of grazing of livestock. The largest portion of the site is comprised of disturbed grassland, totalling

[4] *Bird Impact Assessment Study, Bravo Integration Project: Phase 4, December 2008.*

approximately 61.7 % of the study site. The remainder of the site comprises rocky and moist grassland as well as seepage zones and wetlands. All of these are suitable habitat to a number of protected species found in the region.

Species observed on site

A detailed list of the species observed on site is attached in Appendix Q.

Herpetofauna

Herptofauna could potentially occur in all four habitat types. The seepage zones and wetlands could potentially support amphibians representative of the region. The quarter degree squares are known to contain *Agama atra (*Southern Rock Agama*), Bitens arietans* (Puff Adder), *Hemachatus haemachatus* (Rinkhals), *Causus rhombeatus* (Common Night Adder), *Lycodonomorphus rufulus* (Common Brown Water Snake), *Aparallactus capensis* (Cape Centipede Eater), *Cordylus vittifer* (Transvaal Girdled Lizard), *C. vandami* (Van Dam's Girdled Lizard), *Varanus niloticus (*Water Monitor), *Pachydactylus capensis (*Cape Thick-toed Gecko), *Leptotyphlops conjunctus conjunctus* (Cape Thread Snake) and *Mabuya capensis* (Cape Skink). *Hemachatus haemachatus* (Rinkhals) and *Leptotyphlops conjunctus conjunctus* (Cape Thread Snake) are endemic to Southern Africa. During the site visit the only one of the species above that was observed was a *Hemachatus haemachatus* (Rinkhals).

Avifauna

Avifauna on site was identified during the site visits. Table 10 below provides a list of the species observed as well as their occurrence. In addition to the site observations, a detailed specialist study was undertaken and is attached in Appendix Q.

TABLE 10: AVIFAUNA SPECIES LIST

Species	Common name	Occurrence
Phalacrocorax africanus	Reed Cormorant	Pair
Ardea cinerea	Grey Heron	Individual
Ardea melanocephala	Blackheaded Heron	Individual
Bubulcus ibis	Cattle Egret	Individual
Bostrychia hagedash	Hadeda Ibis	Pair
Plegadis falcinellus	Glossy Ibis	Individual
Alopochen aegyptiacus	Egyptian Goose	Pair
Elanus caeruleus	Blackshouldered Kite	Common
Francolinus swainsonii	Swainson's Francolin	Individual

Species	Common name	Occurrence
Numida meleagris	Helmeted Guineafowl	Common
Fulica cristata	Redknobbed Coot	Individual
Gallinula chloropus	Moorhen	Individual
Anthropoides paradisea	Blue Crane	Pair
Sagittarius serpentarius	Secretary Bird	Pair
Eupodotis cafra	Whitebellied Korhaan	Individual
Vanellus armatus	Blacksmith Plover	Pair
Vanellus coronatus	Crowned Plover	Common
Streptopelia semitorquata	Redeyed Dove	Pair
Streptopelia senegalensis	Laughing Dove	Common
Asio capensis	Marsh Owl	Carcass
Colius striatus	Speckled Mousebird	Pair
Mirafra africana	Rufousnaped Lark	Common
Corvus albus	Pied Crow	Individual
Saxicola torquata	Stone Chat	Individual
Phylloscopus trochilus	Willow Warbler	Individual
Cisticola fulvicapilla	Neddicky	Individual
Motacilla clara	Cape Wagtail	Individual
Anthus cinnamomeus	Grassveld Pipit	Individual
Passer domesticus	House Sparrow	Common
Ploceus velatus	Masked Weaver	Common
Euplectes orix	Red Bishop	Pair

Species	Common name	Occurrence
Emberiza capensis	Cape Bunting	Individual

In total 32 bird species were identified during the site investigations, including some sensitive species which are discussed in more detail in Appendix Q. The species on site include waterfowl, grassland specialists and common generalists. This is attributed to the variety of habitats that occur on site, as well as the adequate supply of fresh water.

Mammals

Several mammal species were observed on site, and it was notable that most of the species were limited to a game farm just north of the Zeus substation. Smaller mammals such as mongoose were found throughout the site. The species identified are listed below.

TABLE 11: MAMMAL SPECIES LIST

Species	Common name	Occurrence
Antidorcas marsupialis	Springbok	Herd
Damaliscus dorcas phillipsi	Blesbok	Herd
Cynictis pencillata	Yellow Mongoose	Individuals
Orycteropus afer	Aardvark / Antbear	Individuals
Connochaetes taurinus	Blue wildebeest	Herd
Hystrix africaeaustralis	Porcupine	Individual
Ceraottherium simum	White Rhinoceros	Individuals

FIGURE 40: FAUNA INCLUDING SPRINGBOK (LEFT) AND BLUE WILDEBEEST (RIGHT)

Sensitivities and power line interactions

The impacts to fauna are experienced in a number of ways, but due to the placement of the power lines on pylons the impacts are largely limited to avifauna. The construction and erection of the pylons could impact on habitat for ground dwelling fauna, but due to the large number of existing power lines in the area, this is a low possibility. Therefore the focus will be on the avifauna component.

The Red Data bird species that occur within the study area were recorded by the Bird Atlas project and are listed in Table 12 below. The species that could potentially be impacted on by the power lines are shaded in grey.

TABLE 12: RED DATA BIRD SPECIES

Species	Reporting rate %	Conservation status (Barnes 2000)	Habitat requirements (Barnes 2000; Hockey *et al* 2005; Harrison *et al* 1997; Young *et al* 2003; personal observations)
YELLOW-BILLED STORK *Mycteria ibis*	2628BB:7.4, 2628BD:2.7, 2628DB:8.7, 2629AC:4.1, 2629CA:4.0	near threatened	Always associated with water – dams, wetlands, rivers, marshes, even small pools. Could be present at larger water bodies e.g. Leeuwpan. Vulnerable to collisions.
PINK-BACKED PELICAN	2628BB:-, 2628BD:-, 2628DB:-, 2629AC:, 2629CA:1.3	vulnerable	Always associated with large water bodies. Could be present at larger water bodies e.g. Leeuwpan. Vulnerable to collisions.
LANNER FALCON *Falco biarmicus*	2628BB:-, 2628BD:1.8, 2628DB:1.1, 2629AC:1.4, 2629CA:0.7	near threatened	Generally prefers open habitat, but exploits a wide range of habitats. Will nest in wooded areas if suitable cliffs are present. No negative interaction expected, except possible breeding on crow nests on the proposed lines.
WATTLED CRANE *Bugeranus carunculatus*	2628BB:-, 2628BD:-, 2628DB:1.1, 2629AC:-, 2629CA:-	critically endangered	Shallow wetlands with extensive short emergent vegetation. To a lesser degree in natural grassland and croplands. No suitable habitat along the alignment. Vagrant to the area.
BLUE KORHAAN *Eupodotis caerulescens*	2628BB:1.9, 2628BD:10.8, 2628DB:14.1, 2629AC:-, 2629CA:12.7	near threatened	Grasslands, pastures and cultivated fields. Vulnerable to collisions.
GREATER PAINTED SNIPE *Rostratula benghalensis*	Not recorded by Bird Atlas but recorded by CWAC	near threatened	Various aquatic habitats, preferring exposed mud adjacent to cover. Recorded at Leeuwpan. No interactions expected.
BLACK-WINGED PRATINCOLE *Glareola nordmanni*	2628BB:3.7, 2628BD:3.6, 2628DB:1.1, 2629AC:2.0, 2629CA:3.3	near threatened	Agricultural landscapes, ploughed lands. No interactions expected.

Species	Reporting rate %	Conservation status (Barnes 2000)	Habitat requirements (Barnes 2000; Hockey *et al* 2005; Harrison *et al* 1997; Young *et al* 2003; personal observations)
MELODIOUS LARK Mirafra cheniana	2628BB:-, 2628BD:- 2628DB:1.1, 2629AC:-, 2629CA:-	near threatened	Open climax Themeda grassland, pastures and fallow lands. Vulnerable to habitat destruction and disturbance.
BLACK STORK Ciconia nigra	2628BB:-, 2628BD:-, 2628DB:, 2629AC:, 2629CA:1.3	near threatened	Associated with rivers, dams and cliffs. Could be present at larger water bodies e.g. Leeuwpan. Vulnerable to collisions.
SECRETARYBIRD Sagittarius serpentarius	2628BB:5.6, 2628BD:6.3, 2628DB:10.9, 2629AC:6.1, 2629CA:7.3	near threatened	Prefer open grassland, densities low in maize growing areas. Was recorded during field visits in the study area. Vulnerable to collisions.
WHITE-BELLIED KORHAAN Eupodotis senegalensis	2628BB:3.7, 2628BD:1.8, 2628DB:5.4, 2629AC:-, 2629CA:0.7	vulnerable	Often in the interface between grassland and savanna. Avoids severely grazed and recently burnt sites. Vulnerable to collisions.
LESSER FLAMINGO Phoenicopterus minor	2628BB:0.9, 2628BD:0.9, 2628DB:5.4, 2629AC:0.7, 2629CA:7.3	near threatened	Moves extensively between water bodies. May be found in small numbers on any suitable dam. Vulnerable to collisions.
GREATER FLAMINGO Phoenicopterus ruber	2628BB:2.8, 2628BD:2.7, 2628DB:21.7, 2629AC:5.4, 2629CA:17.3	near threatened	Moves extensively between water bodies. May be found in small numbers on any suitable dam. Vulnerable to collisions.
LESSER KESTREL Falco naumanni	2628BB:11.1, 2628BD:9.9, 2628DB:8.7, 2629AC:10.2, 2629CA:10.0	vulnerable	No negative impacts expected from power line. Small and nimble species, likely to use the power line as hunting perch.
AFRICAN GRASS-OWL Tyto capensis	2628BB:-, 2628BD:1.8, 2628DB:1.1, 2629AC:-, 2629CA:2.0	vulnerable	Likely to be found in rank grass adjacent to wetlands. Could be vulnerable to collisions with power line as potentially suitable habitat could exist in wetlands. Also vulnerable to habitat destruction.
BLUE CRANE Anthropoides paradiseus	2628BB:0.9, 2628BD:14.4, 2628DB:39.1, 2629AC:-, 2629CA:3.3	vulnerable	Low reporting rate but can be present in the pockets of remaining grassland and wetlands. Vulnerable to collisions.
CASPIAN TERN Sterna caspia	2628BB:-, 2628BD:-, 2628DB:3.3, 2629AC:1.4, 2629CA:1.3	near threatened	Estuaries and large inland water bodies. No negative interactions expected.

Species	Reporting rate %	Conservation status (Barnes 2000)	Habitat requirements (Barnes 2000; Hockey *et al* 2005; Harrison *et al* 1997; Young *et al* 2003; personal observations)
AFRICAN MARSH-HARRIER Circus ranivorus	2628BB:0.9, 2628BD:9.9, 2628DB:-, 2629AC:2.7, 2629CA:1.3	vulnerable	Large permanent wetlands with dense reed beds. Sometimes forages in smaller wetlands and adjacent grassland. Could be vulnerable to collisions with power line as potentially suitable habitat could exist in wetlands. Also vulnerable to habitat destruction.
BLACK HARRIER Circus maurus	2628BB:-, 2628BD:-, 2628DB:-, 2629AC:4.1, 2629CA:4.0	near threatened	Dry grassland and rarely in agricultural fields. Vulnerable to collisions with power lines.
PALLID HARRIER Circus macrourus	2628BB:-, 2628BD:-, 2628DB:1.1, 2629AC:0.7, 2629CA:-	near threatened	Grasslands associated with open pans and floodplains. Vulnerable to collisions with power lines.
BOTHA'S LARK Spizocorys fringillaris	2628BB:-, 2628BD:-, 2628DB:-, 2629AC:2.0, 2629CA:0.7	endangered	Prefers short grass, such as heavily grazed grassland in upland areas. No negative interactions expected. Vulnerable to habitat destruction and disturbance.
CHESTNUT-BANDED PLOVER Charadrius pallidus	2628BB:2.8, 2628BD:-, 2628DB:-, 2629AC:-, 2629CA:-	near threatened	Found primarily in salt pans. No negative interactions expected.
DENHAM'S BUSTARD Neotis denhami	2628BB:-, 2628BD:0.9, 2628DB:-, 2629AC:-, 2629CA:-	vulnerable	In the grassland biome it favours sour grassland in high rainfall areas. Vagrant to the area, no negative interactions expected.
SOUTHERN BALD IBIS Geronticus calvus	2628BB:, 2628BD:1.8, 2628DB:, 2629AC:2.0, 2629CA:-	vulnerable	Likely to be found on recently burnt ground and unburnt, short-grazed grassland, cultivated pastures, reaped maize fields and ploughed lands. Vulnerable to collision with power lines.
GREY CROWNED CRANE Balearica regulorum	2628BB:-, 2628BD:, 2628DB:1.1, 2629AC:-, 2629CA:-	vulnerable	Breeds in marshes, pans, and dam margins with tall emergent vegetation. Feeds in adjacent short grasslands and croplands. Vulnerable to collision with power lines.

Power Line Interactions

According to the Avifauna assessment the following interactions are prevalent in South Africa. Because of their size and prominence, electrical infrastructures constitute an important interface between wildlife and man. Negative interactions between wildlife and electricity structures take many forms, but two common problems in southern Africa are electrocution of birds and other animals and birds colliding with power lines.

Other problems are electrical faults caused by bird excreta when roosting or breeding on electricity infrastructure, and disturbance and habitat destruction during construction and maintenance activities.

According to the specialist report the most severe potential impact that the proposed line will have is bird collisions with the overhead earth wire. This impact will most likely occur close to wetlands, where the line skirts a dam, where it crosses a drainage line and in areas of natural grassland.

Species at risk are water birds of several species where it skirts larger dams, particularly Leeuwpan, where flamingo collisions have been recorded. Collision hazards also exist where the line will cross pockets of natural grassland, as this is the preferred habitat of most of the remaining large terrestrial Red Data species, including the Blue Crane, Blue Korhaan, White-bellied Korhaan and Secretarybird in the Mpumalanga highveld. As mentioned earlier, the impacts on grassland and wetlands that are evident in the study area have been severe, reducing most Red Data, large terrestrial species to vagrants. The dense grid of existing power lines that covers the whole study area is a death trap for cranes, and the impact of these lines on the remaining Blue Cranes in the area can only be guessed at. Large areas of what seems to be suitable grassland remain the study area, yet they are devoid of any cranes. Given the extreme vulnerability of cranes to power lines, there is no question that the power lines must have effectively sterilized large areas for these birds. There are, however, substantial numbers of non Red Data power line sensitive species in the study area that have managed to survive and even thrive in some instances despite the habitat degradation that have occurred. In some instances, man-made developments such as the proliferation of artificial water bodies have benefited certain species. Examples are Red-knobbed Coot, Reed Cormorant *Phalacrocorax africanus*, Egyptian Goose, White-breasted Cormorant *Phalacrocorax lucidus*, Black-headed Heron *Ardea melanocephala*, Grey Heron *Ardea cinerea* and Yellow-billed Duck (Harrison *et.al* 1997). These species (and many other non Red Data ducks, herons and waders) run the risk of collision with the proposed power lines.

During the site investigations several dead birds were found underneath the existing power lines that traverse over the study area. The birds included Blue Crane, Lesser Flamingo, Marsh Owl, Secretary Bird, Sacred Ibis and Feral Pigeon (refer to Figure 41).

FIGURE 41: DEAD BIRDS FOUND UNDERNEATH THE EXISTING POWER LINES ON SITE, LESSER FLAMINGO (LEFT) MARSH OWL (CENTRE) AND SECRETARY BIRD (RIGHT).

Preferred Alternative

According to the specialist report, attached in Appendix 3, the most suitable power line alternative is Alternative 3. This is due to the avoidance of drainage areas and wetlands as well as the more developed nature of the route.

7.1.10 Wetland and Riparian Zone Delineation

Riparian Zones vs. Wetlands

Wetlands

The riparian zone and wetlands were delineated according to the Department of Water Affairs and Forestry (DWAF) guideline, 2003: A practical guideline procedure for the identification and delineation of wetlands and riparian zones. According to the DWAF guidelines *a wetland* is defined by the National Water Act as:

"land which is transitional between terrestrial and aquatic systems where the water table is usually at or near surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."

In addition the guidelines indicate that wetlands must have one or more of the following attributes:

- Wetland (hydromorphic) soils that display characteristics resulting from prolonged saturation;
- The presence, at least occasionally, of water loving plants (hydrophytes); and
- A high water table that results in saturation at or near surface, leading to anaerobic conditions developing in the top 50 centimetres of the soil.

During the site investigation the following indicators of potential wetlands were identified:

- Terrain unit indicator;
- Soil form Indicator;
- Soil wetness indicator; and
- Vegetation indicator.

Riparian Areas

According to the DWAF guidelines *a riparian area* is defined by the National Water Act as:

"Riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas"

The difference between Riparian Areas and Wetlands

According to the DWAF guidelines the difference between a wetland and a riparian area is:

"Many riparian areas display wetland indicators and should be classified as wetlands. However, other riparian areas are not saturated long enough or often enough to develop wetland characteristics, but also perform a number of important functions, which need to be safeguarded. Riparian areas commonly reflect the high-energy conditions associated with the water flowing in a water channel, whereas wetlands display more diffuse flow and are lower energy environments."

Delineation

The site was investigated for the occurrence of wetlands and riparian areas, using the methodology described above and described in more detail in the DWAF guidelines.

Terrain Unit Indicator

The terrain on site varies from 1480 mamsl to 1760 mamsl as illustrated in Figure 12. From Figure 12 it can be seen that the site is located in an area of undulating hills with the dominant terrain units on site being the midslope, footslope and valley bottom units. According to the DWAF guidelines the valley bottom is the terrain unit where wetlands are most likely to occur, but they are not excluded from any of the other terrain units.

Soil Form Indicator

The soils on site follow a strong correlation with the underlying geology. The Sandstone soils are generally sandy, deep soils that are good for agriculture, while the Dolerite soils are dark in colour and have a high clay content. These soils are less suitable for agriculture and are mostly used for grazing.

The soils are located on the rolling landscape described above that slopes to the numerous streams and rivers in the area. Water enters the soils profile and then flows through the profile down-slope. This action of water movement through the slope typifies a small section of the site (eluvial and plinthic soils). Closer to the streams (within the valley bottom terrain unit) the soils gradually deepen due to the down-slope transport of soil (colluvium). In addition these soils have gradually higher percentages of clays that over time have been washed down-slope and accumulate at the valley bottom where the slope angle reduces.

During the site visits the soils on site were identified (Refer to Section 7.1.5). Of the soils identified on site the Katspruit, Rensburg and Willowbrook soil forms are indicative of the permanent wetland zone, while the Kroonstad, Wasbank, Westleigh, Avalon, Inhoek and Longlands soil forms are indicative of the temporary or seasonal wetland zone.

Soil Wetness Indicator

The soils on site were subjected to a soil wetness assessment. If soils showed signs of wetness within 50 cm of the soil surface, it was classified as a hydromorphic soil and divided into the following groups:

Temporary Zone

- Minimal grey matrix (<10%);
- Few high chroma mottles; and
- Short periods of saturation.

Seasonal Zone

- Grey matrix (>10%);
- Many low chroma mottles present; and
- Significant periods of wetness (>3 months / annum).

Permanent Zone

- Prominent grey matrix;
- Few to no high chroma mottles;
- Wetness all year round; and
- Sulphuric odour.

The soils mentioned above were classified accordingly and the results are visually represented in Figure 13 and Figure 14.

Vegetation Indicator

The vegetation units on site are described in Section 7.1.8 above and illustrated in Figure 38. The vegetation found in the moist grassland and the seepage zone vegetation units both have species present to indicate the presence of wetlands.

Wetlands and Buffer Zones

According to the methodology that was followed for delineation of wetlands by DWAF, there are wetlands on site. It should however be noted that several of the so-called wetlands could also be classified as riparian zones as they follow drainage paths of the streams on site.

All the areas identified above perform critical ecosystem functions and also provide habitat for sensitive species. It is suggested that a 100 m buffer be placed from the edge of the wetland and riparian zones in order to sufficiently protect these zones. Figure 42 and Figure 43 below illustrates the various wetland zones including the buffers. From the figures it is once again clear that Alternative 3 is the best alignment, as it limits the interaction with the sensitive wetlands.

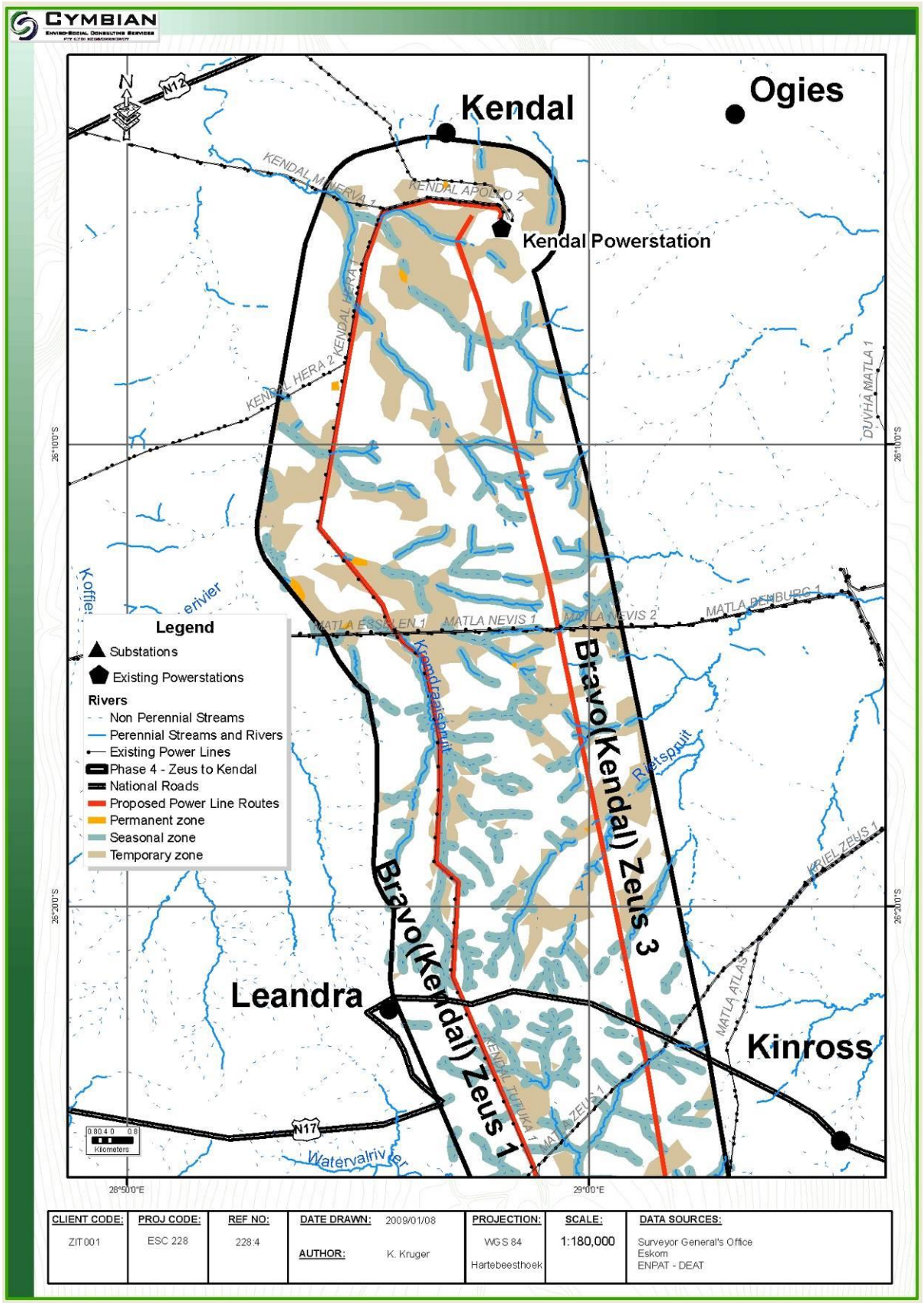


FIGURE 42: WETLAND AND RIPARIAN ZONE MAP OF THE NORTHERN SECTION OF THE SITE

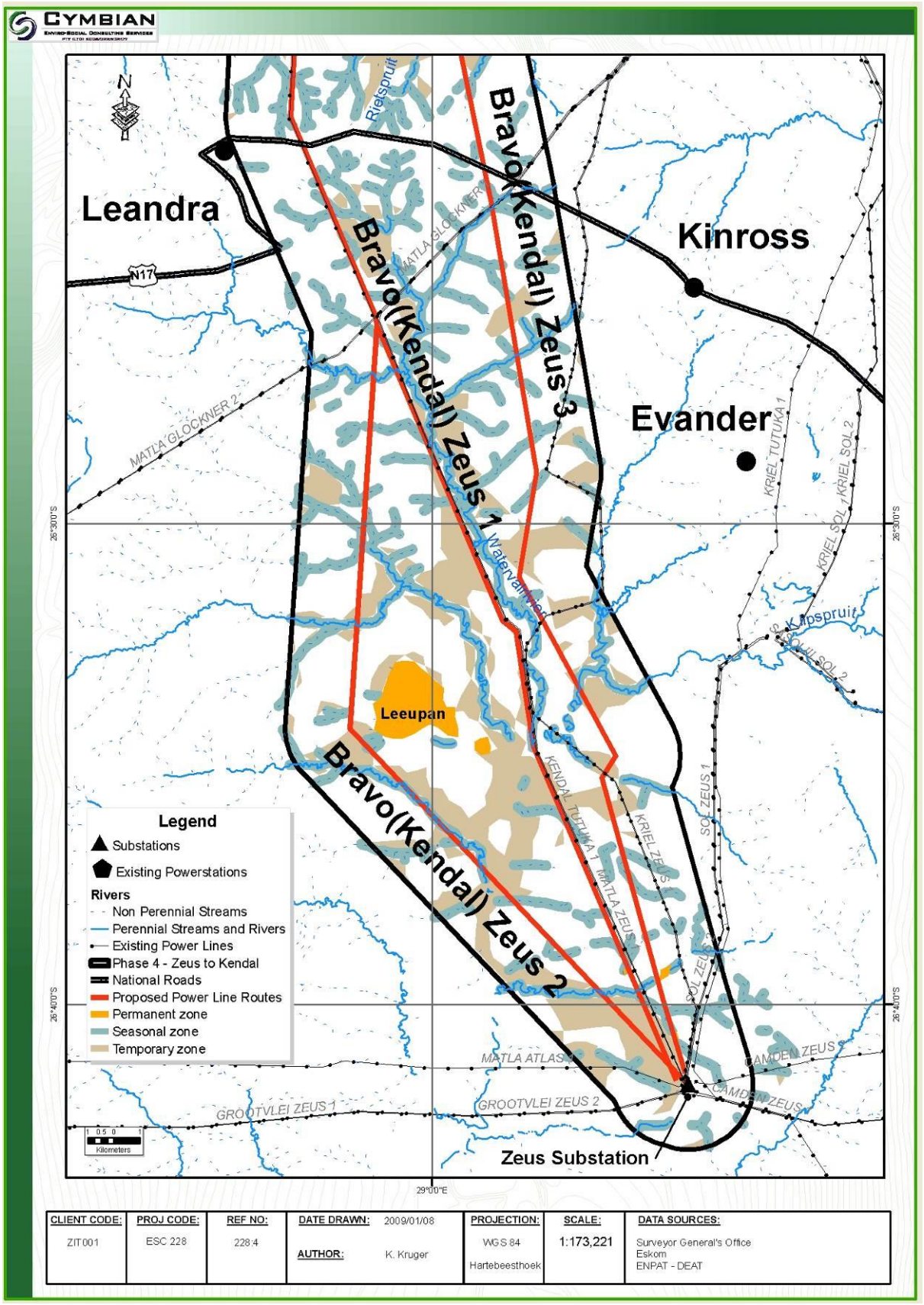


FIGURE 43: WETLAND AND RIPARIAN ZONE MAP OF THE SOUTHERN SECTION OF THE SITE

7.1.11 Biodiversity Rating

The following vegetation units were identified on site:

- Antropogenic grassland;
- Moist grassland;
- Grazed grassland; and
- Seepage areas and wetlands.

Each of the abovementioned vegetation units are rated for their biodiversity value below.

Grazed Grassland

This vegetation unit has a moderate biodiversity rating as indicated in Table 13 below. The moderate conservation value is attributed to the moderate grassland species diversity in the unit and the large area of rocky grassland remaining. The high functional rating is attributed to the obvious ecological services and the high aesthetic value of the rocky grassland.

TABLE 13: BIODIVERSITY RATING FOR THE GRAZED GRASSLAND UNIT

Conservation status	**Size of vegetation unit**	**Species diversity**	**Condition**
	3 – Moderate	3 - Moderate	3 – Moderately Disturbed
Functional status	**Use**	**Ecological service**	**Aesthetic value**
	3 – Periodic	5 – Obvious	5 - High
Biodiversity Rating	**Conservation status**	**Functional status**	**Biodiversity**
	9 – Moderate	13 - High	Moderate

Moist Grassland

This vegetation unit has a **moderate** biodiversity rating as indicated in Table 14 below. The **moderate** conservation value is attributed to the moderate grassland species diversity in the unit and the moderate area of moist grassland remaining. The **high** functional rating is attributed to the obvious ecological services and the high aesthetic value of the moist grassland.

TABLE 14: BIODIVERSITY RATING FOR THE *MOIST GRASSLAND* UNIT

Conservation status	**Size of vegetation unit**	**Species diversity**	**Condition**
	3 – Moderate	3 – Moderately Disturbed	3 – Moderately Disturbed
Functional status	**Use**	**Ecological service**	**Aesthetic value**
	1 – none	5 – Obvious	5 - High
Biodiversity Rating	**Conservation status**	**Functional status**	**Biodiversity**
	9 - Moderate	11 - High	**Moderate**

Antropogenic Grassland

This vegetation unit has a **low** biodiversity rating as indicated in Table 15 below. The **low** conservation value is attributed to the low grassland species diversity in the unit and the large area of disturbed grassland remaining. The **low** functional rating is attributed to the lack of ecological services provided by the disturbed grassland.

TABLE 15: BIODIVERSITY RATING FOR THE *DISTURBED GRASSLAND* UNIT

	Size of vegetation unit	Species diversity	Condition
Conservation status	1 - Large	1 - Low	1 - Disturbed
	Use	**Ecological service**	**Aesthetic value**
Functional status	1 - None	3 - Undetermined	1 - Low
	Conservation status	**Functional status**	**Biodiversity**
Biodiversity Rating	3 - Low	5 - Low	Low

Drainage Areas and Wetlands

This vegetation unit has a **high** biodiversity rating as indicated in Table 16 below. The **high** conservation value is attributed to the high grassland species diversity in the unit and the small area of wetlands remaining. The **high** functional rating is attributed to the obvious ecological services and the high aesthetic value of the wetlands and seepage areas.

TABLE 16: BIODIVERSITY RATING FOR THE *DRAINAGE AREAS AND WETLANDS*

	Size of vegetation unit	Species diversity	Condition
Conservation status	5 – Small	5 – High	3 – Moderately Disturbed
	Use	**Ecological service**	**Aesthetic value**
Functional status	1 – none	5 – Obvious	5 - High
	Conservation status	**Functional status**	**Biodiversity**
Biodiversity Rating	13 – High	11 - High	**High**

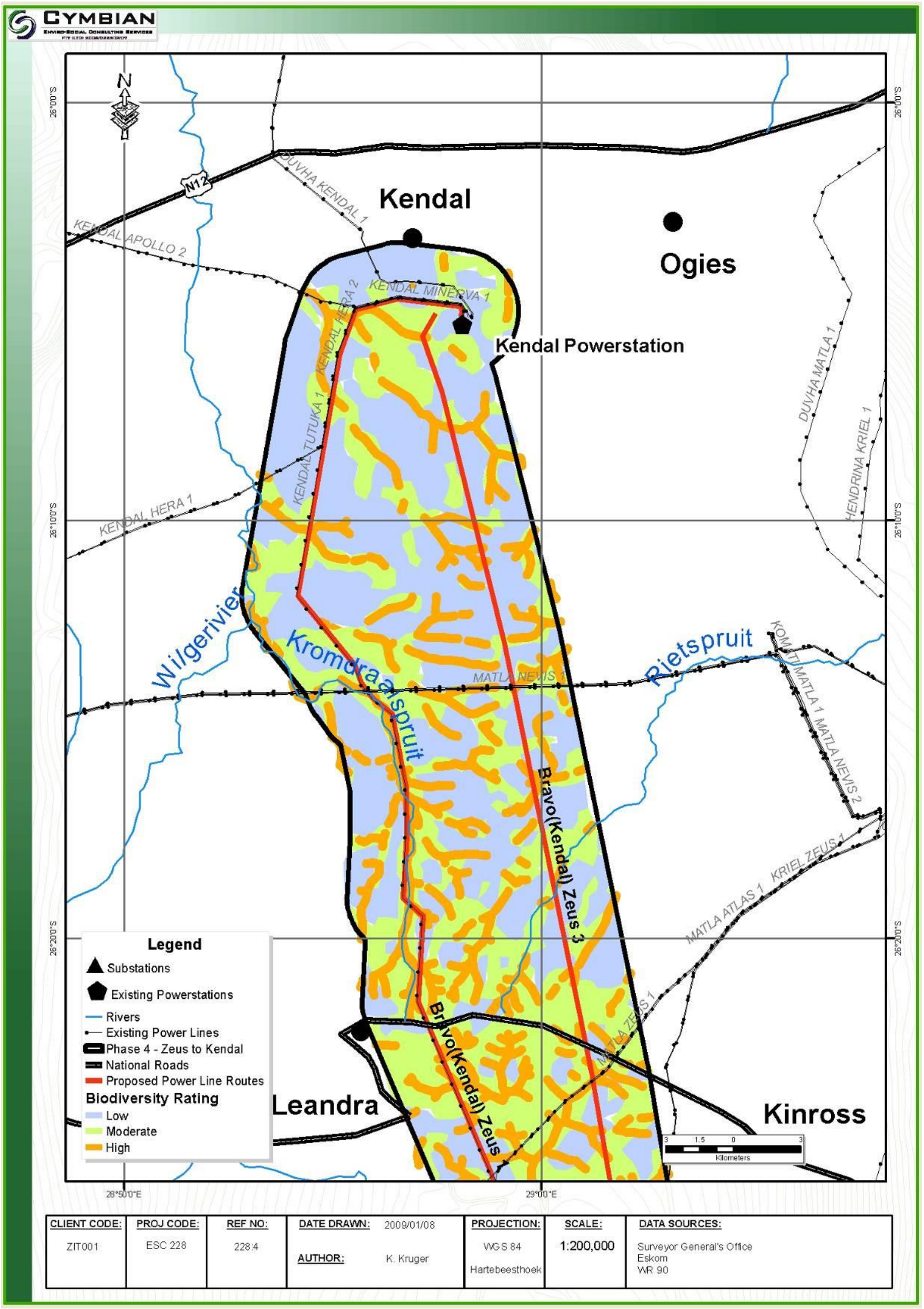


FIGURE 44: BIODIVERSITY RATING MAP OF THE NORTHERN PART OF THE SITE

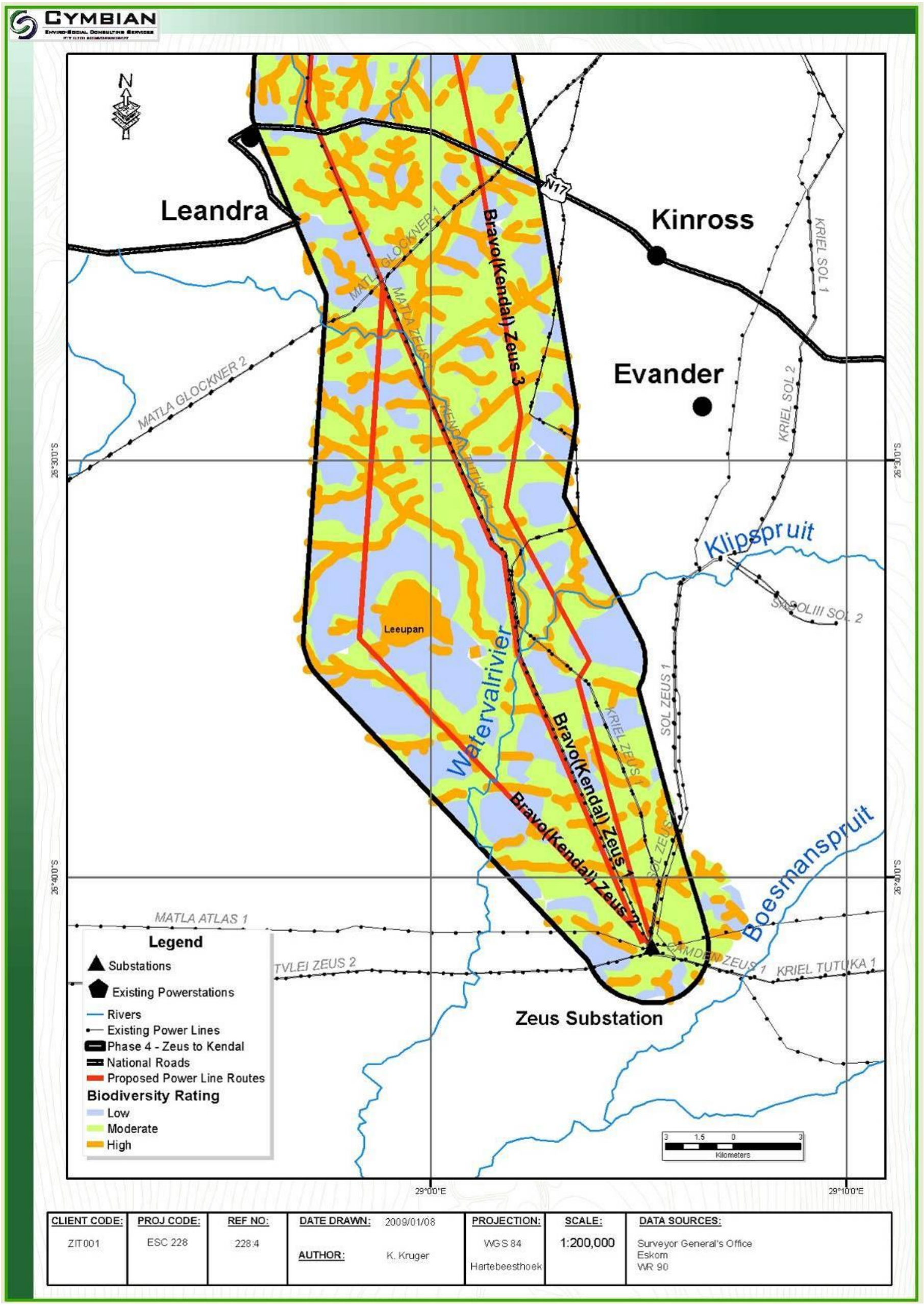


FIGURE 45: BIODIVERSITY RATING MAP OF THE SOUTHERN PART OF THE SITE

7.1.12 Visual Character

Landscape Character

The site and the surrounding area can be described as an agricultural landscape with intermittent mining and power generation activities. All the power line alternatives are located on rolling slopes with very little screening from topography or vegetation. Refer to Figure 12 for the topography of the site.

The major rivers in the south of the site are the Klipspruit and the Waterval River, with several smaller tributaries. In the northern section the Wilge River is the main watercourse that drains northwards. Alternative 1 follows the Waterval River as well as the Kromdraaispruit, Alternative 2 crosses the Waterval River before joining the same alignment as Alternative 1, also following the Kromdraaispruit. Alternative 3 does not traverse along any major water courses but does cross over the Rietspruit and the Klipspruit.

The landscape surrounding the proposed power lines can be described as open grassland with numerous cultivated fields. The natural vegetation does not provide any substantial screening of the power lines. There are several existing power lines throughout the site, and in deed the intention of the project is to connect the existing power lines with the new power station. Figure 46 below provides a view of some of the existing power lines on site.

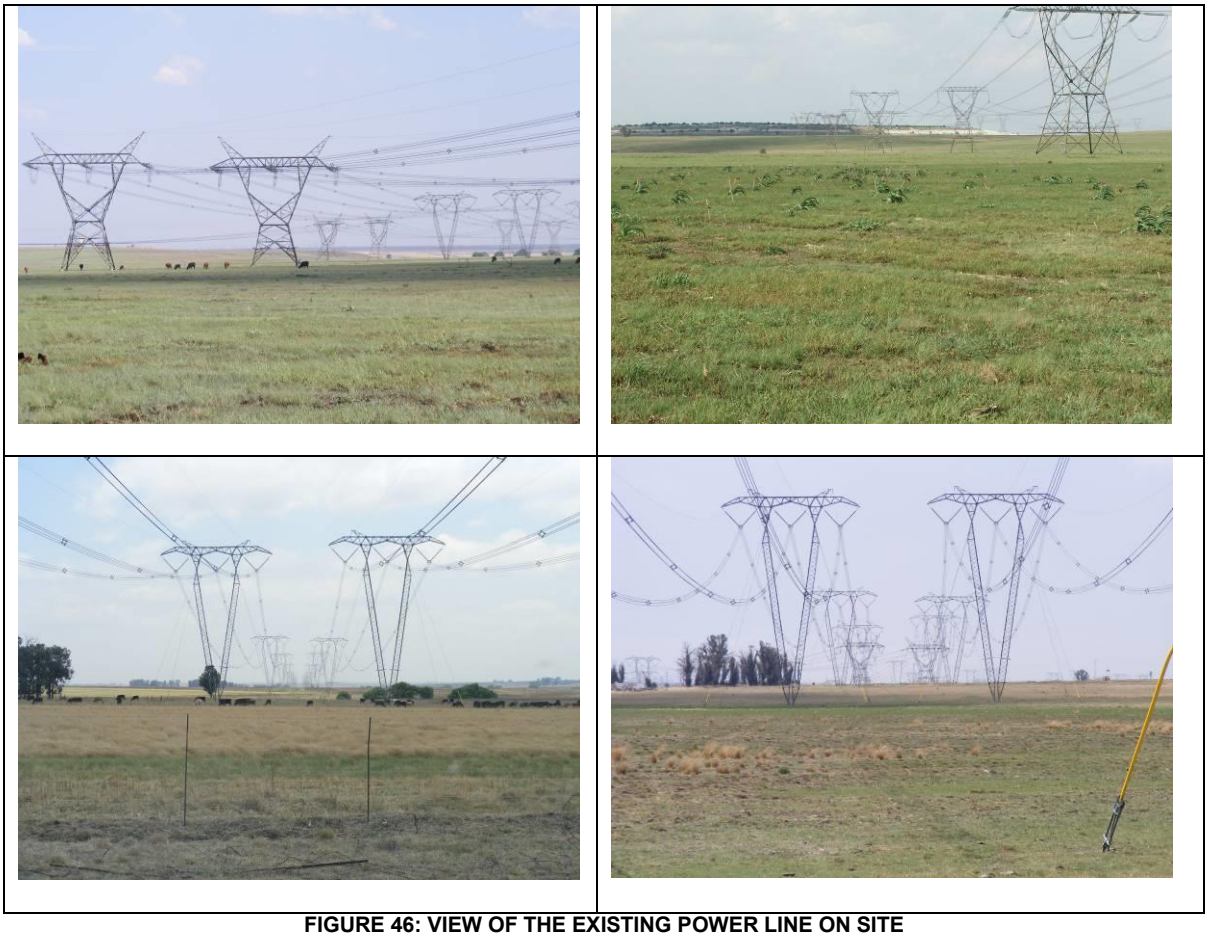


FIGURE 46: VIEW OF THE EXISTING POWER LINE ON SITE

The study area is relatively devoid of any other infrastructure, with the exception of several farm houses, fences and roads. In a few isolated areas the power lines traverse close to areas used for mining, urban settlements and power generation.

Viewshed

It should be noted that the viewshed for each of the alternatives, which is plotted on Figure 47, Figure 48 and Figure 49, is an approximation that may vary in some locations. Potential views to the proposed upgrade are likely to be blocked in some localised situations by buildings, vegetation or local landform features at specific locations within the viewshed. Similarly, glimpses of the proposed upgrade may be available from some isolated high-elevation locations outside the plotted viewshed. The figures illustrate the visibility of each of the alternatives. The coloured areas indicate areas that are visible with the red areas having very high visibility and the blue having lower visibility. It should be noted that Alternatives 3 is more visible than Alternative 1 and 2 due to the fact that it is located along the higher altitudes and is not aligned along drainage lines like the other two alternatives.

Notable features of the viewshed are summarised by the following points:

- The viewshed extends approximately 50 km to the northwest of the proposed upgrade;
- In a easterly direction the viewshed is generally limited by a ridgelines approximately 40 km from the site at Bethal;
- To the west the viewshed extends approximately 70 km with isolated views on high outcrops; and
- Potential views from the south are blocked by the flowing ridges located south from the proposed site, and the viewshed extends about 5 km.

Impact Assessment

The visual simulations prepared by Cymbian illustrate the extent to which the upgrade will be visible from key observation points (static and dynamic views). The vertical form/dimensions of the buildings/structures would be hidden by their location among existing buildings and within a well vegetated area. The visual contrast is increased by the "shape" and scale of the buildings/structures, which generally will not be viewed along the skyline.

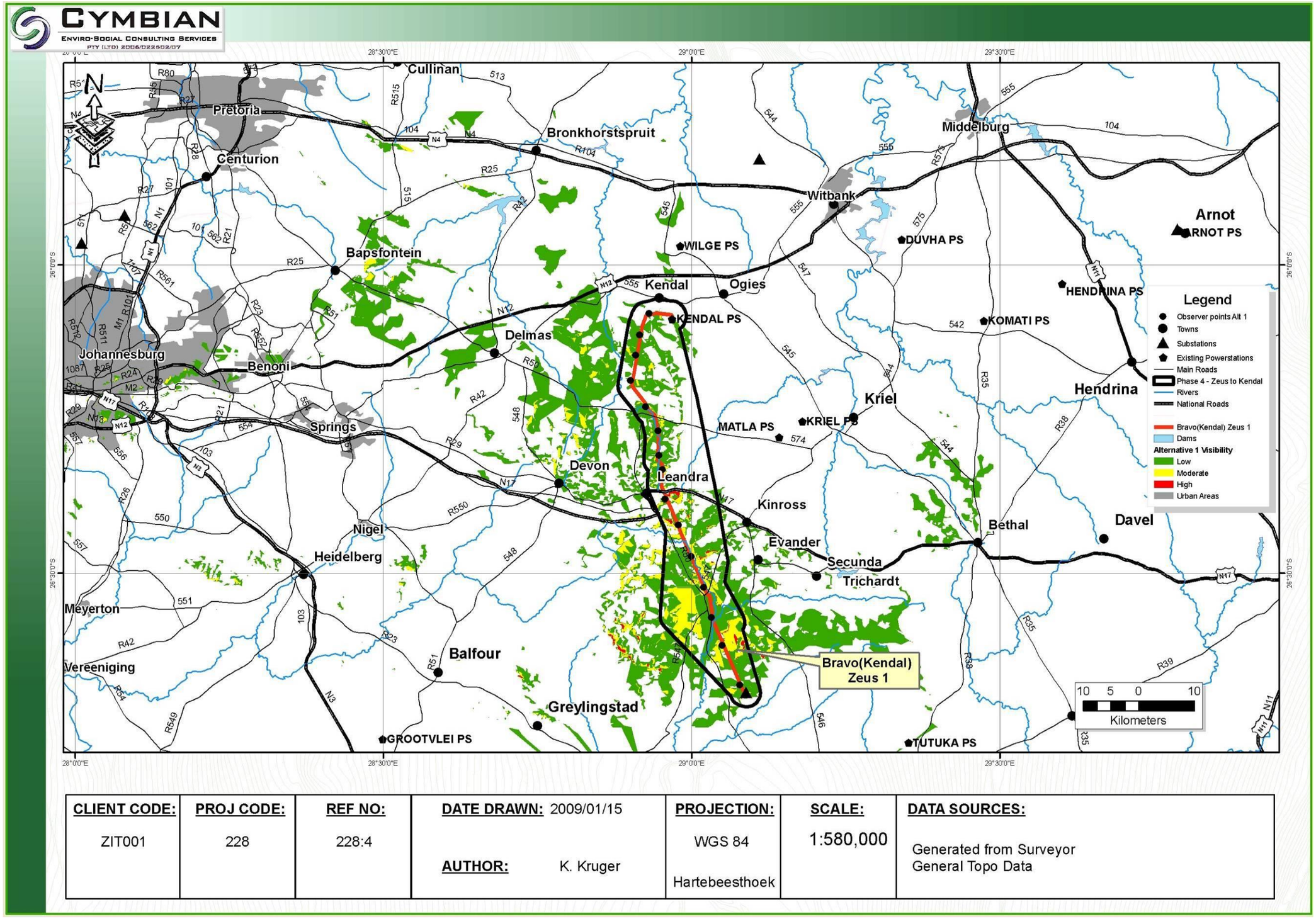
Static Views

The upgrade would potentially be visible from the surrounding farmland and several towns in the region as listed in Table 17. The potential number of viewers from this area could vary as the farmlands are quite sparsely populated while the towns have denser populations. The views would vary greatly depending on site specific conditions like the orientation of the homes as well as the location of other buildings, fences, vegetation and localized landforms. All these elements have the potential to block views to the proposed upgrade. It should be noted that a viewing distance of more than 5 km reduces the visibility as atmospheric

effects reduce the contrast between the power lines and the surrounding landscape. In addition several existing power lines traverse the site, reducing the impact of an additional line.

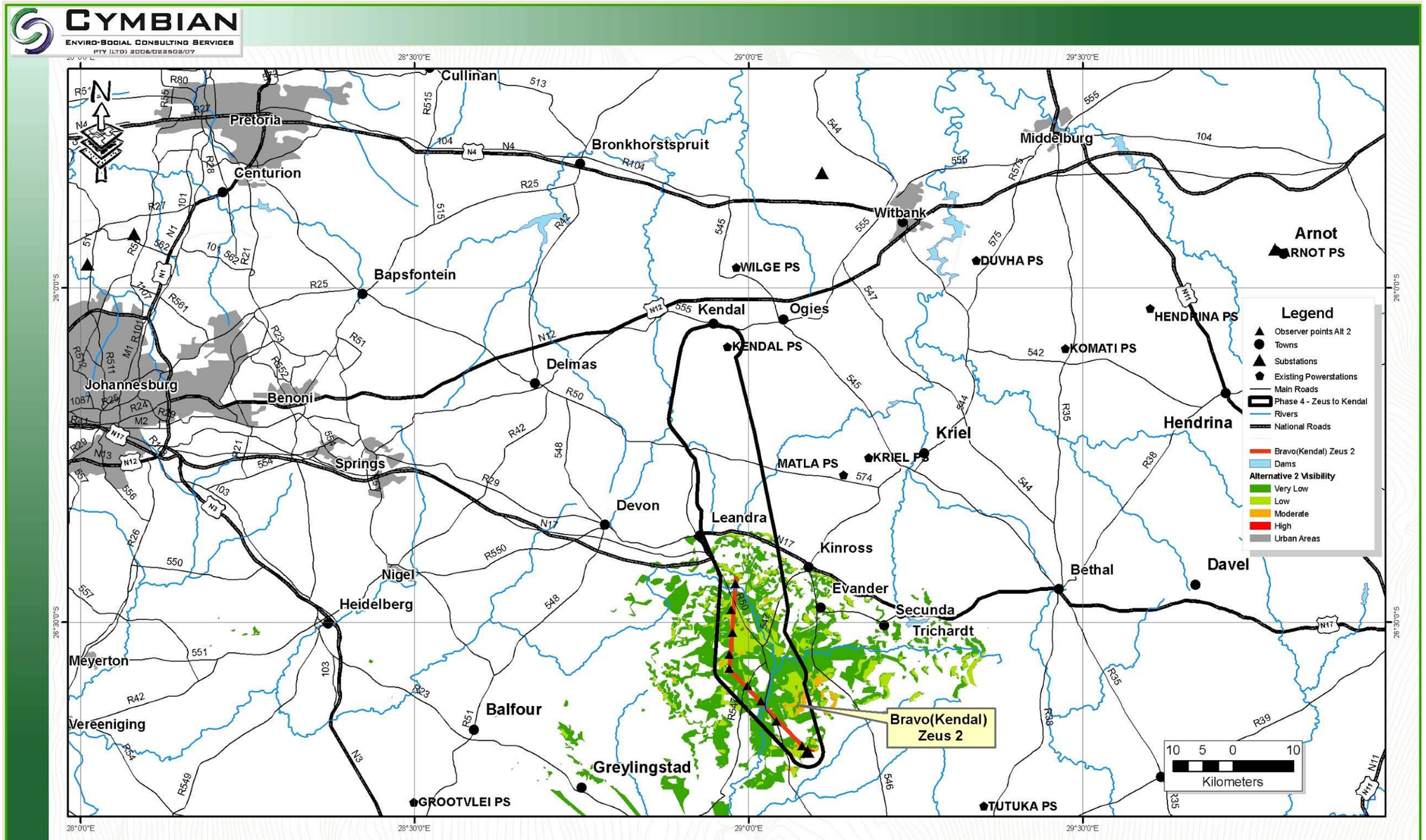
TABLE 17: STATIC VIEWS

Town	Alt 1 Distance (km)	Alt 2 Distance (km)	Alt 3 Distance (km)
Kendal	0	0	0
Leandra	2	2	10
Kinross	15	15	10
Evander	7.5	10	7.5
Devon	15	15	20
Secunda	15	20	15
Greylingstad	25	20	25
Delmas	20	20	30



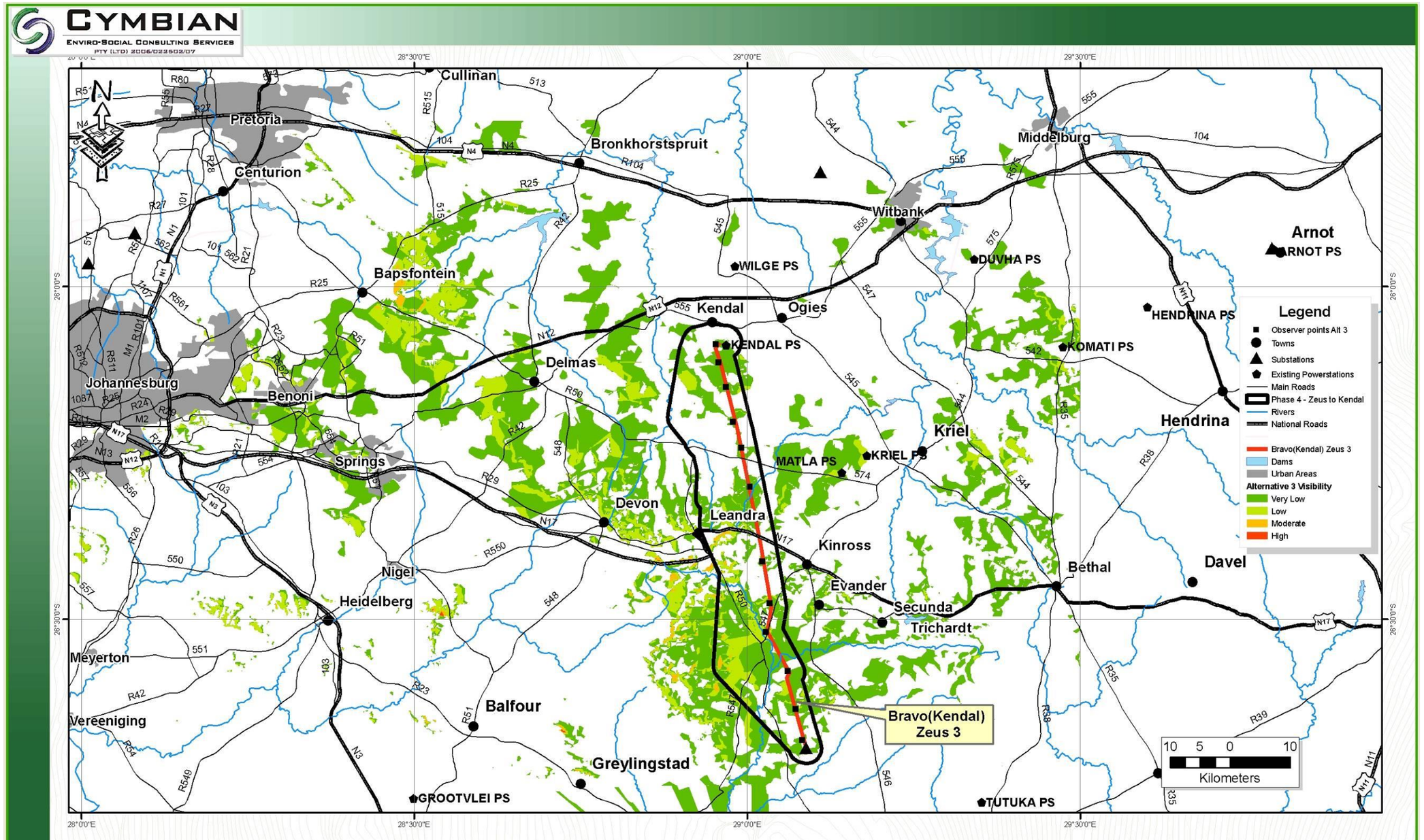
CLIENT CODE:	PROJ CODE:	REF NO:	DATE DRAWN: 2009/01/15	PROJECTION:	SCALE:	DATA SOURCES:
ZIT001	228	228:4	AUTHOR: K. Kruger	WGS 84 Hartebeesthoek	1:580,000	Generated from Surveyor General Topo Data

FIGURE 47: VIEWSHED FROM THE ALTERNATIVE 1 ALIGNMENT.



CLIENT CODE:	PROJ CODE:	REF NO:	DATE DRAWN: 2009/01/15	PROJECTION:	SCALE:	DATA SOURCES:
ZIT001	228	228:4	AUTHOR: K. Kruger	WGS 84 Hartebeesthoek	1:580,000	Generated from Surveyor General Topo Data

FIGURE 48: VIEWSHED FROM THE ALTERNATIVE 2 ALIGNMENT



CLIENT CODE:	PROJ CODE:	REF NO:	DATE DRAWN: 2009/01/15	PROJECTION:	SCALE:	DATA SOURCES:
ZIT001	228	228:4	AUTHOR: K. Kruger	WGS 84 Hartebeesthoek	1:580,000	Generated from Surveyor General Topo Data

FIGURE 49: VIEWSHED FROM THE ALTERNATIVE 3 ALIGNMENT

Dynamic Views

The power lines will be visible to a moderate number of viewers, mainly those travelling along the highways and other main routes in the area. The level of visibility of the power lines reduces as a result of a view distance of more than 5 km and the resulting atmospheric effects that reduce the contrast between the power lines and the surrounding landscape. Please refer to Table 18 for a summary of the dynamic impacts of all three alternatives on the main roads in the study site. The power line upgrade would also be visible from several farm roads which are located around the proposed site.

As the table below illustrates, the power lines will be visible from a number of roads in the area, and exposures to the view will range from 40 seconds to 17 minutes. The R50 and the R547 runs through the study area and the power lines will be most visible along these roads. Although the lines will also be visible for ling periods along the N12 and N17 highways, these are from further away and hence the impact will not be as high.

TABLE 18: DYNAMIC IMPACT TABLE

Road	Speed limit	Length (km)	Visibility (min)	Distance from power line (km)
N12	120	31.53	15.77	5 – 30
N17	120	27.53	13.77	0 - 45
N3	120	1.29	0.64	50 – 60
N4	120	8.02	4.01	30 – 40
R547	100	25	15	0 – 10
R50	100	35	17.5	0 – 15

Conclusion

Table 19 lists the observation points together with the category of viewer, context of view, relative numbers of viewers and approximate distance of observation point to the proposed site.

TABLE 19: VISUAL IMPACT MATRIX

Potential Observation Point	Category of Potential Receptor	Context of View	Approximate View Distance	Period of View	Visibility Rating
Surrounding Farmland	Static	Above & below	0 – 50 km	Long Term	Medium
Towns	Static	Above & below	0 - 30 km	Long Term	Medium
Gravel Roads	Dynamic	Above & below	0 – 20 km	Medium	Medium
Tar Roads	Dynamic	Level - Above	0 – 40 km	Medium	Medium

It should however be noted that there are a number of existing power lines in the study area as shown in the Figures above. Viewers in the viewshed have become accustomed to these power lines in the landscape and an additional power line will not increase the impact significantly. In terms of the preferred alternative, there is very little to choose between the alternatives from a visual standpoint. But it should be noted that the impact along Alternatives 1 and for sections along Alternative 2 is existing, while the bulk of Alternative 3 will be a new visual impact.

7.2 Cultural Environment

7.2.1 Archaeological and Cultural Historical Features

Focused archaeological research has been conducted in the Gauteng and Mpumalanga Provinces of South Africa for more than four decades. This research consists of surveys and of excavations of Stone Age and Iron Age sites as well as the recording of rock art and historical sites. The Gauteng and Mpumalanga Provinces have a rich heritage comprised of remains dating from the pre-historical and from the historical (or colonial) periods of South Africa. Pre-historical and historical remains in the Gauteng and Mpumalanga Provinces therefore form a record of the heritage of most groups living in South Africa today.

Various types and ranges of heritage resources that qualify as part of South Africa's 'national estate' as outlined in Section 3 of the National Heritage Resources Act (No 25 of 1999) occur in the Gauteng and Mpumalanga Provinces.

Within a cultural landscape

The project area is located in the midst of a cultural landscape that is marked by heritage remains dating from the pre-historical into the historical (colonial) period. Stone Age sites, Iron Age sites and colonial remains therefore do occur in the Eastern Highveld.

The archaeological and historical significance of this cultural landscape therefore must be described and explained in more detail before the results of the Phase I HIA study is discussed.

FIGURE 50 THE PROJECT AREA ON THE EASTERN HIGHVELD IN THE MPUMALANGA PROVINCE OF SOUTH AFRICA. THE PROJECT AREA STRETCHES FROM THE KENDAL AND MATLA POWER STATIONS IN THE NORTH TO THE ZEUS SUBSTATION IN THE SOUTH (BELOW).

The project area is an undulating piece of land which is characterised by an outstretched grass veldt. This piece of land is dotted with farmstead complexes which are usually associated with Blue Gum avenues or with smaller plantations of these trees.

FIGURE 51: THE PROJECT AREA NEAR THE ZEUS SUBSTATION ON THE EASTERN HIGHVELD IN THE MPUMALANGA PROVINCE

Contextualising the project area

The following brief overview of pre-historical, historical, cultural and economic evidence will help to contextualise the proposed project area.

Stone Age sites

Stone Age sites are marked by stone artefacts that are found scattered on the surface of the earth or as parts of deposits in caves and rock shelters. The Stone Age is divided into the Early Stone Age (covers the period from 2.5 million years ago to 250 000 years ago), the Middle Stone Age (refers to the period from 250 000 years ago to 22 000 years ago) and the Late Stone Age (the period from 22 000 years ago to 200 years ago).

The Later Stone Age is also associated with rock paintings and engravings which were done by the San, Khoi Khoi and in more recent times by Iron Age farmers.

Heritage surveys up to now have recorded few Stone Age sites, rock paintings and engravings in the Eastern Highveld.

Iron Age remains

The Iron Age is associated with the first agro-pastoralists who lived in semi-permanent villages and who practised metal working during the last two millennia. The Iron Age is usually divided into the Early Iron Age (covers the 1st millennium AD) and the Later Iron Age (covers the first 880 years of the 2nd millennium AD).

The Eastern Highveld has not been occupied by Early Iron Age communities but was occupied by Late Iron Age communities such as the Sotho, Swazi and Ndebele who established settlement complexes that are associated with stone walls.

The historical period

Towns closest to the project area include Ogies and Delmas in the north, Leandra in the central part and Evander and Secunda in the south. A brief historical background to this region is provided below.

Ogies serves as an important link in the running railway line running between Pretoria and Maputo which was built in 1896. It is also linked via Broodsnyersplaas, 35 km south of Middelburg to join the railway line between Ermelo and Piet Retief to Richards Bay. This railway line carries some of the longest and heaviest trains in the world**.** The town of Ogies developed around the railway station which was built on the farm Ogiesfontein in 1928.

Delmas was laid out in 1907 on the farm Witklip ('white stone') which was divided into 192 residential stands, 48 smallholdings of 4 ha each and a commonage of 138ha. The farm belonged to Frank Dumat who originated from France where he grandfather had a small farm. He named the town

Delmas which is derived from ‘mas’ which means a small farm in a southern dialect of French. In 1909 the government added another 5 500 ha to Frank Dumat’s original rural settlement.

The town of Leandra’s name is derived from two townships, Leslie and Eendrag, which are incorporated in this mining village.

Evander, south of Kinross, was established in 1955 by the Union Corporation as a residential township for the employees of the Winkelkaak. Leslie and Bracken mines. The name Evander is a composite of Evelyn and Anderson, the names of the widow of the managing director of the company when prospecting began in the area.

Secunda developed around Sasol 1 and Sasol 2 in the 1970's. Sasol was born during the oil crisis of 1973 when OPEC virtually quadrupled the price of crude oil overnight. Construction started in 1976 and the first oil was delivered on 1 March 1980. Following the overthrow of the Shah of Iran in 1979, South Africa's major source of crude oil at the time, the government announced the construction of a second plant at Secunda to double output. Sasol 3 delivered its first oil from coal in May 1982. The total costs of the two plants came to R 5,8 billion, mostly financed by levies on motorists.

Sasol 2 and 3 use about 35 million tons of coal a year to produce mostly liquid fuels. The coal is produced by four mines collectively known as Secunda Colliers which is the world's largest underground mining complex and by a new open-cast mine at Syferfontein.

A coal mining heritage

Coal mining on the Eastern Highveld is now older than one century and has become the most important coal mining region in South Africa**.** Whilst millions of tons of high-grade coal are exported annually more than 80% of the country’s electricity is generated on low-grade coal in Eskom’s power stations such as Duvha, Matla and Arnot situated near coalmines on the Eastern Highveld.

The earliest use of coal (charcoal) in South Africa was during the Iron Age (300-1880AD) when metal workers used charcoal, iron and copper ores and fluxes (quartzite stone and bone) to smelt iron and copper in clay furnaces.

Colonists are said to have discovered coal in the French Hoek Valley near Stellenbosch in the Cape Province in 1699. The first reported discovery of coal in the interior of South Africa was in the mid-1830 when coal was mined in Kwa Zulu/Natal.

The first exploitation for coal was probably in Kwa Zulu/Natal as documentary evidence refers to a wagon load of coal brought to Pietermaritzburg to be sold in 1842. In 1860 the coal trade started in Dundee when a certain Pieter Smith charged ten shillings for a load of coal dug by the buyer from a coal outcrop in a stream. In 1864 a coal mine was opened in Molteno. The explorer, Thomas Baines mentioned that farmers worked coal deposits in the neighbourhood of Bethal (Transvaal) in 1868.

Until the discovery of diamonds in 1867 and gold on the Witwatersrand in 1886, coal mining only satisfied a very small domestic demand.

With the discovery of gold in the Southern Transvaal and the development of the gold mining industry around Johannesburg came the exploitation of the Boksburg-Spring coal fields, which is now largely worked out. By 1899, at least four colliers were operating in the Middelburg-Witbank district, also supplying the gold mining industry. At this time coal mining also has started in Vereeniging. The Natal Collieries importance was boosted by the need to find an alternative for imported Welsh anthracite used by the Natal Government Railways.

By 1920 the output of all operating colliers in South Africa attained an annual figure of 9,5million tonnes. Total reserves were estimated to be 23 billion tonnes in Witbank-Springs, Natal and Vereeniging. Total reserves today are calculated to be 121 billion tonnes. The largest consumers of coal are Sasol, Iscor and Eskom.

A vernacular stone architectural heritage

A unique stone architectural heritage was established in the Eastern Highveld from the second half of the 19th century well into the early 20th century. During this time period stone was used to build farmsteads and dwellings, both in urban and in rural areas. Although a contemporary stone architecture also existed in the Karoo and in the Eastern Free State Province of South Africa a wider variety of stone types were used in the Eastern Highveld. These included sandstone, ferricrete ('ouklip'), dolerite ('blouklip'), granite, shale and slate.

The origins of a vernacular stone architecture in the Eastern Highveld may be ascribed to various reasons of which the ecological characteristics of the region may be the most important. Whilst this region is generally devoid of any natural trees which could be used as timber in the construction of farmsteads, outbuildings, cattle enclosures and other structures, the scarcity of fire wood also prevented the manufacture of baked clay bricks. Consequently stone served as the most important building material in the Eastern Highveld.

Late Iron Age communities who contributed to the Eastern Highveld's stone walled architecture were the Sotho, Pedi, Ndebele and Swazi. The tradition set by these indigenous groups may have influenced the first settlers from Natal and the Cape Colony to utilize the same resources that their predecessors did. Many farmers from Scottish, Irish, Dutch, German and Scandinavian descend settled and farmed in the Eastern Highveld. These colonials brought the knowledge of stone masonry from Europe which compensated for the lack of fire wood necessary to manufacture baked clay bricks.

7.3 Socio-Economic Environment

In order to address the overall objective of this study, it was necessary to compile a detailed description of the study area. The first subsection below provides a profile of the social processes in

terms of demographic, economic, institutional and empowerment, socio-cultural, geographical and biophysical baseline conditions in the study area. Each subsection concludes with a table summarising how the project is likely to change these baseline profiles, and the related impacts that could be expected as a result of the project.

A change process can be defined as change that takes place within the receiving environment as a result of a direct or indirect intervention. A potential impact follows as a result of the change process. However, a change process can only result in an impact once it is experienced as such by an individual/community on a physical and/or cognitive level.

7.3.1 Baseline Demographic Processes

Demographic processes relate to the number of people and composition of a community and include an overview of the population size and the educational profile of the affected communities.

Population

The Emalahleni Local Municipality (ELM) covers an area of approximately 2 678 km^2 and in 2007 had a total population of 435 217 people. Compared to the population size of 2001, when the population stood at approximately 276 413 people, this means that the population size within the ELM increased at an average rate of 26 467 people per annum or a total of 158 804 over the 6-year period between 2001 and 2007. This population increase also brought about a change in the population density in the area from 103.2 persons per km^2 in 2001 to 162.5 persons per km^2 in 2007.

In comparison, the Govan Mbeki Local Municipality (GMLM) covers an area of approximately 2 954.6 km^2 and in 2007 had a total population of 268 947 people. Compared to the population size of 2001, when the population stood at approximately 221 739 people, this means that the population within the GMLM grew at an average rate of 7 868 people per annum or a total of 47 208 over the 6-year period between 2001 and 2007. This population growth also brought about a change in the population density in the area from 75.0 persons per km^2 in 2001 to 91.0 persons per km^2 in 2007.

Although the population density within both areas increased significantly, such population densities are still regarded as fairly low when compared to an urban area such as Johannesburg where the population density in 2007 stood at approximately 2 364 people per km^2.

When considering the households within these areas, the following definition was applied: *"One or more people occupying a housing unit as their usual place of residence. The occupants may be a*

single family, one person living alone, two or more families living together, or any other group of related or unrelated people who share living arrangements".[5]

In 2001, the ELM had a total of 74 917 households which increased steadily at a rate of 5 113 households per annum to a total of 105 592 households in 2007. It seems that in both areas the number of households developed more ore less on par with the population growth rate so that there has been an average increase of between 0.1 and 0.4 persons per household over the 6-year period between 2001 (when the average number of persons per household was estimated at 3.7 for the ELM and 3.3 for the GMLM) and 2007 (an average of 4.1 persons per household for the ELM and 3.4 for the GMLM).

The predominant population groups in the both areas remained the same between 2001 and 2007 and are therefore still Black African (85.8% for the ELM and 82.5% for the GMLM), followed by White (12.7% for the ELM and 15.8% for the GMLM). However, the population growth rate amongst the White population group (estimated at 25.1%) within the GMLM is much faster that than of their Black African counterparts (estimated at 16.4%), whereas in the ELM the growth rate amongst the Black African population is faster than that of the White group (which decreased by 3.2% between 2001 and 2007).

The same sort of phenomenon can be found amongst the gender distribution in the study area. In the GMLM in 2001 there was an almost equal split between the male and female ratio (with males dominating slightly at 50.3% in the GMLM and at 50.6% for the ELM). The gender ratio in the GMLM has since been far surpassed by the females so that in 2007 females dominated at 53.5%. This is due to the fact that the male growth rate in the area is at 2.6% per annum; whereas the female growth rate is almost double that at 4.6% per annum. A declining male population might also be ascribed to the migrant labour patterns in South Africa where the male moves to a different area in search of work in order to support his family. The reverse was true for the ELM, where the male population kept increasing so that in 2007, 51.1% of the total population was male. This might also be ascribed to the migrant labour patterns which might have resulted in an influx of males from GMLM to the ELM in search of employment. This scenario is however unlikely in view of the fact that most of the major industries (notably Sasol and other major mining houses) are located in the GMLM and not the ELM.

More than two thirds (approximately 70%) of the total population of the study fall within the working age category, which is defined by Statistics South Africa as the ages between 15 and 64.

Table 20 below provides an overview of the population demographics of the study area in relation to South Africa as a whole, the province and the district. From this table it is evident that there are more

[5] irhr.ua.edu/blackbelt/glossary.html

females than males in the study area, which, as mentioned above, might be ascribed to the migrant labour patterns in South Africa where the male moves to a different area in search of work. If this is the case, it can very well be assumed that these males are employed elsewhere and would therefore not be seeking work at the proposed project. It is therefore necessary to take cognisance of the fact that the majority of work seekers might be female.

TABLE 20: SUMMARY OF POPULATION CHARACTERISTICS

<	***South Africa***	***MP***	***NDM***	***ELM***		***GSDM***	***GMLM***	
<	***2007***			***2001***	***2007***	***2007***	***2001***	***2007***
Area size (km^2)	1 219 912	79 511.5	16 892.6	2 678		31 845.9	2 954.6	
Total population	48 502 063	3 643 435	1 226 498	276 413	435 217	890 699	221 739	268 947
	<			Average decrease of 26 467 persons per annum			Average increase of 7 868 persons per annum	
Population density (people per km^2)	39.8	45.8	72.6	103.2	162.5	28.0	75.0	91.0
	<			Average increase of 9.9 persons per km^2 per annum			Average increase of 2.7 persons per km^2 per annum	
Total households	12 500 610	940 403	305 566	74 917	105 592	247 518	67 622	79 192
	<			Average increase of 5 113 households per annum			Average increase of 1 928 households per annum	
Avg. persons per household	3.9	3.9	4.0	3.7	4.1	3.6	3.3	3.4
Predominant Population Groups	Black African (79.5%)[4]	Black African (92.0%) White (6.8%)	Black African (90.9%) White (7.8%)	Black African (82.2%) White (15.9%)	Black African (85.8%) White (12.7%)	Black African (89.5%) White (9.1%)	Black African (83.6%) White (14.4%)	Black African (82.5%) White (15.8%)
	<			Average increase of 24 381 Black Africans p.a., with an equal increase of 3.6% proportion of total population.			Average increase of 6 076 Black Africans p.a., but decrease by 1.1% proportion of total population.	

<	***South Africa***	***MP***	***NDM***	***ELM***		***GSDM***	***GMLM***	
<	***2007***			***2001***	***2007***	***2007***	***2001***	***2007***
				Average decrease of 1 866 Whites p.a., with an equal decrease of 3.2% proportion of total population.			Average increase of 1 782 Whites p.a., and increase by 1.4% proportion of total population.	
Predominant Gender	Female (50.8%)[6]	Female (51.4%)	Female (50.1%)	Male (50.6%)	Male (51.5%)	Female (51.0%)	Male (50.3%)	Female (53.5%)
	<			Male population growing faster than female population.			Female population growing faster at 4.6% p.a. against male counterparts' growth of 2.6% p.a.	
Predominant Age Group	Working age (% unknown)	Working age (62.0%)	Working age (64.3%)	Working age (68.8%)	Working age (69.1%)	Working age (62.4%)	Working age (68.1%)	Working age (70.0%)
	<			Working age population increased by an average of 18 409 persons p.a., and proportionally increased by 0.05% p.a.			Working age population increased by an average of 6 200 persons p.a.	

[6] *Census 2001 data (2007 data not readily available)*

Education

An overview of the educational profile for the study area on local municipal level is provided in Figure 52. Overall it would appear as if the area is characterised by a semi-skilled to skilled population, which is reflected in the fact that, in 2007, only a small minority (7.6% for the ELM and 8.0% for the GMLM) of the population has had no form of formal education.

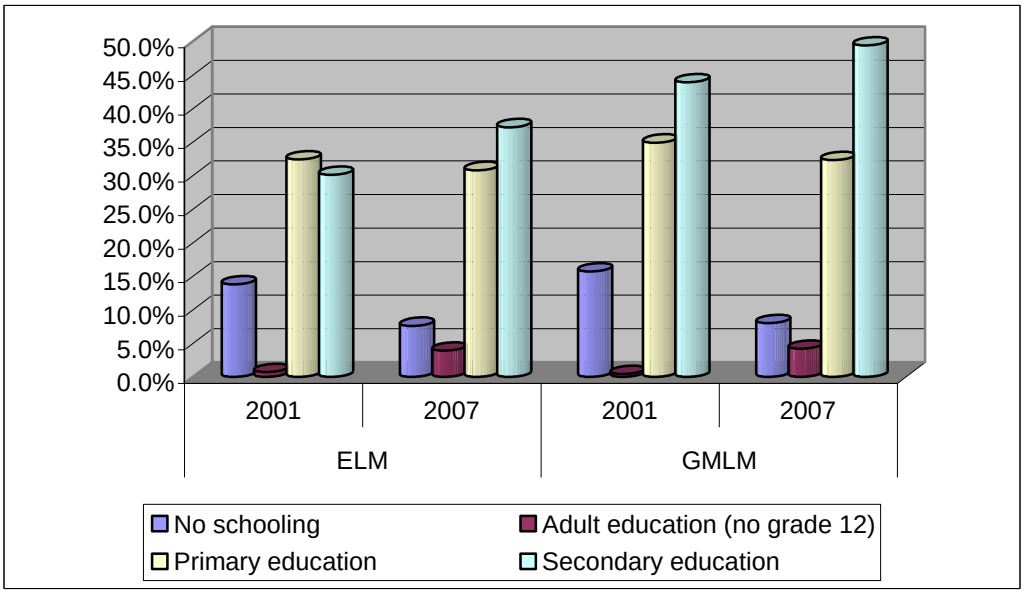


FIGURE 52: COMPARATIVE EDUCATIONAL PROFILE (GROUPED) FOR THE STUDY AREA

When considering the educational levels reported for the total population of the study area between 2001 and 2007, the number of people who attended and/or completed a primary level education, decreased in both areas as reflected in figure 4 above. On the upside, the number of people who have had no schooling also decreased, while at the same time the number of people who completed some form of secondary education increased by between 5.5% and 7.1%.

The number of people who obtained a higher (post-Grade 12) qualification also increased by between 0.5% and 0.9%. The increase in the secondary and tertiary educational levels could be as a result of a need to get out of the poverty cycle, realising that some form of education might be beneficial.

One of the driving forces behind social change is educational attainment, which in turn is linked to poverty levels as there appears to be a correlation between the level of educational attainment and income levels. People with higher educational levels tend to be economically better off, and therefore contribute more to the reduction of the unemployment rate. Educational attainment is also linked to poverty in the sense that funds are required to further studies, therefore people living in less favourable economic conditions tend to be unable to further their education, which in turn holds them in a downward poverty spiral.

7.3.2 Baseline Geographic Processes

Geographical processes relate to land use patterns and infrastructure in the area. This section therefore describes the land use in the study area from a social perspective, specifically in terms of settlement patterns and land use developments.

Land use is defined as "the way land is developed and used in terms of the types of activities allowed (agriculture, residences, industries, etc.) and the size of buildings and structures permitted. Certain types of pollution problems are often associated with particular land uses, such as sedimentation from construction activities".[7]

Another definition of land use is as follows: "Patterns of land use arise naturally in a culture through customs and practices, but land use may also be formally regulated by zoning, other laws or private agreements such as restrictive covenants".[8]

Current Land Use

The ELM IDP[9] states that the southern parts of the municipal area is known as the "Energy Mecca of South Africa", which is as a result of rich coal deposits and coal reserves and the presence of a number of power stations. The area is further described as an urban and rural area, which includes large farms and dispersed urban settlements.

According to the GMLM IDP[10], the main land use in the area is commercial farming followed by coal and gold mining, and then industries, of which the petro-chemical industry is said to be the largest.

A general assessment of the land uses in the study area indicated the following trends:

- Residential;
- Commercial cattle and crop farming;
- Mining; and
- Industries.

The following subsections briefly describe the current land use in the towns and areas in the immediate vicinity and/or in close proximity to the proposed transmission power line corridor

[7] www.soil.ncsu.edu/publications/BMPs/glossary.html

[8] www.wikipedia.org/wiki/Land_use.html

[9] Emahlahleni Local Municipality IDP 2008/2009

[10] Integrated Development Plan 2007-2011 for the Govan Mbeki Local Municipality

alternatives. Unless otherwise stated, the information was adapted from the GMLM Spatial Development Framework (SDF)[11] and the ELM IDP.

Emahlahleni Local Municipality

The land use within the ELM has been divided into five main uses, namely business activities, industrial activities, mining areas, electricity and agriculture. These land uses will be discussed briefly.

- **Business Activities:** The eMalahleni Central Business District (CBD) is the primary business centre within the ELM. The area includes offices, retail, general businesses and commercial uses. The most prominent focal point within the ELM is the junction between the N12 and the N4, which the ELM believes offers opportunities for further business and commercial development. This junction offers a highly visible site of approximately 89ha, for which there is a high demand for high tech industrial and office development. Apart from the eMalahleni CBD, business nodes can also be found in areas such Ga-Nala and Ogies, which has offices, retail and general business uses. These two centres mostly serve as business areas to the surrounding farms.

- **Industrial Activities:** The nine industrial areas in the ELM are all mostly centred in and around the town of eMalahleni. These nine areas also constitute the largest concentration of industrial areas in the whole district. The development of these areas is constrained as a result of the presence of undermining, which is viewed by the ELM as a huge constraint as there is a demand for industrial sites within the area.

- **Mining areas:** The central and southern portions of the ELM are characterised as mining areas, with large parts of the area affected by shallow undermining. Also, a number of mines in the area closed down, which had significant environmental impacts in the form of sinkhole formation, subsiding, underground fires and water seepage. Mine closure also gave rise to economic impacts with large scale retrenchments which in turn lead to the closure of mining towns.

- **Electricity:** Eskom developed a number of power generating facilities within the ELM, mainly as a result of the presence of rich coal reserves within the ELM. The presence of these power stations lead to the development and expansion of towns such as Ga-Nala, Thubelihle, and Wilge (which closed down).

- **Agriculture:** The rural areas of the ELM consist mostly of farms and agricultural holdings, characterised by cattle farming and maize farming. Agricultural holdings are mostly located on the periphery of the urban areas.

[11] Govan Mbeki Municipality: Spatial Development Framework. June 2006.

Figure 53 below provides an overview of the current land use along the **Western alternative**, which mostly traverses agricultural land and follows the alignment of the existing transmission power line.

FIGURE 53: LAND USE ALONG THE WESTERN CORRIDOR WITHIN THE ELM

Govan Mbeki Local Municipality

Urban Areas:

Initially the town of **Leandra** was meant to be an agricultural support centre but over the years it grew and developed due to the various mining activities in the area. However, the town lacks economic diversification, which in turn resulted in substantial urban decay, notably in the Central Business District (CBD) and industrial areas within the town. The residential areas of Leandra is characterised by formal housing structures in the form of single dwelling units on stands ranging between 1200m^2 and 3000m^2. In addition, there are also still a fairly large number of vacant stands, some of which are serviced whilst others are not. Industrial and commercial land uses are located to the south of Leslie, south of the railway line and east of the R50. Again there are a number of vacant stands within the industrial and commercial area. Although some business can also be found in the Leslie industrial area, most businesses are located within the CBD. As is the case with the rest of the town, the CBD is also in a state of urban decay. Community facilities in the area include churches, a mosque, a clinic, a community hall, a police station and two primary schools, of which the one is vacant.

Secunda is the biggest urban centre within the GMLM. The town was established in 1975 around the Sasol II and III developments as a result of the urgent need to house Sasol employees. The development and expansion of Secunda also lead to the revitalisation of some of the more dormant town in the area, such as Trichardt. Today Secunda is the most diversified economic hub of the total district. As could be expected, the majority of the residential area consists of formal single dwelling housing structures, located on stands of approximately 900m2 in size. Again there are a substantial

number of vacant residential stands throughout the town. Apart from Sasol who is located to the south of town, Secunda also has two other industrial and commercial areas, namely a newly established light industrial/commercial area north of the CBD, and an industrial area on the north-eastern edge of town that is partially undeveloped. The vast majority of businesses and retail centres are situated in the CBD, where some parts are in need of upgrading. In addition to the seven shopping centres scattered throughout the town, other community facilities include a number of churches, schools (5 primary and 3 secondary), a private hospital and municipal clinic, a police station, and a magistrate's court.

Trichardt is situated east of and adjacent to Secunda. These two towns are only separated by a railway line and therefore appear to be a single town as opposed to two separate towns. The town was initially established as a farming support centre during the early 1900s. Trichardt threatened to become a "ghost town" until SASOL developed its large plants in adjacent Secunda, which lead to development and diversification albeit on a smaller scale as Secunda. As a result of the presence of SASOL's hostels in Trichardt, the town has quite a high proportion of multiple residential units. Apart from these residential units, single residential components of approximately 1 300m^2 can also be found in the town. There are no informal settlements in Trichardt. Trichardt has no clearly defined industrial area. Light industrial and commercial areas are situated to the north-western part of town with no clear distinction between these areas and the adjacent residential areas. The businesses are mostly concentrated along the N17, which includes mostly motor trade and associated businesses.

eMbalenhle is the largest residential urban settlement area in the GMLM and was established in 1978 to accommodate members of SASOL's workforce. In this regard, SASOL's further expansion and development also lead to the development and growth of eMbalenhle. The main land use in eMbalenhle is residential in nature and therefore this town relies heavily on Secunda to meet its physical and economical needs. Although the town is well serviced, it is lagging behind economically.

- **Agriculture:** Despite the fact that large parts of the GMLM area are not suitable for arable agriculture, most of the rural areas within the GMLM are taken up by commercial farming activities. These agricultural activities are mostly centred on dry land crop cultivation (e.g. maize, sunflowers and beans), whereas the grasslands are used as grazing fields. Scattered chicken farms can also be found in the area. Notable improvements have been done on some of the commercial farms, but such improvements mostly relate to the farmsteads, e.g. the farmhouse, farm stores and labourers' complexes. Figure 54 below provides an overview of the current land use along the **Western alternative**, which mostly traverses agricultural land and follows the alignment of the existing transmission power line.

FIGURE 54: LAND USE ALONG THE WESTERN CORRIDOR WITHIN THE GMLM.

Mining:

Two types of mining occur within the GMLM, namely coal and gold mining. According to the GMLM SDF, almost the whole municipal area is underlain with coal reserves. Although Sasol is the major role player in the coal mining sector, other mining title holders include Anglo, Ingwe, Xstrata, Eyesiswe and Tesa. A total of 13 shafts are located in the central part of the GMLM, together with an extensive network of surface conveyor belts. Despite the fact that it seems as if the coal seems are generally shallow, opencast mining only takes place at Syferfontein to the north of Secunda. The level at which these coal seams are found therefore sterilizes large parts of the GMLM for surface development.

Harmony Gold is the only gold mining company in the GMLM and mostly operates in the vicinity of Evander and eMbalenhle, which lies to the west of Secunda. As opposed to the shallow coal seams, the gold reefs are generally deep below the surface and therefore gold mining operations do not pose a significant development constraint. However, despite the fact that these operations do not sterilise the land as is the case with the coal mining operations, the surface infrastructure associated with these gold mining operations does sterilise large parcels of land. Infrastructure associated with gold mining operations include rock dumps, mine dumps and tailings facilities, of which the tailings facilities in particular pose the biggest constraints to development as a result of the size of such facilities, the associated dust pollution and the potential impact on downstream areas.

Future Land Use

The proposed Evander South gold mine is located to the west of the R50 on the farms Rietkuil and Wildebeestspruit. The area is located along the south-western extent of the Evander Goldfields in the Mpumalanga Province, approximately 15 km south-southeast of Leandra and 27 km west of Secunda.

Harmony Gold Mining (Pty) Ltd. undertook a pre-feasibility assessment in 2006/07 to determine the viability of developing the proposed Evander South gold mine. The results of the pre-feasibility study indicated the need for further drilling to clarify the extent of the ore body, as well as to improve the geological and resource modelling. If the feasibility of the proposed new mine is proved by means of this additional drilling, a full EIA process will be undertaken.

The proposed operation plans to make use of conventional stoping, which will be supported by a trackless infrastructure (meaning that trucks will collect the ore from box holes and tip this onto truck conveyors on the decline system). The footwall infrastructure will be mechanised and there is also an option to mechanise the stoping.

The ore will be milled on site and then transported to the existing metallurgical plant at Kinross via the use of an underground pipeline that will be approximately 16 km in length. It is believed that the use of an underground pipeline would reduce the surface infrastructure required at the proposed mine, while at the same time making optimal use of existing infrastructure and resources.

Municipal-wide Development Framework

The GMLM has included a municipal-wide development framework in their SDF with the aim to integrate development principles and objectives. As part of this municipal-wide development framework, Secunda has been identified as a primary urban node, supported by Bethal and Leandra. The N17 has furthermore been earmarked as a primary high-order mobility corridor. Secunda and Evander have been identified as nodal development areas (refer to Figure 55 below, study area marked in red).

Areas such as Secunda, Evander and parts of Kinross are viewed as fully serviced urban areas and therefore the emphasis in these towns are placed on the maintenance of infrastructure, social services and densification. One such densification project entails a mixed use township development in the Secunda area (an area of approximately 28 km2 between Secunda and Evander), which will consist of commercial, shopping, social, housing and other land uses. This project has been initiated by Harmony Gold and approved by the GMLM. This project forms part of the GMLM's urban infill zone where they foresee that most developments in the area would be of a residential nature, but that other development such as industrial and commercial developments would also have to be promoted to aid the creation of employment opportunities.

Other areas that have been identified for urban development is mostly situated to the north of Secunda. However, development in this area would only be allowed once the urban infill zone has

been developed and therefore urban expansion into this area is not foreseen within the short to medium term (or within the next 10 years).

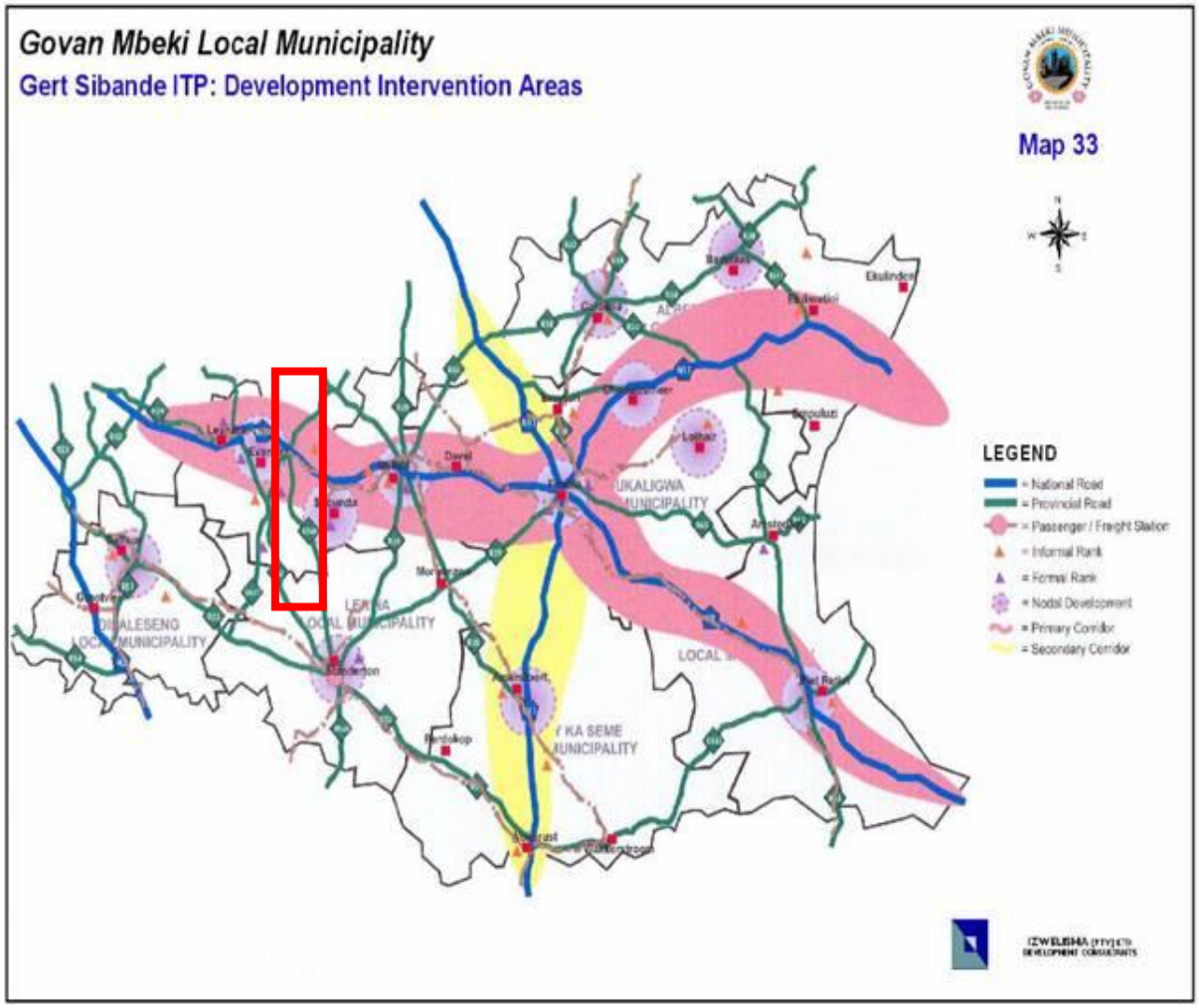


FIGURE 55: DEVELOPMENT INTERVENTION AREAS WITHIN THE GMLM

7.3.3 Baseline Economic Profile

Economic processes relate to the way in which people make a living and the economic activities within that society. The employment status within a community gives an indication of the economic stability of such a community and also serves as an indicator of such a community's general well-being.

Employment and Economic Sectors

Table 21 below provides an overview of the employment and economic sectors of the study area in relation to South Africa as a whole, the province and the district. From this table it is clear that the

study is not only characterised by a predominantly semi-skilled to skilled male population, but also a fairly high employment rate.

Close on three quarters (or 70.1% for the ELM and 72.9% for the GMLM) of the working age population within the study is formally employed. This represents an average increase of 10.6% in the employment rate in the whole study area.

Overall it would therefore appear as if the economy of the study area is growing at a steady pace. As economic industries are growing, more employment opportunities are created thereby further reducing the unemployment rate, creating sources of income which in turn leads to the creation of other opportunities such as further education, a need for housing (which in turn creates further employment opportunities, both directly and indirectly), etc.

TABLE 21: SUMMARY OF EMPLOYMENT AND ECONOMIC SECTORS

<	South Africa	MP	NDM	ELM		GSDM	GMLM	
<	2001[12]	2007		2001	2007	2007	2001	2007
Employed[13]	33.7%	40.1%	42.1%	40.2%	50.0%	43.4%	40.0%	53.8%
Unemployed[14]	24.0%	20.0%	19.8%	25.0%	21.3%	21.6%	26.5%	20.0%
Not economically active	42.3%	39.9%	38.1%	34.8%	28.7%	35.1%	33.5%	26.2%
Employment rate[14]	58.4%	66.7%	68.0%	61.6%	70.1%	66.8%	60.2%	72.9%
Predominant industry	Community services (29.1%)	Unspecified (29.0%)	Unspecified (26.1%)	Unspecified (73.8%)	Unspecified (32.6%)	Unspecified (48.6%)	Unspecified (74.6%)	Unspecified (41.3%)

[12] Census 2001 data (2007 data not readily available)

[13] This is the percentage employed/unemployed of the entire working age population and should not be read as the unemployment rate, i.e. the *not economically active* population is included in this segment.

[14] In order to reflect a more accurate employment rate, the *not economically active* population has been excluded from this segment.

Household and Personal Income

In 2001, close on a fifth to a quarter (or one in every 4-5 households) in the study area had no annual household income. A further 33.6% (or 27 621) of the households within the ELM lived below the acceptable minimum standard, which is nationally defined as an annual household income of at least R20 000 per annum. In the GMLM this figure was even higher and was estimated at 40.7% (or 27 528) of the households. In the ELM, close on half (45.6%) lived above the acceptable minimum standard (> R20 000 p.a. per household). This figure dropped again in the GMLM, where only slightly over a third (37.6%) lived above the acceptable minimum standard.

Unfortunately Community Survey 2007 did not include data on household incomes and therefore this report also includes an overview of personal income (which was covered in CS 2007) in an attempt to provide an overview of the baseline economic conditions of individuals in the area.

The graph below (Figure 56) provides a comparative overview of the personal income levels of individuals in the study area between 2001 and 2007. However, it should be noted that the 'no income' category also includes persons under the age of 14 (who is not regarded as people within a working age category and therefore would earn no income) as well as persons from the 'not economically active' population, who are therefore not only unemployed, but who are also not actively seeking employment and therefore also do not earn an income.

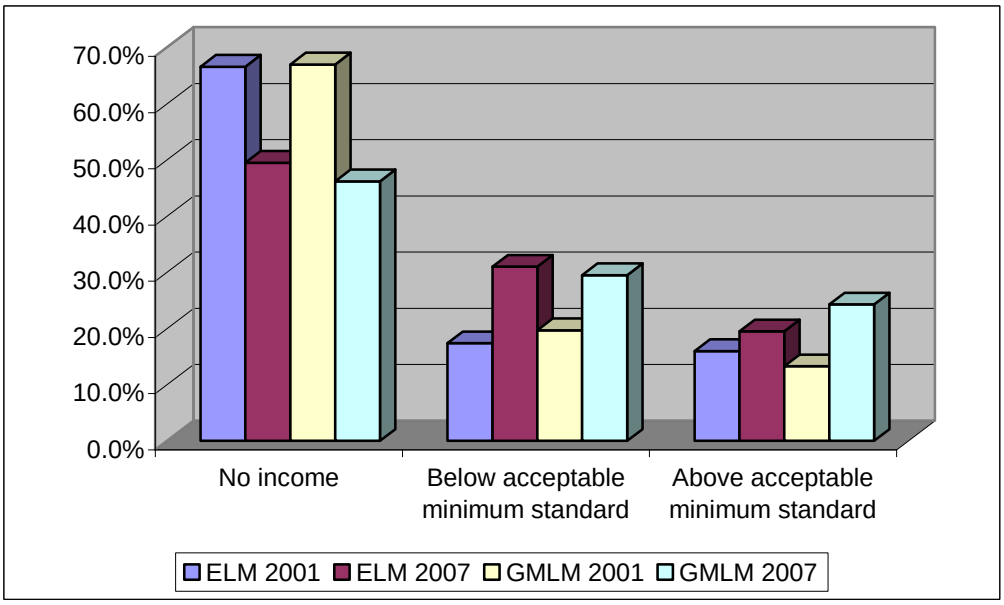


FIGURE 56: OVERVIEW OF MONTHLY PERSONAL INCOME (2001 AND 2007 COMPARED)

The number of individuals with no personal income decreased by between approximately 17.1% and 20.8% over the 6 year period between 2001 and 2007, bearing in mind that a large segment of those with no personal income are either under the age of 14 or not economically active. The number of individuals who earn a personal monthly income below the national accepted minimum standard (defined as earning at least R1 600 per month) has increased by between 9.8% (in the GMLM) and

13.6% (in the ELM) between 2001 and 2007. The number of individuals who earn above the acceptable minimum standard increased only marginally in the ELM (3.5%), but by 11% in the GMLM.

From this data, it would appear as if more people entered the economic market, which is linked to the increased employment rate and the broadening of the economic sectors within the study area.

7.3.4 Baseline Empowerment and Institutional Profile

Institutional and empowerment processes relate to the role, efficiency and operation of government sectors and other organisations within the area in terms of service delivery. It also investigates the ability of people to engage in decision-making processes to such an extent that they have an impact on the way in which decisions are made that would concern them.

Municipal Services

The years between 2001 and 2007 saw a steady increase in the delivery of municipal services to the households within the study area. Some of the most significant increases have been in the number of households who connected to the electricity network, most notably the fact that, of the almost half of all households who made use of coal for heating purposes in 2001, more than half made use of electricity for this purpose in 2007.

The municipal infrastructure is mostly located within the urban areas of the municipal areas. Municipal infrastructure backlogs are mostly confined to the previously disadvantaged township areas, and, as could be expected, in informal settlement areas. The outlying rural areas rely almost exclusively on water and sanitation services that are below Reconstruction & Development Programme (RDP) standard. In terms of water services, RDP standard is defined as piped water either within a dwelling or within 200m of such a dwelling. Sanitation services on par or above RDP standard is defined as any waterborne sanitation services that are connected to a municipal sewerage system or a ventilated pit latrine (VIP) system.

Table 22 below provides an overview of the municipal services of the affected area in relation to the province and the district as a whole. No data could be obtained for the overall municipal service delivery in South Africa. Although there has been a steady increase and expansion of municipal service delivery in the GMLM, the opposite has occurred in the ELM where it appears that municipal service delivery has decreased. The mostly likely explanation for this occurrence is that the municipal services were unable to keep up with the huge increase in the number of households, which had an average annual growth rate of 5 113 households (or 30 678 households between 2001 and 2007).

Therefore, it would appear that, in general within the study area, municipal services are at a very vulnerable stage and that the municipal network might not be able to sustain additional connections to the network. It should further be noted water is a scarce commodity in specifically the GMLM and

that there are limited water sources within the area. In this regard the GMLM IDP also stated that it is very crucial that all water supplies are regulated and measured so that water losses can be measured in a quantitative manner.

TABLE 22: OVERVIEW OF MUNICIPAL SERVICE DELIVERY TO THE AFFECTED AREAS

<	*South Africa*	*MP*	*NDM*	*ELM*		*GSDM*	*GMLM*	
<	<	*2007*		*2001*	*2007*	*2007*	*2001*	*2007*
Energy cooking	<	*Electricity (55.7%)*	*Electricity (59.6%)*	*Electricity (62.6%)*	*Electricity (56.4%)*	*Electricity (53.3%)*	*Electricity (42.2%)*	*Electricity (71.7%)*
Energy heating	<	*Electricity (45.0%)*	*Electricity (49.3%)*	*Electricity (59.2%)*	*Electricity (47.1%)*	*Electricity (39.7%)*	*Coal (42.1%)*	*Electricity (58.2%)*
Energy lighting	<	*Electricity (82.2%)*	*Electricity (81.5%)*	*Electricity (70.3%)*	*Electricity (60.1%)*	*Electricity (79.8%)*	*Electricity (71.3%)*	*Electricity (87.5%)*
Refuse	<	*Own disposal (49.6%)*	*Own disposal (48.1%)*	*Removed once a week (64.2%)*	*Removed once a week (56.9%)*	*Removed once a week (59.7%)*	*Removed once a week (82.9%)*	*Removed once a week (82.9%)*
Sanitation	<	*RDP standard or above (55.5%)*	*RDP standard or above (54.9%)*	*RDP standard or above (74.7%)*	*RDP standard or above (66.2%)*	*RDP standard or above (73.6%)*	*RDP standard or above (71.9%)*	*RDP standard or above (95.0%)*
Water	<	*RDP standard or above (91.1%)*	*RDP standard or above (96.6%)*	*RDP standard or above (94.2%)*	*RDP standard or above (98.6%)*	*RDP standard or above (91.9%)*	*RDP standard or above (91.1%)*	*RDP standard or above (97.5%)*

Empowerment and Participation

In terms of baseline empowerment processes, the hierarchy of needs as set out by Maslow, offers an insightful backdrop in terms of people's potential level of involvement in the EIA process and the issues that might be pertinent to them in a development of this nature. Maslow argued that the type of need that a person experiences is dependent on the fulfilment of other needs. The various categories of needs are organised in a hierarchy, which indicates which level of need has to be fulfilled before the next level of need would be experienced (refer to Figure 57).

Therefore, in order to expect people to fully participate in a process that might affect their future, people would have to function on a higher level within the hierarchy of needs (the need for self esteem, characterised by knowledge and understanding needs as well as the need for an environment that is aesthetically appealing, as indicated by the dashed red arrow). This means that their basic needs had to be met first (as indicated by the solid red arrow). The flipside is that people, who live in poverty as a result of high unemployment rates, low income levels and a poor education, struggle to survive on a daily basis and are therefore more focused on their more basic needs.

FIGURE 57: MASLOW'S HIERARCHY OF NEEDS

People who are more focused on their basic needs are therefore in a sense disempowered to fully participate in the process. The issue here is not that these communities are misinformed or lack information as such, but rather that these communities are ignorant about their rights and responsibilities as participants in the process. In such an instance it can very well be expected that such community members' expectation of the project mostly relates to employment opportunities. However, due to the fact such residents mostly function on a very basic needs level, they might fail to comprehend the "bigger picture" or in other words, the associated impacts (both negative and

positive) that the proposed project would bring to their area. Their lack of understanding has bearing on future generations that will inhabit the area.

7.3.5 Baseline Socio-Cultural Processes

Socio-cultural processes relate to the way in which humans behave, interact and relate to each other and their environment, as well as the belief and value systems which guide these interactions.

8 IMPACT ASSESSMENT METHODOLOGY

In order to ensure uniformity, a standard impact assessment methodology has been utilised so that a wide range of impacts can be compared. The impact assessment methodology makes provision for the assessment of impacts against the following criteria:

- Significance;
- Spatial scale;
- Temporal scale;
- Probability; and
- Degree of certainty.

A combined quantitative and qualitative methodology was used to describe impacts for each of the aforementioned assessment criteria. A summary of each of the qualitative descriptors along with the equivalent quantitative rating scale for each of the aforementioned criteria is given in Table 23.

TABLE 23: QUANTITATIVE RATING AND EQUIVALENT DESCRIPTORS FOR THE IMPACT ASSESSMENT CRITERIA.

RATING	SIGNIFICANCE	EXTENT SCALE	TEMPORAL SCALE
1	VERY LOW	*Isolated route / proposed route*	Incidental
2	LOW	*Study area*	Short-term
3	MODERATE	*Local*	Medium-term
4	HIGH	*Regional / Provincial*	Long-term
5	VERY HIGH	*Global / National*	Permanent

A more detailed description of each of the assessment criteria is given in the following sections.

8.1 Significance Assessment

Significance rating (importance) of the associated impacts embraces the notion of extent and magnitude, but does not always clearly define these since their importance in the rating scale is very relative. For example, the magnitude (i.e. the size) of area affected by atmospheric pollution may be extremely large (1000 km^2) but the significance of this effect is dependent on the concentration or level of pollution. If the concentration is great, the significance of the impact would be HIGH or VERY HIGH, but if it is diluted it would be VERY LOW or LOW. Similarly, if 60 ha of a grassland type are destroyed the impact would be VERY HIGH if only 100 ha of that grassland type were known. The impact would be VERY LOW if the grassland type was common. A more detailed description of the impact significance rating scale is given in Table 24 below.

TABLE 24: DESCRIPTION OF THE SIGNIFICANCE RATING SCALE.

RATING		DESCRIPTION
5	VERY HIGH	Of the highest order possible within the bounds of impacts which could occur. In the case of adverse impacts: there is no possible mitigation and/or remedial activity which could offset the impact. In the case of beneficial impacts, there is no real alternative to achieving this benefit.
4	HIGH	Impact is of substantial order within the bounds of impacts, which could occur. In the case of adverse impacts: mitigation and/or remedial activity is feasible but difficult, expensive, time-consuming or some combination of these. In the case of beneficial impacts, other means of achieving this benefit are feasible but they are more difficult, expensive, time-consuming or some combination of these.
3	MODERATE	Impact is real but not substantial in relation to other impacts, which might take effect within the bounds of those which could occur. In the case of adverse impacts: mitigation and/or remedial activity are both feasible and fairly easily possible. In the case of beneficial impacts: other means of achieving this benefit are about equal in time, cost, effort, etc.
2	LOW	Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts: mitigation and/or remedial activity is either easily achieved or little will be required, or both. In the case of beneficial impacts, alternative means for achieving this benefit are likely to be easier, cheaper, more effective, less time consuming, or some combination of these.
1	VERY LOW	Impact is negligible within the bounds of impacts which could occur. In the case of adverse impacts, almost no mitigation and/or remedial activity is needed, and any minor steps which might be needed are easy, cheap, and simple. In the case of beneficial impacts, alternative means are almost all likely to be better, in one or a number of ways, than this means of achieving the benefit. Three additional categories must also be used where relevant. They are in addition to the category represented on the scale, and if used, will replace the scale.
0	NO IMPACT	There is no impact at all - not even a very low impact on a party or system.

8.2 Spatial Scale

The spatial scale refers to the extent of the impact i.e. will the impact be felt at the local, regional, or global scale. The spatial assessment scale is described in more detail in Table 25.

TABLE 25: DESCRIPTION OF THE SIGNIFICANCE RATING SCALE.

RATING		DESCRIPTION
5	Global/National	The maximum extent of any impact.
4	Regional/Provincial	The spatial scale is moderate within the bounds of impacts possible, and will be felt at a regional scale (District Municipality to Provincial Level).
3	Local	The impact will affect an area up to 5 km from the proposed route corridor.

RATING		DESCRIPTION
2	Study Area	The impact will affect a route corridor not exceeding the Boundary of the corridor.
1	Isolated Sites / proposed site	The impact will affect an area no bigger than the route site.

8.3 Duration Scale

In order to accurately describe the impact it is necessary to understand the duration and persistence of an impact in the environment. The temporal scale is rated according to criteria set out in Table 26.

TABLE 26: DESCRIPTION OF THE TEMPORAL RATING SCALE.

RATING		DESCRIPTION
1	Incidental	The impact will be limited to isolated incidences that are expected to occur very sporadically.
2	Short-term	The environmental impact identified will operate for the duration of the construction phase or a period of less than 5 years, whichever is the greater.
3	Medium term	The environmental impact identified will operate for the duration of life of the line.
4	Long term	The environmental impact identified will operate beyond the life of operation.
5	Permanent	The environmental impact will be permanent.

8.4 Degree of Probability

Probability or likelihood of an impact occurring will be described as shown in Table 27 below.

TABLE 27: DESCRIPTION OF THE DEGREE OF PROBABILITY OF AN IMPACT ACCRUING.

RATING	DESCRIPTION
1	Practically impossible
2	Unlikely
3	Could happen
4	Very Likely
5	It's going to happen / has occurred

8.5 Degree of Certainty

As with all studies it is not possible to be 100% certain of all facts, and for this reason a standard "degree of certainty" scale is used as discussed in Table 28. The level of detail for specialist studies is determined according to the degree of certainty required for decision-making. The impacts are discussed in terms of affected parties or environmental components.

TABLE 28: DESCRIPTION OF THE DEGREE OF CERTAINTY RATING SCALE.

RATING	DESCRIPTION
Definite	More than 90% sure of a particular fact.
Probable	Between 70 and 90% sure of a particular fact, or of the likelihood of that impact occurring.
Possible	Between 40 and 70% sure of a particular fact or of the likelihood of an impact occurring.
Unsure	Less than 40% sure of a particular fact or the likelihood of an impact occurring.
Can't know	The consultant believes an assessment is not possible even with additional research.

8.6 Quantitative Description of Impacts

To allow for impacts to be described in a quantitative manner in addition to the qualitative description given above, a rating scale of between 1 and 5 was used for each of the assessment criteria. Thus the total value of the impact is described as the function of significance, spatial and temporal scale as described below:

$$\textit{Impact Risk} = \frac{(\text{SIGNIFICANCE} + \textit{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

An example of how this rating scale is applied is shown below:

TABLE 29: EXAMPLE OF RATING SCALE.

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	LOW	*Local*	Medium Term	*Could Happen*	
Impact to air	**2**	***3***	**3**	**3**	**1.6**

Note: The significance, spatial and temporal scales are added to give a total of 8, that is divided by 3 to give a criteria rating of 2,67. The probability (3) is divided by 5 to give a probability rating of 0,6. The criteria rating of 2,67 is then multiplied by the probability rating (0,6) to give the final rating of 1,6.

The impact risk is classified according to 5 classes as described in the table below.

TABLE 30: IMPACT RISK CLASSES.

RATING	IMPACT CLASS	DESCRIPTION
0.1 – 1.0	**1**	**Very Low**
1.1 – 2.0	**2**	**Low**
2.1 – 3.0	**3**	**Moderate**
3.1 – 4.0	**4**	**High**
4.1 – 5.0	**5**	**Very High**

Therefore with reference to the example used for air quality above, an impact rating of 1.6 will fall in the Impact Class 2, which will be considered to be a low impact.

8.7 Notation of Impacts

In order to make the report easier to read the following notation format is used to highlight the various components of the assessment:

Significance or magnitude- IN CAPITALS

Duration – in underline

Probability – *in italics and underlined*.

Degree of certainty - **in bold**

Spatial Scale – *in italics*

9 ALTERNATIVE SENSITIVITY ANALYSIS

This section provides a short sensitivity matrix, which compares the three different alternatives and their associated environmental sensitivities.

TABLE 31: ALTERNATIVE SENSITIVITY MATRIX

Sensitivity	Alternative 1	Alternative 2	Alternative 3
Geology	None	None	None
Climate	None	None	None
Topography	None	None	None
Surface Water	Most river crossings, traverses along several major streams.	Traverses along several major streams and in close proximity	Avoids the bulk of the surface water bodies.
Soils & Land Capability	Clay soils dominate	Clay soils dominate	Agricultural soils dominate
Flora	Traverses through sensitive vegetation	Traverses through sensitive vegetation	Limits interaction with sensitive vegetation.
Fauna	Potential high impact on avifauna	Potential high impact on avifauna	Smallest impact to avifauna
Wetlands	Traverses along wetlands and streams	Traverses along wetlands and streams	Limits interaction with wetlands
Visual	Existing impact	Limited existing impact	New impact
Heritage	Moderate	Moderate	Low
Social	Moderate	Low	Moderate
Total Sensitivities	**7**	**7**	**3**

On the basis of the matrix presented above, it is suggested that the Bravo 4 Alternative 3 be utilised as the preferred alternative for the proposed project, as it has the least sensitive features associated with the alignment.

10 IMPACT ASSESSMENT

The Impact Assessment will highlight and describe the impact to the environment following the abovementioned methodology and will assess the following components:

- Geology;
- Climate;
- Surface Water;
- Topography;
- Soils;
- Land Capability
- Land Use;
- Flora;
- Fauna;
- Visual Assessment
- Heritage; and
- Social.

The impact assessment was undertaken for the construction, operational and decommissioning phases of the project. The impact of each line/route alternative was also assessed separately, however, where the impact was not significantly different, only one impact assessment was undertaken. Also, at the time of writing this report, no technical data was available as to the type of tower to be used for the construction of the transmission lines. Therefore, it is assumed that the Self-supporting strain and suspension tower type would be used. Contained in this assumption is that the maximum distance between towers would be 300 m and that the tower would be erected on concrete footings with dimensions of 2 x 2 x 2 m (area = 4 m^2 and volume = 8 m^3).

10.1 Construction Phase

During the construction phase, the 400 kV power lines will be erected. A 400 kV transmission line requires a servitude width of 55 m. Where there are physical constraints such as other power lines adjacent to the new servitude, a minimum of 35 m-separation distance from such lines is required. Without physical constraints, parallel lines will have at least 55 m-separation distance. The power line cables are strung between pylons / towers, which are steel structures erected on concrete footings fixed in the substrate (soil or rock) below the pylon.

The major impacts during construction are the construction activities associated with the erection of the power lines and include, amongst others, heavy vehicle movement, construction of an access road and any wastes generated.

10.1.1 Geology

Initial Impact

Impacts that could occur to geology are limited to the physical removal of geological strata, resulting in permanent damage to those strata. There are no present indications that any existing impacts to geology have ocurred and therefore there is no initial impact rating.

Additional Impact

The additional impact resulting from the power line construction could occur on rocky ridges or places of shallow geology. The impact would be limited to the construction of the pylon footings, and should be a maximum of $8m^3$ of geological strata per footing. It should be noted that the erection of the pylons require a firm foundation, and this is achieved by casting a concrete slab under the soil surface. This VERY LOW impact **could** *probably* occur in *isolated sites* over the long term. This results in a final impact class of **Low** as rated in the table below.

TABLE 32: GEOLOGY ADDITIONAL IMPACT ASSESSMENT

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Geology	VERY LOW	*Isolated sites*	Long Term	*Probably*	Low
	1	**1**	**4**	**4**	**1.6**

Cumulative Impact

Since there is no initial impact, the cumulative impact is the same as rated for the additional impact above.

Mitigation Measures

- No blasting is undertaken on site without a suitable blast design, compiled in line with relevant SANS codes and approved by an appropriately qualified professional;

Residual Impact

Although mitigation measures will not reduce the significance of impact to geology they will ensure that the impacts are contained. Mitigation measures will ensure that the likelihood of secondary

impacts occurring is significantly reduced. The residual impact to geology at the completion of the construction phase will be the same as for the additional impact assessment.

10.1.2 Topography

Initial Impact

The topography throughout the site has been left relatively unimpacted. The only impacts to topography were the establishment of mine dumps at the gold mining activities south of Kinross and the coal mining activities throughout the site. Please refer to the figure below for an illustration of the mine dump. This impact is limited to a very small area of the site, and as such is too small to be rated. Therefore the initial impact is rated as **no impact.**

FIGURE 58: MINE DUMP ON SITE

Additional Impact

The construction of the power lines should not impact on the topography and therefore there is no additional impact.

Cumulative Impact

The cumulative impact is the same as assessed for the initial impact.

Mitigation Measures

No mitigation measures are required as there is no impact to topography from the proposed development.

Residual Impact

The residual impact remains **no impact** as assessed for the initial impact.

10.1.3 Soils, Land Capability and Land Use

Initial Impact

The bulk of the study area comprises agricultural and transitional soils. These soils can and in most cases are used for agricultural activities. The areas with existing power lines are usually on soils that are not suitable for agriculture, thereby ensuring that optimal land use is practised. The farming and especially ploughing of the soils breaks down the soil structure and increases the potential for erosion, which in turn could reduce the land capability.

The initial impact to soils and land capability is **probably** a LOW negative impact acting over the long term, and is *presently occurring* in the *study area*. As indicated in Table 33 below the impact rating class is a Moderate Impact.

TABLE 33: SOIL AND LAND CAPABILITY INITIAL IMPACT ASSESSMENT

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Soils	LOW	*Study Site*	Long Term	*Is occurring*	Moderate
	2	**2**	**4**	**5**	**2.67**

Additional Impact

The additional impact from the new power lines will mainly be as a result of the construction of the power line pylons and their footings. The route alternatives are approximately 70 km in length and each will have a double power line. Therefore if using the average pylon distance of 300 m it can be assumed that there would be 467 pylons constructed. At the time of writing this report, the proponent has not determined which of the various pylon designs will be utilised, and therefore the actual impact could vary. For this analysis it is assumed that pylons similar to the existing power lines will be utilised. This will result in 4 footings impacting on the soils per pylon.

In addition to the pylon footings the soils will also be disturbed by the establishment of a construction road as well as the movement of construction vehicles. The impact from each of the routes are summarised below.

TABLE 34: SOIL IMPACT

Soil Type	Alternative 1 (km)	Alternative 2 (km)	Alternative 3 (km)
Clay	35.2	40.1	31.8
Transitional	21.7	18	11.9
Disturbed	1.5	1.5	0.5
Agricultural	12.2	13.6	19

As indicated in Table 34 above, Alternatives 1 and 2 crosses more sensitive soils than Alternative 3. That said, the impact rating class between the two alternatives differ and is therefore rated separately.

For Alternative 3 the additional impact to soils and land capability is **probably** a LOW negative impact acting over the long term, and *will definitely occur* at *isolated sites*. As indicated in **Error! Reference source not found.** below the impact rating class is a Moderate Impact.

TABLE 35: SOIL AND LAND CAPABILITY ADDITIONAL IMPACT ASSESSMENT – ALTERNATIVE 1

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Soils	Low	*Isolated Site*	Long Term	*Will occur*	Moderate
	2	**1**	**4**	**5**	**2.3**

For Alternatives 1 and 2 the additional impact to soils and land capability is **probably** a MODERATE negative impact acting over the long term, and *will definitely occur* at *isolated sites*. As indicated in Table 36 below the impact rating class is a Moderate Impact.

TABLE 36: SOIL AND LAND CAPABILITY ADDITIONAL IMPACT ASSESSMENT – ALTERNATIVES 2 AND 3

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Soils	Moderate	*Isolated Site*	Long Term	*Will occur*	Moderate
	3	**1**	**4**	**5**	**2.67**

Cumulative Impact

Due to the fact that the two impacts (power station and the power lines) are in adjacent locations, the cumulative impact remains as rated for the initial impact i.e. a High impact class.

Mitigation Measures

- Take land use into consideration when choosing pylon types, it is recommended that smaller footprint pylons be used in cultivated areas;
- Avoid placement of pylon footings in the clay soils;
- Spread absorbent sand on areas where oil spills are likely to occur, such as the refuelling area in the hard park;
- Oil-contaminated soils are to be removed to a contained storage area and bio-remediated or disposed of at a licensed facility;
- If soils are excavated for the footing placement, ensure that the soil is utilised elsewhere for rehabilitation/road building purposes; and
- Ensure that soil is stockpiled in such a way as to prevent erosion from storm water.

Residual Impact

The residual impact remains a Moderate Impact, as the mitigation measures will not reduce the overall impact of the power station construction.

10.1.4 Surface Water

Initial Impact

Due to the size of the site and the numerous drainage lines and streams on site, the estimation of the potential initial impact to surface water is almost impossible. That said, all the watercourses observed on site was in good health. The largest potential impact in the area is the industrial complex of Secunda as well as the open cast coal mines near Kendal. The impact to surface water would be limited to contaminated storm water runoff and sediment entering the streams. This is also the case for the various towns in the district, that discharge their stormwater runoff into the natural systems. The impact is assessed in Table 37 below.

TABLE 37: SURFACE WATER INITIAL IMPACT RATING

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Surface water	LOW	*Study Site*	Medium Term	*Could happen*	Low
	2	***2***	**3**	**3**	**1.4**

The initial impact to surface water is LOW, occurs in *Isolated sites / proposed site* and will be Medium Term and *It's going to happen / has occurred*. This results in a rating of 1.4 or a Low impact class.

Additional Impact

During the construction phase there should be limited impacts to surface water features as the placement of the pylons will be done in such a way as to avoid the surface water features on site.

Waste generated during the construction phase may enter the environment through surface water runoff i.e. litter or pollution such as hydrocarbons can be washed into aquatic systems affecting those systems negatively. Storm-water flowing over the site will also mobilise loose sediments, which may enter the surface water environment affecting water quality. Storm-water containing sediment can be discharged to grassland buffers to ensure sediments fall out prior to water entering surface water bodies. Care must be taken that storm-water containing hydrocarbons and other pollution sources are not discharged.

Impacts will be felt as wide as the *study area* when storm-water flows from the power line sites into the study area. The impact to the surface water will **probably** be of a VERY LOW negative significance, and will act in the short-term. This impact *could happen*. This results in a Very Low impact class as assessed in Table 38.

TABLE 38: SURFACE WATER ADDITIONAL IMPACT RATING

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Surface water	VERY LOW	*Study area*	Short Term	*Could happen*	Very Low
	1	***2***	**2**	**3**	**1.0**

Cumulative Impact

The cumulative impact of the current activities and the future activities will not increase the impact rating from a Low Impact as rated in the initial impact assessment.

Mitigation Measures

- Demarcated areas where waste can be safely contained and stored on a temporary basis during the construction phase should be provided at the hard park;
- When adequate volumes of wastes (not more than 1 month) have accumulated, all waste is to be removed from site and disposed of at a licensed facility;
- Waste is not to be buried on site;
- Hydro-carbons should be stored in a bunded storage area;
- All hazardous materials *inter alia* paints, turpentine and thinners must be stored appropriately to prevent these contaminants from entering the environment;

- Spill-sorb or similar type product must be used to absorb hydrocarbon spills in the event that such spills should occur;
- Care must be taken to ensure that in removing vegetation adequate erosion control measures are implemented;
- No construction vehicles or activities will be allowed to work within 100 m of any of the streams or wetlands on site.
- If possible utilise Alternative 3 as the preferred alternative.

Residual Impact

The mitigation measures proposed will reduce the risk of the additional impact occurring, but it will not reduce the residual impact class, which remains at a Low impact as rated in the initial impact assessment.

10.1.5 Flora

Initial Impact

The initial impacts to flora include extensive grazing, cultivation and within the mines and towns, large areas of vegetation have also been cleared. Of the total area on site only an estimated 30 % of natural vegetation remains. The initial impact to flora is **probably** a HIGH negative impact acting over the long term, and is *presently occurring* in the *study area*. As indicated in Table 39 below the impact rating class is a High Impact.

TABLE 39: FLORA INITIAL IMPACT ASSESSMENT

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Flora	HIGH	*Study Site*	Long Term	*Is occurring*	High
	4	**2**	**4**	**5**	**3.33**

Additional Impact

The additional impact to flora during the construction phase will be as a result of vegetation clearance for access roads and the removal of vegetation in the areas of the pylon footings. Table 40 below illustrates the length that each route alternative will cross the vegetation types identified. Alternatives 1 and 2 traverse a much longer section of the sensitive moist grassland and seepage area vegetation units when compared to Alternative 3.

TABLE 40: FLORA IMPACT

Soil Type	Alt 1 (km)	Alt 2 (km)	Alt 3 (km)

Cultivated Fields	22.4	29.2	27.2
Moist Grassland and Drainage areas*	22	24.7	13.5
Eastern Highveld Grassland	7.3	7.3	4.7
Rand Highveld Grassland	3.3	3.3	1.5
Soweto Highveld Grassland	19.5	14.8	18.9
Disturbed Grassland	2	1.5	0.5

* Indicates sensitive vegetation types

The additional impact from the Alternative 3 alignment to flora is **probably** a MODERATE negative impact acting over the short term, and *will occur* in *isolated sites*. As indicated in Table 41 below the impact rating class is a Low Impact.

TABLE 41: FLORA ADDITIONAL IMPACT ASSESSMENT – ALTERNATIVE 3

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Flora	Moderate	*Isolated Site*	Short Term	*Will occur*	Low
	3	**1**	**2**	**5**	**2**

Due to the alignment of Alternatives 1 and 2 in line with the sensitive vegetation types, the impact is higher and will be active for a longer period. As there is sensitive species along this alignment the additional impact from the Alternatives 1 and 2 to flora is **probably** a HIGH negative impact acting over the long term, and *will occur* in *isolated sites*. As indicated in Table 42 below the impact rating class is a Moderate Impact.

TABLE 42: FLORA ADDITIONAL IMPACT ASSESSMENT – ALTERNATIVES 1 AND 2

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Flora	High	*Isolated Site*	Long Term	*Will occur*	Moderate
	4	**1**	**4**	**5**	**3**

Cumulative Impact

The cumulative impact to flora will remain as assessed for the initial impact assessment with a High impact class.

Mitigation Measures

- All construction areas should be demarcated prior to construction to ensure that the footprint of the impacts are limited (including areas where vehicles may traverse);
- The sensitive vegetation unit should be avoided and construction limited to 100 m from the edge of the wetlands and streams;
- Alternative 3 should be considered as the preferred alternative;
- All alien invasive species on site should be removed and follow up monitoring and removal programmes should be initiated once construction is complete;
- Adhere to the Eskom vegetation management guideline (Appendix N).

Residual Impact

If the mitigation measures are implemented and Alternative 3 is constructed then the residual impact to flora is **probably** a MODERATE negative impact acting over the medium term, and *will occur* in the *study area*. As indicated in Table 43 below the impact rating class is a Moderate Impact.

TABLE 43: FLORA RESIDUAL IMPACT ASSESSMENT

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Flora	MODERATE	*Study Site*	Medium Term	*Will happen*	Moderate
	3	**2**	**3**	**5**	**2.33**

10.1.6 Fauna

Initial Impact

As described in the habitat assessment in Section 7.1.9 the site is relatively disturbed with the Soweto, Rand and Eastern Highveld grasslands, the moist grassland and the drainage areas the main habitat still available for fauna. The site is 61.7 % disturbed and the habitat available for fauna is limited. The suitable habitats did show low species diversity, indicating that the impact of cultivation has limited faunal activity throughout the site. The bulk of the faunal species observed were limited to a game farm to the north of the Zeus Sub Station.

The study area is criss crossed with existing high voltage power lines that could potentially impact on the faunal life. While there appears to be no negative impacts associated with electro magnetic fields generated by the power lines, Eskom's document, *Transmission Bird Collision Prevention Guideline* (Ref. no.: TGL41-335)[5], the major impact to birds or avi-fauna is in the form of collisions with power

lines. According to the document, it was found that the majority of birds affected are large flighted birds, which are also often endangered or threatened species.

These large flighted birds are also long lived, with low breeding rate and often mate for life. Therefore, a single mortality due to a collision with a power line should be viewed as a high impact. In addition some of the most sensitive species to power line collisions such as Blue Crane are found in the study site in addition to other sensitive species such as White-Bellied Korhaan and Secretary Birds. As shown in Figure 41 above, several birds have been found dead under the exisitng power lines.

The current impact on fauna on site is **probably** of a HIGH negative significance, affecting the *region*, and acting in the long-term. The impact can *likely occur*. The impact class is classified as a High impact.

TABLE 44: FAUNA INITIAL IMPACT ASSESSMENT

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Fauna	HIGH	*Region*	Long Term	*Likely*	High
	4	**4**	**4**	**4**	**3.2**

Additional Impact

The impact to fauna during the construction phase of the power lines will mostly be in the form of disturbance from the construction workers and vehicle noise. Due to the fact that the area is habitat to sensitive species, the impact could be quite high. Once again Alternatives 1 and 2 are significantly closer to the habitat for the sensitive species and therefore the impacts are assessed separately.

The additional impact from the Alternative 3 alignment to fauna is **probably** a MODERATE negative impact acting over the short term, and *will occur* in *isolated sites*. As indicated in Table 45 below the impact rating class is a Low Impact.

TABLE 45: FAUNA ADDITIONAL IMPACT ASSESSMENT – ALTERNATIVE 1

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Fauna	MODERATE	*Isolated Site*	Short Term	*Will occur*	Low
	3	**1**	**2**	**5**	**2**

The additional impact from the Alternative 1 and 2 alignments to fauna is **probably** a HIGH negative impact acting over the short term, and *will occur* in *isolated sites*. As indicated in Table 46 below the impact rating class is a Moderate Impact.

Table 46: Fauna Additional Impact Assessment – Alternative 1

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Fauna	High	*Isolated Site*	Short Term	*Will occur*	Moderate
	4	**1**	**2**	**5**	**2.3**

Cumulative Impact

The cumulative impact to fauna should remain as assessed for the initial impact assessment as the impacts are identical. Therefore the impact remains a High impact to Fauna.

Mitigation Measures

- All construction areas should be demarcated prior to construction to ensure that the footprint of the impacts are limited (including areas where vehicles may traverse);
- The sensitive habitat should be avoided and construction limited to 50 m from the edge of the wetlands and streams;
- Alternative 3 should be considered as the preferred alternative;
- All alien invasive species on site should be removed and follow up monitoring and removal programmes should be initiated once construction is complete;
- Adhere to the ESKOM vegetation management guideline (Appendix N); and
- Install power lines according to the Eskom bird collision prevention guideline.
- Demarcate the sections of line that need to be mitigated once the alignment has been finalized
  - only through a combination of physical inspection of the entire length of the final alignment, and
  - detailed analysis of high resolution satellite imagery.
  - It is standard procedure by the Eskom Transmission Group to perform this procedure with the help of a suitably experienced ornithologist once the line has been pegged.
- All construction and maintenance activities should be undertaken in accordance with Eskom Transmission's environmental best practice standards.
- Care should be taken not to unnecessarily disturb any birds along the servitude.
- The Environmental Control Officer should identify any breeding birds along the servitude, particularly large terrestrial species such as cranes, korhaans or Secretary birds and notify the avifauna specialist of these so that advice can be given on how to best deal with the situation.

- The construction of new access roads in particular should be limited to a minimum.
- All vehicle and pedestrian movement should be restricted to the actual construction site and, in the case of maintenance patrols, to the actual servitude.

Residual Impact

The mitigation measures proposed above will ensure that the construction of the proposed power line remains a Moderate impact but the Residual Impact remains High. If the mitigation measures were to be extended into the existing power lines and bird flappers be installed, the residual impact could be mitigated to a Moderate Impact Class.

10.1.7 Wetlands

The impact assessment for wetlands is the same as assessed for the surface water component in Section 7.1.10.

10.1.8 Visual Impact

Initial Impact

At present the viewers in the viewshed are seeing the Zeus Sub Station, Kendal Power Station, coal mines and cultivated fields. In addition to the abovementioned impacts there are numerous power lines already traversing the landscape. The initial impact to the visual environment is HIGH negative acting in the long term, and *has already occurred*. The impact has **definitely** impacted on the *local region*.

TABLE 47: VISUAL IMPACT ASSESSMENT – INITIAL IMPACT

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Visual	High	*Local*	Long Term	*Has occurred*	High
	4	**3**	**4**	**5**	**3.6**

As illustrated in Table 47 above the initial impact to the visual environment is rated as a High impact.

Additional Impact

The additional impact from the power lines as described in Section 4.4 indicated that the additional impact to the visual environment is **probably** a LOW negative impact acting in the short term and impacting on the *local region*. This impact *will definitely occur*.

TABLE 48: VISUAL IMPACT ASSESSMENT – ADDITIONAL IMPACT

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Visual	Low	*Local*	Short Term	*Will occurr*	Moderate
	2	**3**	**2**	**5**	**2.3**

From Table 48 above it is clear that the additional impact from the construction of the power lines will be a Moderate impact. It should be noted that Alternative 3 has the least number of existing lines in the vicinity and therefore could be perceived as a higher impact by a observer.

Cumulative Impact

There are a high number of existing industrial and agricultural activities present on site as well as a high number of power lines on site. The cumulative impact from the developments will remain as assessed for the initial impact above; therefore the impact remains a High negative impact.

Mitigation Measures

- Only the footprint of the proposed power line should be exposed. In all other areas, the natural vegetation should be retained;
- Dust suppression techniques should be in place at all times during the construction phase;
- Access roads should be minimised to prevent unnecessary dust.

Residual Impact

The mitigation measures proposed above will ensure that the construction of the proposed power line remains a High impact to the visual environment.

10.1.9 Archaeology and Cultural Historical Sites

The Phase I HIA study revealed the following types and ranges of heritage resources as outlined in Section 3 of the National Heritage Resources Act (No 25 of 1999) for the project area, namely:

- Houses and structures older than sixty years with historical significance.
- Graveyards, some older than sixty years and therefore also with historical significance.

Thee graveyards were geo-referenced and mapped in this report. A number of the graveyards are discussed in detail whilst others are merely mentioned and listed (Appendix N). The significance of the graveyards is indicated and mitigation measures are outlined should they be affected by the project.

Historical structures in close proximity of the proposed power line corridors were not geo-referenced. These structures are not directly threatened by the project as Eskom does not demolish structures in order to make way for new power lines. However, the historical significance of these structures is indicated and mitigation measures are outlined should any historical structures be affected by the project.

Remains from the more recent past have no significance and are not discussed in this report.

The significance of the heritage resources

It is possible that some of the graveyard may be impacted by the project. Consequently, the significance of the graveyards is indicated while mitigation measures are outlined for those graveyards which may be affected by the proposed project.

Graveyards

At least twenty-two graveyards were observed in and near the project area. These graveyards were geo-referenced (Appendix Q). A number of graveyards close to the project area are also pointed out by Arch View (Appendix Q).

It is highly likely that more graveyards may exist but that they were not observed during this survey as a result of no-access to certain stretches of the proposed new power line corridors or that that graveyards may be obscure or inconspicuous as a result of negligence and abandonment.

All graveyards and graves can be considered to be of high significance and are protected by various laws. Legislation with regard to graves includes Section 36 of the National Heritage Resources Act (No 25 of 1999) whenever graves are older than sixty years. The act also distinguishes various categories of graves and burial grounds.

Other legislation with regard to graves includes those which apply when graves are exhumed and relocated, namely the Ordinance on Exhumations (No 12 of 1980) and the Human Tissues Act (No 65 of 1983 as amended).

Historical structures

Houses and structures older than sixty years or which are approaching this age are protected by Section 34 of the National Heritage Resources Act (No 25 of 1999).

The significance of each and every historical house, whenever these structures are to be affected by the project, can further be determined according to criteria such as the following: the cultural-historical background of these structures; their scientific or architectural value; their use in the field of tourism, museums or education as well as their aesthetic appearance; their repeatability (scarcity/abundance), or their emotional (ideological) value.

Mitigating the heritage resources

The following mitigation measures have to be followed whenever graveyards or historical structures may be affected by the project.

Graveyards

Graveyards can be mitigated by following one of the following strategies, namely:

- Graveyards can be demarcated with brick walls or with fences and can be conserved *in situ* beneath power lines. Pylons should be erected on opposite ends of graves or graveyards. Consequently, power lines can be strung across and above the latter. Conserving graves and graveyards in power line corridors create the risk that they may be damaged, accidentally, and that Eskom may be held responsible for such damages. Controlled access must exist for any relatives or friends who wish to visit graves or graveyards in power line corridors.
- Graveyards can also be exhumed and relocated. The exhumation of human remains and the relocation of graveyards are regulated by various laws, regulations and administrative procedures. This task is undertaken by forensic archaeologists or by reputed undertakers who are acquainted with all the administrative procedures and relevant legislation that have to be adhered to whenever human remains are exhumed and relocated. This process also includes social consultation with a 60 days statutory notice period for graves older than sixty years. Permission for the exhumation and relocation of human remains have to be obtained from the descendants of the deceased (if known), the National Department of Health, the Provincial Department of Health, the Premier of the Province and the local police.

Historical houses

Houses older than sixty years may not be affected (demolished, renovated, altered) by the Eskom Project *prior* to their investigation by a historical architect in good standing with the South African Heritage Resources Agency (SAHRA). The historical architect has to acquire a permit from the South African Heritage Resources Authority (SAHRA) prior to any of these structures been affected or altered as a result of the Eskom Project

10.1.10 Socio-Economic Environment

The change processes are grouped per project phase in Table 49 (expected category 1 impacts) and in Table 50 (expected category 2 impacts) with an indication of the significance of these potential impacts before and after mitigation. The significance of potential category 1 impacts is then grouped per change process in Table 51, while Table 52 reflects a summary of the potential category 2 impacts per change process.

TABLE 49: SUMMARY OF CATEGORY 1 IMPACTS PER PROJECT PHASE

CHANGE PROCESS	*ASSESSMENT AREA*	*SIGNIFICANCE (pre-mitigation)*	*SIGNIFICANCE (post-mitigation)*
< ***CONSTRUCTION & DECOMMISSIONING***			
Demographic	Influx of construction workers	Very Low -	Very low ±
	Influx of job seekers	Low -	Very low ±
Geographic	Temporary loss of cultivated land	Moderate -	Low -
	Temporary loss of grazing land	Low -	Low – to ±
Economic	Compensation for servitude	Low +	n/a
	Direct formal employment opportunities to local individuals	Low +	Low +
	Indirect formal and/or informal employment opportunities to local individuals	Low +	Low +
Institutional and Empowerment	Negotiation process	Moderate	Moderate +
	Additional demand on municipal services	Low -	Low -
Socio-Cultural	Integration with local community	Low -	Very low -
	Health	Moderate -	Moderate -
	Safety and security	Low -	Very low -
	Construction noise	Low -	Very low -
< ***OPERATION & MAINTENANCE***			
Demographic	None	n/a	n/a
Geographic	Permanent loss of grazing land	Very low – to ±	Very low ±
	Spatial development	Low -	Very low -
	Presence of transmission power line	Moderate -	Low – to ±
Economic	Direct formal employment opportunities to local individuals	Low +	Low +
	Electricity supply and economic growth	Moderate +	n/a
Institutional and Empowerment	None	n/a	n/a
Socio-Cultural	Movement of maintenance workers	Low -	Very low -
	Physical splintering	Very low -	Very low -

TABLE 50: SUMMARY OF CATEGORY 2 IMPACTS PER PROJECT PHASE

Change Process	*Assessment Area*	*Western Alternative*		*Eastern Alternative*		*Western Sub-Alternative*	
< *CONSTRUCTION & DECOMMISSIONING*							
Demographical	*Relocation*	*Low -*	*Low -*	*Moderate -*	*Low -*	*Low -*	*Low -*
Geographical	*None*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
Economical	*None*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
Empowerment and Institutional	*None*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
Socio-Cultural	*None*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
< *OPERATION & MAINTENANCE*							
Demographical	*None*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
Geographical	*Cultivated land and irrigation*	*Low -*	*Low – to ±*	*Low -*	*Low – to ±*	*Low -*	*Low – to ±*
	Mining	*Moderate -*	*Low – to ±*	*Low -*	*Low – to ±*	*Low -*	*Low – to ±*
Economical	*None*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
Empowerment and Institutional	*None*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
Socio-Cultural	*Sense of place*	*Low -*	*Low -*	*Moderate -*	*Low -*	*Moderate -*	*Low -*
	Third party tampering	*Low -*	*Low -*	*Low -*	*Low -*	*Low -*	*Low -*

The pre-construction and construction phase of the proposed project is characterised by a number of negative impacts. This is mainly due to the nature of the activities that take place during these phases. The same holds true for the operational phase of the proposed project. Most of the negative impacts within these various phases can be mitigated successfully.

There are also a number of positive impacts, which could be further enhanced if managed effectively (as outlined in the enhancement measures for the various impacts and summarised in section 5). These impacts mostly relate to a temporary change in the employment and economic profile of the local area by means of employment opportunities, which in turn leads to a positive economic impact on local households.

TABLE 51: SUMMARY OF CATEGORY 1 IMPACTS PER CHANGE PROCESS

CHANGE PROCESS	*ASSESSMENT AREA*	*SIGNIFICANCE (pre-mitigation)*	*SIGNIFICANCE (post-mitigation)*
< ***DEMOGRAPHICAL***			
Construction & De-commissioning	Influx of construction workers	Very Low -	Very low ±
	Influx of job seekers	Low -	Very low ±
Operation & Maintenance	None	n/a	n/a
< ***GEOGRAPHICAL***			
Construction & De-commissioning	Temporary loss of cultivated land	Moderate -	Low -
	Temporary loss of grazing land	Low -	Low – to ±
Operation & Maintenance	Permanent loss of grazing land	Very low – to ±	Very low ±
	Spatial development	Low -	Very low -
	Presence of transmission power line	Moderate -	Low – to ±
< ***ECONOMICAL***			
Construction & De-commissioning	Compensation for servitude	Low +	n/a
	Direct formal employment opportunities to local individuals	Low +	Low +
	Indirect formal and/or informal employment opportunities to local individuals	Low +	Low +
Operation & Maintenance	Direct formal employment opportunities to local individuals	Low +	Low +
	Electricity supply and economic growth	Moderate +	n/a

CHANGE PROCESS	*ASSESSMENT AREA*	*SIGNIFICANCE (pre-mitigation)*	*SIGNIFICANCE (post-mitigation)*
< ***EMPOWERMENT & INSTITUTIONAL***			
Construction & De-commissioning	Negotiation process	Moderate	Moderate +
	Additional demand on municipal services	Low -	Low -
Operation & Maintenance	None	n/a	n/a
< ***SOCIO-CULTURAL***			
Construction & De-commissioning	Integration with local community	Low -	Very low -
	Health	Moderate -	Moderate -
	Safety and security	Low -	Very low -
	Construction noise	Low -	Very low -
Operation & Maintenance	Movement of maintenance workers	Low -	Very low -
	Physical splintering	Very low -	Very low -

TABLE 52: SUMMARY OF CATEGORY 2 IMPACTS PER PROJECT PHASE

Change Process	*Assessment Area*	*Western Alternative*		*Eastern Alternative*		*Western Sub-Alternative*	
< ***DEMOGRAPHICAL***							
Construction & De-commissioning	Relocation	Low -	Low -	Moderate -	Low -	Low -	Low -
Operation & Maintenance	None	n/a	n/a	n/a	n/a	n/a	n/a
< ***GEOGRAPHICAL***							
Construction & De-commissioning	None	n/a	n/a	n/a	n/a	n/a	n/a
Operation & Maintenance	Cultivated land and irrigation	Low -	Low – to ±	Low -	Low – to ±	Low -	Low – to ±
	Mining	Moderate	Low – to ±	Low -	Low – to ±	Low -	Low – to ±
< ***ECONOMICAL***							
Construction & De-commissioning	None	n/a	n/a	n/a	n/a	n/a	n/a
Operation & Maintenance	None	n/a	n/a	n/a	n/a	n/a	n/a
< ***EMPOWERMENT & INSTITUTIONAL***							
Construction & De-commissioning	None	n/a	n/a	n/a	n/a	n/a	n/a
Operation & Maintenance	None	n/a	n/a	n/a	n/a	n/a	n/a
< ***SOCIO-CULTURAL***							
Construction & De-commissioning	None	n/a	n/a	n/a	n/a	n/a	n/a
Operation & Maintenance	Sense of place	Low -	Low -	Moderate	Low -	Moderate -	Low -
	Third party tampering	Low -	Low -	Low -	Low -	Low -	Low -

The geographic, demographic and socio-cultural processes all have a number of negative impacts. However all of these impacts can be mitigated successfully if effectively managed. Economic impacts as a result of the project are for the most part positive in nature, which is mainly due to the economic investment and development that will take place in the community as a result of the project.

Although the expected construction impacts across all the change processes are mostly negative, these impacts are for the most part only temporary in nature and only expected to last over the construction period. In comparison, operational impacts are expected to last over the longer term and therefore would have a prolonged effect on especially the geographical environment in terms of the presence of the Transmission power lines in the area. People are more inclined to get "used" to the infrastructure in their area if servitude and line maintenance are applied effectively and with due diligence. The regular monitoring and evaluation of the Transmission power lines as a whole would also ensure that corrective measures can be taken immediately to prevent adverse effects either on the infrastructure itself, or on the local area.

Preferred Route Corridor

To come up with a preferred corridor, a comparison among the alternative corridor alignments was conducted by assessing all of the category 2 impacts identified with a certain change process. A summary of the outcome of this brief assessment is as per Table 53 below, where:

<	***Sensitive area, not recommended from a social perspective (high to very high significance impact rating prior to mitigation).***
<	***Acceptable area neither ideal nor flawed from a social perspective (moderate significance impact rating prior to mitigation).***
<	***Ideal area, from a social perspective (low to very low significance impact rating prior to mitigation).***

Please note that a 'red site' does not constitute a fatal flaw, but does however imply that careful consideration should be given to the development and implementation of mitigation measures in the event that such a site is selected.

Also note that category 1 impacts have not been included in this table, as it is believed that these impacts would occur regardless of which site is selected in the end.

TABLE 53: SUMMARY OF ASSESSMENTS (CATEGORY 2 IMPACTS)

Process	***Change Process***	***Western***	***Eastern***	***Western Sub***
Demographical	***Relocation of households and/or population segments***	***1.48***	***2.22***	***1.48***
Geographical	***Permanent loss of cultivated land (including irrigation)***	***1.84***	***1.6***	***1.6***
	Mining operations	***2.16***	***1.98***	***1.98***

Economical	***No category 2 impacts***	-	-	-
Institutional & Empowerment	***No category 2 impacts***	-	-	-
Socio-Cultural	***Sense of place***	***1.8***	***2.96***	***2.96***
	Third party tampering	***1.38***	***1.62***	***1.62***
TOTAL		***8.66***	***10.38***	***9.64***

Based on the comparison of category 2 impacts prior to mitigation, overall the **western alternative** emerged as the preferred route corridor from a social perspective. This is based on the fact that the potential impacts as a result of the expected change process taking place, significantly decreases as outlined below:

- **Inhabited areas**: The eastern alternative passes in close proximity to inhabited formal and informal settlements, which in some cases (such as eMbalahle) have high population densities. It is believed that, as the western alternative is located further away from such areas, the expected impact on the demographic change process would be less.
- **Irrigation (centre pivots):** Although the current alignments are all located a safe distance away from centre pivots, the western alternative encroaches upon a number of irrigation schemes, which would be further compounded if transmission power lines are placed in parallel. Also, transmission power lines in parallel on the western alternatives would mean that farmers along this corridor would lose more land (most of these farms already have registered servitudes due to the existing transmission power line) – and in some cases an additional 110m of servitude might render some of these farms economically unviable.
- **Mining operations:** Again the western alternative pass in close proximity to open cast mining areas (collieries), which would be further compounded if more than one transmission power line is placed in parallel to the existing transmission power line. If this alternative is chosen as the preferred alignment, it is believed that some realignment would be required to bypass the open cast mining areas to ensure the safe operation of both the transmission power lines as well as that of the mining operation itself.
- **Sense of place**: The area surrounding the eastern alternative is still quite pristine and unspoilt, whereas the area surrounding the western alternative is regarded as 'spoilt' due to the presence of the existing transmission power line.
- **Third party tampering**: Reflecting on the Opportunity Model of Cohen, Kleugel and Land (in Snyman, 2007), the basic underlying principle of the Opportunity Model is that the daily operations and physical location of the Transmission power line brings it into direct contact with potential offenders, more so on the eastern alternative that is located in close proximity to human settlements where unemployment and poverty is rife. This increases the risk for victimisation, even though it has been stated that it is technically not possible for cable theft to occur on a 400 kV Transmission power line – the risk still exists as a result of ignorance or the attempt at an

opportunistic crime. The risk of third party tampering significantly decreases with the use of the western alignment as this alternative is located away from human settlement.

Recommendations

Based on the findings of this report, it can be concluded that the social environment in general pose no fatal flaws to the development of the proposed transmission power lines known as Bravo 4, under the condition that the identified mitigation measures in this document and as recommended for inclusion in the EMP, are implemented and adhered to, particularly where construction activities either takes place in close proximity to or passes through residential areas that could affect the quality of live of these households in terms of noise, dust, safety and security.

This recommendation was based on the specialist's:

- Understanding of the proposed project, including the alternative route alignments and the nature and timeframe of the proposed activities;
- Assessment of the affected communities, settlements and institutions in terms of:
  - Demographic processes: the number and composition of people;
  - Geographical processes: land use patterns – including tourism;
  - Economic processes: the way in which people make a living and the economic activities in society – including tourism;
  - Institutional and Empowerment processes: the ability of people to be involved and influence decision making processes; and the role, efficiency and operation of governments and other organisations; and
  - Socio-cultural processes: the way in which humans behave, interact and relate to each other and their environment and the belief and value systems which guide these interactions, including physical and mental health processes.
- Assessment of potential change processes that might occur as a result of the project.

10.2 Operational Phase

The main impacts during the operatational phase are the electro magnetic field associated with the power lines and the occurrence of the physical structures in the landscape. See *Electric and Magnetic Fields – A summary of Technical and Biological Aspects* (2006)[15] for a detailed discussion regarding the impact of electro magnetic fields (**Error! Reference source not found.**).

[15] *Electric and Magnetic Fields – A summary of Technical and Biological Aspects*, Empetus cc, 2006.

10.2.1 Geology

The impact assessment does not change from that of the construction phase, refer to Section 10.1.1 above.

10.2.2 Topography

The impact assessment does not change from that of the construction phase, refer to Section 10.1.2 above.

10.2.3 Soils, Land Capability and Land Use

The impact assessment does not change from that of the construction phase, refer to Section 10.1.3 above.

10.2.4 Surface water

The impact assessment does not change from that of the construction phase, refer to Section 10.1.4 above.

10.2.5 Vegetation

The impact assessment does not change from that of the construction phase, refer to Section 10.1.5 above.

10.2.6 Fauna

Initial impact

The initial impact remains as assessed in Section 10.1.6, a High impact.

Additional impact

During the operational phase the proposed development will add approximately 70 km of high voltage power lines to the existing network of power lines in the area. Sensitive avifauna were identified right under the potential alignments and a single death of one of these protected species would be seen as a high impact.. The additional impact to faune will **probably** be a HIGH negative impact, acting in the long term, and affected the *local area* and this impact *could occur*. This calculates to a Moderate impact class as illustrated in Table 54 below.

TABLE 54: FAUNA ADDITIONAL IMPACT RATING – OPERATIONS

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Fauna	HIGH	*Local*	Long Term	*Could occur*	Moderate
	4	***3***	**4**	**3**	**2.2**

Cumulative impact

During the operational phase the proposed development will add approximately 70 km of high voltage power lines to the existing network of power lines in the area. The addition is moderate in comparison with the approximately 300 km of existing high voltage power lines in the area. The cumulative impact to fauna remains a High impact as assessed in the initial impact assessment.

Mitigation Measures

- The sensitive habitat should be avoided and power lines limited to 50 m from the edge of the wetlands and streams;
- Adhere to the construction phase mitigation measures;
- Alternative 3 should be considered as the preferred alternative;
- Adhere to the Eskom vegetation management guideline (Appendix N); and
- Install power lines according to the Eskom bird collision prevention guideline.

Residual impact

In order to prevent power line collisions from birds, anti-collision devices can be installed to the power lines. These include static, dynamic, reflective and illuminated devices. As mentioned in **Error! Reference source not found.** these devices have resulted in a 60% reduction in bird collisions but they will not completely eliminate the impact risk to birds. In addition this reduction will only be effective if the anti-collision devices are installed on all the power lines in the region. If the anti collision devices are only installed for the proposed 70 km of new power line, the impact would remain a High impact. If the devices are to be installed on all the regional power lines the impact to fauna would **prabably** be a HIGH negative impact, acting on the *regional scale* in the long term. The prabability would however be reduced to *unlikely*.

TABLE 55: FAUNA RESIDUAL IMPACT RATING

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Impact to Fauna	HIGH	*Regional / Provincial*	Long Term	*Unlikely*	Low
	4	***4***	**4**	**2**	**1.6**

The residual impact to fauna as calculated in Table 55 above has a rating of 1.6 and a Low impact class.

10.2.7 Visual

The impact assessment does not change from that of the construction phase, refer to Section 10.1.7 above.

10.2.8 Archaeology and Cultural Historical Sites

The impacts to the archaelolgy and cultural historical sites during the operational phase of the development remain as assessed in the construction phase in Section 10.1.9 above.

10.2.9 Socio-Economic Environment

The impacts to socio-economic environment during the operational phase of the development remain as assessed in the construction phase in Section 10.1.10 above.

10.3 Decommisioning Phase

10.3.1 Geology

The impacts to geology during the decomissioning phase of the development remain as assessed in the construction phase in Section 10.1.1 above.

10.3.2 Topography

The impacts to topography during the decomissioning phase of the development remain as assessed in the construction phase in Section 10.2.2 above.

10.3.3 Soils, Land Capability and Land Use

The impacts to soils during the decomissioning phase of the development remain as assessed in the construction phase in Section 10.2.3 above.

10.3.4 Surface water

The impacts to surface water during the decomissioning phase of the development remain as assessed in the construction phase in Section 10.2.4 above.

10.3.5 Vegetation

The impacts to vegetation during the decomissioning phase of the development remain as assessed in the construction phase in Section 10.2.5 above.

10.3.6 Fauna

Even though the removal of the 70 km of proposed power lines will reduce the number of power lines in the area that could impact on fauna, the impact after decomissioning will remain as assessed in Section 7.2.6 above due to the remaining network if high voltage power lines.

10.3.7 Visual

Even though the removal of the 70 km of proposed power lines will reduce the number of power lines in the area that could impact on the visual environment, the impact after decomissioning will remain as assessed in Section 10.2.7 above due to the remaining network if high voltage power lines.

10.3.1 Archaeology and Cultural Historical Sites

The impacts to the archaelolgy and cultural historical sites during the decommissioning phase of the development remain as assessed in the construction phase in Section 10.1.9 above.

10.3.2 Socio-Economic Environment

The impacts to socio-economic environment during the decommissioning phase of the development remain as assessed in the construction phase in Section 10.1.10 above.

10.4 Impact Assessment Summary

The environmental impacts for each phase of the proposed 400 kV overhead power line from Kendal to Zeus have been summarised in Table 56 and table 57. The following broad conclusions can be drawn from the impact assessment.

- The receiving environment is not of a sensitive nature with the exception of the wetlands and seepage zones.
- There are sensitive fauna, flora and wetlands on site.
- The most significantly impacted baseline elements in the area are Fauna, Flora, Visual aspects and Wetlands depending on the Alternative utilised.
- During the Construction Phase of the power line the impacts will range from VERY LOW to HIGH. The most significant impacts will be to vegetation, fauna, flora as well visually. Mitigation measures employed will adequately reduce the significance of impacts that may be sustained by the by-pass lines construction activities.
- Additional impacts sustained during the construction phase will not result in a more significant cumulative impact to the environment.
- During the operational phase negative impacts sustained will be in the VERY LOW to HIGH range. The most significant impact will be to fauna.
- Cumulative negative impacts to the physical environment are nominal, and with proper mitigation it is possible to minimise impacts.

TABLE 56: SUMMARY OF THE CONSTRUCTION PHASE IMPACTS

		Construction Phase											
		Initial	Additional			Residual	Cumulative		Initial	Additional			Residual	Cumulative
GEOLOGY	Significance	-	Very Low			Very Low	Very Low		-	1			1	1
	Spatial	-	Isolated Sites			Isolated Sites	Isolated Sites		-	1			1	1
	Temporal	-	Long Term			Long Term	Long Term		-	4			4	4
	Probability	-	Probability			Probability	Probability		-	4			4	4
	CLASS	-	**Low**			**Low**	**Low**		-	**1.6**			**1.6**	**1.6**
TOPOGRAPHY	Significance	-	-			-	-			-			-	-
	Spatial	-	-			-	-			-			-	-
	Temporal	-	-			-	-			-			-	-
	Probability	-	-			-	-			-			-	-
	CLASS	-	-			-	-		-	-			-	-
			Alt 1	**Alt 2**	**Alt 3**					**Alt 1**	**Alt 2**	**Alt 3**		
SOILS & LAND CAPABILITY	Significance	Low	Low	Moderate	Moderate	Low	Low		2	2	3	3	2	2
	Spatial	Study Site	Isolated Site	Isolated Site	Isolated Site	Study Site	Study Site		2	1	1	1	2	2
	Temporal	Long Term	Long Term	Long Term	Long Term	Long Term	Long Term		4	4	4	4	4	4
	Probability	Is occurring	Will occur	Will occur	Will occur	Is occurring	Is occurring		5	5	5	5	5	5
	CLASS	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**Moderate**		**2.67**	**2.3**	**2.67**	**2.67**	**2.67**	**2.67**
VEGETATION	Significance	High	High	High	Moderate	High	High		4	4	4	3	4	4
	Spatial	Study Site	Isolated Site	Isolated Site	Isolated Site	Isolated Site	Study Site		2	1	1	1	1	2
	Temporal	Long Term	Long Term	Long Term	Short Term	Long Term	Long Term		4	4	4	2	4	4
	Probability	Is occurring	Will occur	Will occur	Will occur	Will occur	Is occurring		5	5	5	5	5	5
	CLASS	**High**	**Moderate**	**Moderate**	**Low**	**Moderate**	**High**		**3.33**	**3**	**3**	**2**	**3**	**3.33**
FAUNA	Significance	High	High	High	Moderate	High	High		4	4	4	3	4	4
	Spatial	Region	Isolated Site	Isolated Site	Isolated Site	Region	Region		4	1	1	1	4	4
	Temporal	Long Term	Short Term	Short Term	Short Term	Long Term	Long Term		4	2	2	2	4	4
	Probability	Likely	Will occur	Will occur	Will occur	Likely	Likely		4	5	5	5	4	4
	CLASS	**High**	**Moderate**	**Moderate**	**Low**	**High**	**High**		**3.2**	**2.3**	**2.3**	**2**	**3.2**	**3.2**
SURFACE WATER	Significance	Low	Very low			Low	Low		2	1			2	2
	Spatial	Study Site	Study Area			Study Site	Study area		2	2			2	2
	Temporal	Medium Term	Short Term			Medium Term	Medium Term		3	2			3	3
	Probability	Could happen	Could happen			Could happen	Could happen		3	3			3	3
	CLASS	**Low**	**Very Low**			**Low**	**Low**		**1.4**	**1**			**1.6**	**1.6**
			Alt 1	**Alt 2**	**Alt 3**					**Alt 1**	**Alt 2**	**Alt 3**		
CULTURAL HISTORICAL	Significance	-	Very Low	-	Very Low	-	Very Low		0	1		1	0	1
	Spatial	-	Isolated Sites	-	Isolated Sites	-	Isolated Sites		0	1		1	0	1
	Temporal	-	Long Term	-	Long Term	-	Long Term		0	2		2	0	2
	Probability	-	Unlikely	-	Unlikely	-	Unlikely		0	2		2	0	2
	CLASS	**No Impact**	**Very Low**	**-**	**Very Low**	**No Impact**	**Very Low**		**0**	**0.5**		**0.5**	**0**	**0.5**

		Construction Phase											
		Initial	Additional			Residual	Cumulative		Initial	Additional		Residual	Cumulative
VISUAL	Significance	High	Low			High	High		4	2		4	4
	Spatial	Local	Local			Local	Local		3	3		3	3
	Temporal	Long Term	Short Term			Long Term	Long Term		4	2		4	4
	Probability	Has occurred	Will occur			Has occurred	Has occurred		5	5		5	5
	CLASS	**High**	**Moderate**			**High**	**High**		**3.6**	**2.3**		**3.6**	**3.6**
			Alt 1	**Alt 2**	**Alt 3**					**Alt 1**	**Alt 2**	**Alt 3**	
SOCIO-ECONOMIC	Significance	Moderate	Low	Low	Low	Moderate	Moderate		3	2	2	2	3	3
	Spatial	Study Site	Study Site	Study Site	Study Site	Study Site	Study Site		2	2	2	2	2	2
	Temporal	Long Term	Short Term	Short Term	Short Term	Long Term	Long Term		4	2	2	2	4	4
	Probability	Is occurring	Its going to happen	Its going to happen	Its going to happen	Is occurring	Is occurring		5	5	5	5	5	5
	CLASS	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**Moderate**		**3**	**2**	**2**	**2**	**3**	**3**

TABLE 57: SUMMARY OF THE OPERATIONAL PHASE IMPACTS

		Operational Phase											
		Initial	Additional			Residual	Cumulative		Initial	Additional			Residual	Cumulative
GEOLOGY	Significance	-	Very Low			Very Low	Very Low		-	1			1	1
	Spatial	-	Isolated Sites			Isolated Sites	Isolated Sites		-	1			1	1
	Temporal	-	Long Term			Long Term	Long Term		-	4			4	4
	Probability	-	Probability			Probability	Probability		-	4			4	4
	CLASS	-	**Low**			**Low**	**Low**		-	**1.6**			**1.6**	**1.6**
TOPOGRAPHY	Significance	-	-			-	-		-	-			-	-
	Spatial	-	-			-	-		-	-			-	-
	Temporal	-	-			-	-		-	-			-	-
	Probability	-	-			-	-		-	-			-	-
	CLASS	-	-			-	-		-	-			-	-
			Alt 1	**Alt 2**	**Alt 3**					**Alt 1**	**Alt 2**	**Alt 3**		
SOILS & LAND CAPABILITY	Significance	Low	Low	Moderate	Moderate	Low	Low		2	2	3	3	2	2
	Spatial	Study Site	Isolated Site	Isolated Site	Isolated Site	Study Site	Study Site		2	1	1	1	2	2
	Temporal	Long Term	Long Term	Long Term	Long Term	Long Term	Long Term		4	4	4	4	4	4
	Probability	Is occurring	Will occur	Will occur	Will occur	Is occurring	Is occurring		5	5	5	5	5	5
	CLASS	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**Moderate**		**2.67**	**2.3**	**2.67**	**2.67**	**2.67**	**2.67**
VEGETATION	Significance	High	High	High	Moderate	High	High		4	4	4	3	4	4
	Spatial	Study Site	Isolated Site	Isolated Site	Isolated Site	Isolated Site	Study Site		2	1	1	1	1	2
	Temporal	Long Term	Long Term	Long Term	Short Term	Long Term	Long Term		4	4	4	2	4	4
	Probability	Is occurring	Will occur	Will occur	Will occur	Will occur	Is occurring		5	5	5	5	5	5
	CLASS	**High**	**Moderate**	**Moderate**	**Low**	**Moderate**	**High**		**3.33**	**3**	**3**	**2**	**3**	**3.33**
FAUNA	Significance	High	High			High	High		4	4			4	4
	Spatial	Region	Local			Region	Region		4	3			4	4
	Temporal	Long Term	Long Term			Long Term	Long Term		4	4			4	4
	Probability	Likely	Could occur			Unlikely	Likely		4	3			2	4
	CLASS	**High**	**Moderate**			**Low**	**High**		**3.2**	**2.2**			**1.6**	**3.2**
SURFACE WATER	Significance	Low	Very low			Low	Low		2	1			2	2
	Spatial	Study Site	Study Area			Study Site	Study area		2	2			2	2
	Temporal	Medium Term	Short Term			Medium Term	Medium Term		3	2			3	3
	Probability	Could happen	Could happen			Could happen	Could happen		3	3			3	3
	CLASS	**Low**	**Very Low**			**Low**	**Low**		**1.4**	**1**			**1.6**	**1.6**
CULTURAL HISTORICAL	Significance	-	-			-			-	-			-	-
	Spatial	-	-			-	-		-	-			-	-
	Temporal	-	-			-	-		-	-			-	-
	Probability	-	-			-	-		-	-			-	-
	CLASS	-	-			-	-		-	-			-	-

		Operational Phase								
		Initial	Additional	Residual	Cumulative		Initial	Additional	Residual	Cumulative
VISUAL	**Significance**	High	Low	High	High		4	2	4	4
	Spatial	Local	Local	Local	Local		3	3	3	3
	Temporal	Long Term	Short Term	Long Term	Long Term		4	2	4	4
	Probability	Has occurred	Will occur	Has occurred	Has occurred		5	5	5	5
	CLASS	**High**	**Moderate**	**High**	**High**		**3.6**	**2.3**	**3.6**	**3.6**
SOCIO-ECONOMIC	**Significance**	-	-	-	-		0	0	0	0
	Spatial	-	-	-	-		0	0	0	0
	Temporal	-	-	-	-		0	0	0	0
	Probability	-	-	-	-		0	0	0	0
	CLASS	**No Impact**	**No Impact**	**No Impact**	**No Impact**		**0**	**0**	**0**	**0**

11 ENVIRONMENTAL MANAGEMENT PLAN

11.1 Introduction

This section, Section 11, constitutes the Environmental Management Plan (EMP) for the construction and operation of the Kendal - Zeus 400 kV overhead power lines.

The Department of Environmental Affairs and Tourism (DEAT) provided Environmental Authorisation for the construction of the new coal fired Power Station (Bravo [Kusile] Power Station) (DEAT Ref No: 12/12/20/807) on 5 June 2007.

11.2 Purpose of this EMP

This EMP has been compiled in order to address the potential environmental impacts that the proposed power line of the above mentioned project could have on the surrounding environment. The EMP serves as the environmental specification to Eskom staff and outside contractors with regards to addressing environmental issues identified prior to the implementation of this project. It is the overall responsibility of the Project Manager and Contractor to ensure compliance with all the environmental specifications in this section as well as the relevant legislation.

This EMP should also ensure the sustainable management (to avoid and/or minimise environmental damage) of the environment whilst the construction is being undertaken. This EMP must be viewed as a contract document to which all Eskom employees and outside contractors involved in the proposed construction must be committed to.

Thus the aim of this EMP is to:

- Ensure that the team are familiar with the environmental procedures to be followed and comply with all the recommendations made within it;
- Ensure that a list of environmental representatives involved in the project are given to the construction team;
- Ensure that an environmental incident register is implemented and maintained to address environmental impacts;
- Ensure that the mitigatory measures are implemented to avoid and/or minimise the identified negative environmental impacts and to enhance the positive impact of the project on the environment; and
- Ensure that a monitoring programme is in place that tracks the effectiveness of the implemented mitigatory measures.

11.3 Objectives of the EMP

The EMP has a long-term objective to ensure that:

- Appropriate Environmental Management measures and requirements are implemented from the start of the project;
- Precautions against damage and claims arising from damage are taken timeously; and
- The completion date of the contract is not delayed due to problems with landowners arising during the course of construction.

11.4 Legal Context

A growing awareness of the environment and an increase in the number of environmental laws and regulations, present company management with a daunting task of monitoring, interpreting and implementing systems to produce a workable plan to comply with legal requirements.

The list below was compiled to ensure that the person responsible for the construction of the proposed power line is aware of their legal responsibilities and liabilities. Complying with these laws and regulations will minimise the risks in terms of legal, financial (claims) and rehabilitation costs.

Non compliance to environmental law is a criminal offence and if prosecuted Eskom will be liable for any environmental damage incurred.

TABLE 58: LEGAL REQUIREMENTS FOR THIS EMP.

ACT NAME	ACT NO	NOTES/REMARKS
National Environmental Management Act	107 of 1998	**List of activities and competent authorities identified in terms of Sections 24 and 24D**
Conservation of Agricultural Resources Act	43 of 1983	**Control of utilisation and protection of wetlands; soil conservation; control and prevention of veld fires; control of weeds and invader plants**.
Environment Conservation Act	73 of 1989	**Controls for the effective protection and utilisation of the environment, littering, waste disposal, noise and various other activities, which may have a detrimental effect on the environment** *Φ Waste management* *Φ Application of waste disposal permit*
Fencing Act	31 of 1963	**Prohibition of damage to a property owner's gates and fences** *Φ Climbing or crawling over or*

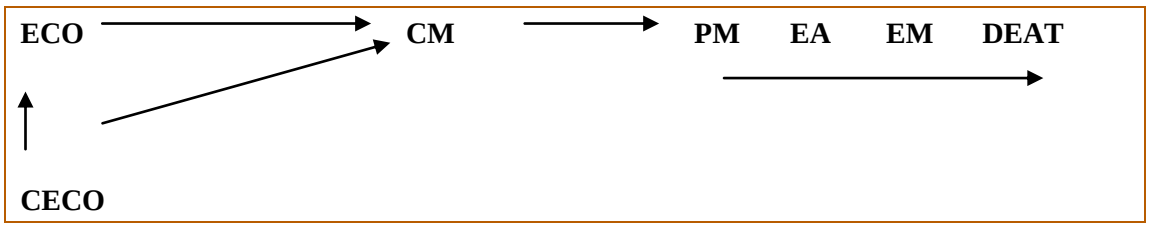
ACT NAME	ACT NO	NOTES/REMARKS
		through fences without permission *Φ Closing gates*
Veld and Forest Fires Act	101 of 1998	**Prevention of unauthorised veld and forest fires**
Transvaal Nature Conservation Ordinance	12 of 1938	**Endangered plants and wild animals.** **Protected fauna and flora**
Occupational Health and Safety Act	85 of 1993	**Prescribes health and safety measures necessary to adhere to for all construction workers**
National Water Act	36 of 1998	**All aspects relating to pollution of surface and ground water.**

11.5 Eskom and Contractor Commitment

Eskom requires a commitment from the Eskom Project Manager and the Contractor on the following issues:

- To underwrite Eskom Transmission's Environmental Policy TRMPBAAX3 Rev 2 at all times;
- Ensure that environmental conditions that are applicable in transmission lines, and are stipulated in the Power Station Record of Decision (Environmental Authorisation) are implemented;
- Resolve problems and claims arising from damage immediately to ensure a smooth flow of operations;
- To implement this EMP for the benefit of all involved; and
- To preserve the natural environment by limiting destructive actions on site.

11.6 Reporting Structure



ECO: Environmental Control Officer (Can be the Eskom Site Supervisor depending on the size of the project)

CM: Contract Manager (Eskom)

CECO: Contractor Environmental Control Officer (Dedicated person)

PM: Project Manager (Eskom)

EA: Environmental Advisor (Eskom)

EM: Environmental Manager (Eskom)

RA Relevant Authority (e.g. DEAT)

11.7 Responsibilities and Duties

11.7.1 Responsibility Matrix

FUNCTION	NAME / CELL NUMBER	RESPONSIBILITY
Project Manager (PM) Eskom		Overall management of project and EMP implementation
Site Supervisor/ Contract Manager (CM) Eskom		Oversees site works, liaison with Contractor, PM and ECO
Environmental Control Officer (ECO) Eskom		Implementation of EMP and liaison between Eskom, Contractor and Landowners/stakeholders
Contractor (C)		Implementation and compliance with recommendations and conditions of the EMP, Appoints dedicated person (CECO) to work with ECO
Contractor Environmental Control Officer (CECO)		Implementation of EMP, landowner interaction, environmental control of site actions, re-mediation and rehabilitation work.
Tx Services Environmental Advisor (Eskom)		Environmental advice and auditing

(Table to be completed upon Contract award)

11.7.2 Project Manager

The primary responsibility of the Project Manager is to ensure that the Contractor complies with the environmental specifications in this EMP. In addition the Project Manager shall:

- Assume overall responsibility for the effective implementation and administration of the EMP;
- Ensure that the EMP is included in the Contractor's contract;
- Ensure that the EMP is given to the applicable Construction Supervisor and the contractors;
- In conjunction with the Construction Supervisor; undertake regular inspections of the Contractor's site as well as the installation works in order to check for compliance with the EMP in terms of the specifications outlined in this EMP. Inspections shall take place at least once a week and copies of the monitoring checklist contained in the file (see Appendix M for copy of the audit inspection protocol);
- Keep a register of all incidents (spills, injuries, complaints, legal transgressions, etc) and other documentation related to the EMP;
- Report to the Senior Environmental Advisor (Vuledzani Thanyani) any problems (or complaints) which cannot first be resolved in co-operation with the Contractor(s);
- Implement recommendations of possible audits; and
- Ensure that construction staff is trained in accordance with requirements of the EMP.

11.7.3 Construction Contractor

The Contractor shall:

- Ensure that the environmental specifications of this document (including any revisions, additions or amendments) are effectively implemented. This includes the on-site implementation of steps to mitigate environmental impacts;
- Discuss implementation of and compliance with this document with staff at routine site meetings;
- Preserve the natural environment by limiting any destructive actions on site;
- Monitor environmental performance and conformance with the specifications contained in this document during site inspections;
- Report progress towards implementation of and non-conformances with this document at site meetings with the Project Manager;
- Ensure that suitable records are kept and that the appropriate documentation is available to the Project Manager;
- Advise the Project Manager of any incidents or emergencies on site, together with a record of action taken;

- Report and record all accidents and incidents resulting in injury or death;
- Take into consideration the legal rights of the individual Landowner, Communities and Eskom Regional staff;
- Ensure quality in all work done, technical and environmental;
- Resolve problems and claims arising from damage immediately to ensure a smooth flow of operations;
- Underwrite Eskom's Environmental Policy at all times, and
- Use this EMP for the benefit of all involved.

11.8 Training

- The SHECO shall be appropriately trained in environmental management and shall possess the skills necessary to impart environmental management skills to all personnel involved in the construction, rehabilitation and operation of the proposed Kendal - Zeus power line corridor;
- Eskom, together with the Environmental and Safety Manager and the SHECO, shall ensure that the employees (including construction workers, engineers, and long-term employees) are adequately trained on the EMP; and
- All employees shall have an induction presentation on environmental awareness. The cost, venue and logistics shall be for the Eskom's account;

Where possible, training must be conducted in the language of the employees. The induction and training shall, as a minimum, include the following:

- The importance of conformance with all EMP and other environmental policies and procedures;
- The significant environmental impacts, actual or potential, of their work activities;
- The environmental benefits of improved personal performance;
- Their roles and responsibilities in achieving conformance with the EMP and other environmental policies and procedures;
- The potential consequences of departure from specified operating procedures; and
- The mitigation measures required to be implemented when carrying out their work activities.

11.9 Commissioning of Tenders for the Project

- All tendering Contractors / Sub-contractors will be made aware of the contents of this EMP and any penalties arising from non-compliance; and
- All appointed Contractors / Sub-contractors will be required to attend the EMP training and induction as detailed in Section 11.7 above.

11.10 Environmental Authorisation

The construction of power lines can have a major impact on the environment. It is thus imperative that precautions be taken to ensure that environmental damage is minimised. This will take a concerted effort from the Contractor and proper planning is of the utmost importance.

The Environmental Control Officer (ECO) shall convey the contents of this EMP and the conditions of the Record of Decision (Environmental Authorisation) from the DEAT and discuss the contents in detail with the Eskom Project Manager and Contractor at a pre-construction meeting. This formal induction training is a requirement of ISO 14001 and shall be done with all main and sub-contractors. Record of the training dates, people who attended and discussion points shall be kept by the ECO.

Most landowners / adjacent landowners will see the construction period as interference with their daily activities. Good relations with adjacent landowners need to be established and sustained. Landowners shall therefore be informed timeously of the construction programme, duration and all interference with their daily activities. This will help in the solving of problems and the prevention thereof. Lines of communication should always be open to ensure proper and timeous reaction to complaints. The contact numbers of the ECO and CECO shall be made available to adjacent landowners. The reputation of both the Contractor and Eskom Transmission is at stake and should be the drive for everybody involved to perform in excellence.

The Contractor (TRMSCAAC1 REV 3 section 4.1.2) shall take all the necessary precautions against damage. The Contractor shall ensure that the correct equipment for construction purposes is available at all times to ensure construction proceeds without unnecessary damage to the environment. Should alternative methods be used, it requires approval from site staff and the ECO must be informed to ensure environmental issues are addressed.

During the construction period at least three (3) Environmental Audits shall be conducted to determine compliance with the recommendations of the EIA, Record of Decision (RoD / Environmental Authorisation) and EMP together with this. These will include internal audits and external by the DEAT or the ISO14001 auditors or combined audits.

11.11 Environmental Management Measures

The management measures documented in each of the sub-sections below have been compiled using the following information:

- Impact Assessment and mitigation measures documented in the Draft EIR for the Kendal - Zeus power line.
- The standard EMP utilised by Eskom: Transmission for the construction of power lines.

In addition to the abovementioned information sources, the EMP will be updated to include the conditions documented in the Environmental Authorisation (RoD) to be received upon approval of the EIA.

11.11.1 Construction Initiation

TABLE 59: ENVIRONMENTAL MANAGEMENT MEASURES DURING CONSTRUCTION INITIATION.

Objectives	• Ensure that all necessary legal obligations and contractual conditions have been met prior to the commencement with construction; • To ensure that all role players and stakeholders are aware of the pending construction activities and have received timeous notice; and • To ensure that power outages are avoided wherever possible during the construction phase.

No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase								
1	Labour Issues	Eskom must appoint a suitably qualified Environmental Control Officer (hereafter referred to as ECO) who would act on behalf of the applicant, on a daily basis, monitor project compliance with the conditions of environmental authorisation, environmental legislation and the recommendations of the revised EMP. This role will be fulfilled by the appointed ECO and CECO.	Throughout Project	Daily	PM	EA	EM	C
		The ECO / CECO must be appointed prior to the commencement of construction and pre-construction related activities and the authorities must be notified of such and appointment.	Throughout Project	Once off	PM	EA	EM	C / RA
		The ECO / CECO shall remain employed until all rehabilitation measures, as required for implementation due to construction damage, are completed and the site is handed over to Eskom by the contractor for operation;	Throughout Project	Daily	PM	EA	EM	C
		The ECO shall maintain the following on site: • A daily site dairy; • A non-conformance register; and • A public complaint registers.	Throughout Project	Daily	CECO	ECO	EA SM	EM PM

2	Initiation	The authorised activity / activities may not commence within thirty (30) days of the date of signature of the authorisation;	Prior to authorisation	Once off	PM	PM SM	EM EA ECO	RA C
		Should Eskom be notified by the minister of a suspension of the authorisation pending appeal procedures, Eskom may not commence with the activity / activities unless authorised by the minister in writing.	Throughout Project	Throughout Project / as and when necessary	PM	PM SM	EM EA ECO	RA C
		Fourteen (14) days written notice must be given to the Department that the activity will commence. Commencement for the purposes of this condition includes site preparation. The notice must include a date on which it is anticipated that the activity will commence. This notification may coincide with the period contemplated in Section 14.9.4.1 above;	Prior to commencement	Once - off	CECO	PM SM	EA EM ECO	RA
		Fourteen (14) days written notice must be given to the Department that the operational phase of the activity will commence.	14 days	Prior to operation commencement	CECO	PM SM	EA EM ECO	RA
		A copy of the authorisation must be kept at the property where the activity will be undertaken. The authorisation must be produced to any authorised official of the Department who requests to see it and must be made available for inspection by any employee or agent of the holder of the authorisation who works or undertake work at the property;	Throughout	Monthly Inspection	CECO	SM	EA	EM PM
		No work shall commence until permission is granted from the Environmental Advisor from Transmission Services and acceptance of this proposal and EMP from DEAT has been obtained.	Prior to commencement	Once-off	SM C	PM	ECO	EA EM

		Obtain a signed agreement statement from the contractor indicating their willingness to comply to the EMP.	Prior to commencement	Once - off	CECO C	SM	ECO	PM EA EM
Construction Phase								
1	Construction Initiation	Ensure that the grid is considered throughout the construction phase.	Throughout construction	Throughout construction	C	SM	ECO	PM EA EM
		Where any of the applicant's contact details change, including then name of the responsible person, the physical or postal address and/or telephonic details, the applicant must notify the Department as soon as the new details become known to the applicant;	Throughout construction	Throughout construction	SM	PM	ECO	EA EM RA
		The holder of the authorisation must notify the Department, in writing and within 24 hours, if conditions of the authorisation cannot be or is not adhered to. In all other cases, the holder of the authorisation must notify the Department, in writing, within 48 hours if a condition of the authorisation is not adhered to. Any notification in terms of this condition must be accompanied by reasons for the non-compliance; and	Prior to commencement	Once off	CECO	SM	ECO EA	PM EM RA
		Non-compliance with a condition of this authorisation may result in criminal prosecution or other actions as per the National Environmental Management Act, 1998 and the regulations.	Throughout	Throughout	CECO	SM	ECO EA	PM EM RA
2	Labour Issues	Ensure proper supervision of employees at all times.	Throughout	Throughout	C	SM	ECO EA	PM EM RA
Rehabilitation Phase								
None								
Operational Phase								
None								

11.11.2 Site Establishment and Demarcation

TABLE 60: ENVIRONMENTAL MANAGEMENT MEASURES DURING SITE ESTABLISHMENT AND DEMARCATION.

Objectives	**Project Area** • Ensure proper demarcation of the project area prior to construction; • Ensure timely notice and negotiation with stakeholders in the event that access is required for construction purposes; and • Ensure that all areas impacted during construction are rehabilitated to suitable levels. **Gate Installation** • Properly installed gates to allow access to the servitude; • Minimise damage to fences; and • Limit access to Eskom and Contractor personnel with gate keys. **Servicing Vehicles** • Prevention of pollution of the environment; and • Minimise chances of transgression of the acts controlling pollution. **Batching Plants** • To ensure all agreements with Landowners are adhered to; • Prevention of complaints from stakeholders; and • Successful rehabilitation of disturbed areas. **Wet Areas** • Avoid impact to wet areas. **Sanitation** • Ensure that proper sanitation is received.

No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase								
1	Gate Installation and Control	No new gate construction is anticipated, however, if needed the contractor must refer to the Fencing Act, Act no 31 of 1963.	Not anticipated	Throughout Project	C CECO	SM	ECO	EA EM PM
		Gate installation shall be according to TRMSCAAC1 REV 3 section 4.5 and the drawing 0.00/10261 Rev 2 as stated in the specifications.	Not anticipated	Once -off	C CECO	SM	ECO	EA EM PM
		All gates installed in electrified fencing shall be re-electrified.	Not anticipated	Once -off	C CECO	SM	ECO	EA EM

								PM
		The Environmental Control Officer shall approve gate positions.	Not anticipated	Once -off	C CECO	SM	ECO	EA EM PM
		All gate positions shall be three (3) metres off centre to allow for continued access when stringing takes place.	Not anticipated	Once -off	C CECO	SM	ECO	EA EM PM
2	Batching Plants	The sitting, if necessary, of batching plants shall be done in conjunction with the Eskom PM and the ECO.	Not anticipated	Once -off	C CECO	SM	ECO	EA EM PM
		Refer to TRMSCAAC1 REV 3 section 4.8 for specifications regarding batching plants.	Pre-Construction	Once off	C CECO	SM	ECO	EA EM PM
		Ensure all agreements reached with the Landowner are fulfilled.	Pre-Construction	Once -off	C CECO	SM	ECO	EA EM PM
3	Sanitation	The Contractor shall install mobile chemical toilets on site (TRMSCAAC1 REV 3). The Contractor camp shall have the necessary ablution facilities with chemical toilets where such facilities are not available at commencement of construction.	Throughout	Weekly	C CECO	SM	ECO	EA EM PM
		The Contractor will be responsible for the provision of and proper utilisation, maintenance and management of toilet, wash and waste facilities. Toilet facilities supplied by the contractor for the workers shall occur at a maximum ratio of 1 toilet per 15 workers. All temporary / portable toilets shall be secured to the ground to prevent them from toppling due to wind or any other cause.	Throughout construction	Daily	C CECO	SM	ECO	EA EM PM
		Prior to the establishment of the ablution facilities, the Site Manager must approve an appropriate location.	Pre-Construction	Once-off	C CECO	SM	ECO	EA EM PM
		The entrances to the ablution facilities shall be	Pre-	Once-off	C	SM	ECO	EA

		adequately screened from public view.	Construction		CECO			EM PM
4	Site Establishment – Contractors camp, wastewater management, Shower facilities	The contractor's camp shall be sited so as to cause the least amount of disturbance to adjacent landowners.	Pre-Construction	Once-off	C CECO	SM	ECO	EA EM PM
		The contractor's camp shall be fenced and the contractor shall maintain in good order all fencing for the duration of the construction activities.	Throughout Construction	Weekly	C CECO	SM	ECO	EA EM PM
		Site establishment shall take place in an orderly manner and all amenities shall be installed at Camp sites before the main workforce move onto site.	Pre-construction	Monthly	C CECO	SM	ECO	EA EM PM
		The Contractor shall supply a wastewater management system that will comply with legal requirements and be acceptable to Eskom. A septic tank system is recommended to ensure the best practice environmental solution.	Pre-Construction	Once-off	C CECO	SM	ECO	EA EM PM
		Where Eskom facilities are available the Contractor shall make use of such facilities where it is viable and negotiated with the Grid.	Pre-Construction	Once-off	C CECO	SM	ECO	EA EM PM
		Should shower facilities be provided for the use by staff staying on site, the following controls must be imposed: • Positioning of the shower, and specifically its discharge point, will be carried out to ensure that erosion and build up detergents does not occur; • All discharge from the shower and other washing facilities must pass through a suitable filter to reduce the load of detergents to the environment; • Filtered water discharge may thereafter be released to the environment, but mechanisms will be investigated to ensure	Throughout Construction	Daily	C CECO	SM	ECO	EA EM PM

		that the water is evenly dispersed so as to lead to "greening up" and / or swampy conditions in one limited area; • Use of the shower facilities must be limited to staff or authorised persons only.						
		The cooking area will be positioned such that no vegetation is in close proximity thereto, including overhanging trees. An area around the cooking area will be cleared such that any escaping embers will not start an uncontrolled fire.	Pre-Construction	Once-off	C CECO	SM	ECO	EA EM PM
5	Eating Areas	Eating areas shall be designated and demarcated.	Pre-Construction	Once-off	C CECO	SM	ECO	EA EM PM
		Sufficient bins shall be present in this area for all waste material.	Pre-Construction	Once-off	C CECO	SM	ECO	EA EM PM
		Dish washing facilities shall be provided. These may be very basic, but a process must be put in place to ensure that wastewater is disposed of appropriately (see Site Establishment - showers).	Pre-Construction	Once-off	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Gate Installation and Control	All gates shall be fitted with locks and be kept locked at all times.	Throughout	Throughout	C CECO	SM	ECO	EA EM PM
		Gates shall only be left open on request of the Landowner if he accepts partial responsibility for such gates in writing.	When necessary	When necessary	C CECO	SM	ECO	EA EM PM
		Claims arising from gates left open shall be investigated and settled in full by the Contractor.	When necessary	When necessary	C CECO	SM	ECO	EA EM PM
		If any fencing interferes with the construction process, such fencing shall be deviated / protected until construction is completed.	When necessary	When necessary	C CECO	SM	ECO	EA EM PM
2	Project Area	Construction activities are limited to the area as demarcated by EA / EM within the site identified	Throughout Project	Monthly	C CECO	SM	ECO	EA EM

		for the construction of the Power Station.						PM
		Any area outside the construction area, required to facilitate access, construction activities, construction camps or material storage areas, where necessary, shall be negotiated with the affected stakeholders and written agreements shall be obtained.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		All construction areas shall be cleared in accordance with the EA / EM Standard for Bush clearing ESKASABG3.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		Any extra space to be cleared outside the construction area shall be negotiated and approved by EA / EM. All areas marked as no go areas inside the substation parameters shall be treated with the utmost care and responsibility.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
3	Batching Plants	The batching plant area shall be operated in such a way as to prevent contaminated water to run off the site and polluting nearby streams or water bodies. To this effect diversion berms can be installed to direct all wastewater to a catchments area.	Throughout Construction	Weekly	C CECO	SM	ECO	EA EM PM
4	Sanitation	Staff shall be sensitised to the fact that they should use these toilets at all times. The Contractor shall inform all site staff to make use of supplied ablution facilities and under no circumstances shall indiscriminate excretion and urinating be allowed other than in supplied facilities.	Throughout Construction	Daily	C CECO	SM	ECO	EA EM PM
		No use of the veld shall be allowed, as this always creates problems with the landowners and may lead to claims for problems with stock diseases.	Throughout Construction	Daily	C CECO	SM	ECO	EA EM PM
		Toilet paper is also a source of littering, and the Contractor shall be forced to clean up any litter.	Throughout Construction	Daily	C CECO	SM	ECO	EA EM PM

		Ablution facilities must be maintained in a hygienic state and serviced regularly. Toilet paper will be provided.	Throughout Construction	Daily	C CECO	SM	ECO	EA EM PM
		The Contractor will ensure that no spillage occurs when the toilets are cleaned or emptied and that a licensed provider removes the contents from the site.	Throughout Construction	Weekly	C CECO	SM	ECO	EA EM PM
		Disposal of such waste is only acceptable at a licensed waste disposal facility.	Throughout Construction	Weekly	C CECO	SM	ECO	EA EM PM
5	Site Establishment	The site must be kept tidy and hygienic at all times with special reference to sanitation & water management.	Throughout Construction	Weekly	C CECO	SM	ECO	EA EM PM
		Open uncontrolled fires will be forbidden at the site camp. Rather "contained" cooking mechanisms will be used – e.g. gas stoves or an enclosed braai facility.	Throughout Construction	Weekly	C CECO	SM	ECO	EA EM PM
		Where possible and practical all maintenance of vehicles and equipment shall take place in the workshop area.	Throughout Construction	Weekly	C CECO	SM	ECO	EA EM PM
		Workshop areas shall be monitored for oil and fuel spills and such spills shall be cleaned and remediate to the satisfaction of the ECO.	Throughout Construction	Weekly	C CECO	SM	ECO	EA EM PM
		The Contractor shall be in possession of an emergency spill kit that must be complete and available at all times on site.	Throughout Construction	Weekly	C CECO	SM	ECO	EA EM PM
		No equipment shall be used which may cause irreparable damage to wet areas. The contractor shall use alternative methods of construction in such areas. **Refer to TRMSCAAC1 REV 3 section 4.4.1 regarding access through seasonally wet areas.**	Throughout Construction	Daily	C CECO	SM	ECO	EA EM PM
6	Eating areas	The feeding of, or leaving of food for animals, is strictly prohibited.	Throughout Construction	Monthly	C CECO	SM	ECO	EA EM PM

		No fires for the purpose of cooking or warming purposes will be permitted other than within designated areas, for instance, at the site camp.	Throughout Construction	Daily	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Batching Plants	All areas used as batching areas must be rehabilitated once construction is completed. Should any claim be instituted against EA / EM, due to the actions of the Contractor at a batching plant site, EA / EM shall hold the Contractor fully responsible for the claim until such time that the Contractor can prove otherwise with the necessary documentation.	Once Construction is completed – during rehabilitation	Monthly	C CECO	SM	ECO	EA EM PM
2.	Site Decommissioning	All areas where site infrastructure or camp sites are established must be rehabilitated to their original state in which they were found.	Once Construction is completed – during rehabilitation	Monthly	C CECO	SM	ECO	EA EM PM
		Prior to the removal of structures an assessment of the end land use will be undertaken to determine which structures will be removed or retained.	Once Construction is completed – during rehabilitation	Monthly	C CECO	SM	ECO	EA EM PM
		Any specific requirements to prevent pollution during demolition of structures must be identified prior to the commencement of rehabilitation activities.	Prior to rehabilitation	Once - off	C CECO	SM	ECO	EA EM PM
		Disposal requirements must be identified prior to the commencement of rehabilitation or structure removal.	Prior to rehabilitation	Once - off	C CECO	SM	ECO	EA EM PM
		Equipment, structures and building material that can be reused will be identified prior to the commencement of rehabilitation activities.	Prior to rehabilitation	Once - off	C CECO	SM	ECO	EA EM PM
		Scrap metal and equipment will be sold as scrap	Once	Monthly	C	SM	ECO	EA

		or disposed of at a suitably licensed facility.	Construction is completed – during rehabilitation		CECO			EM PM
		Vegetation that was removed for the establishment of site infrastructure shall be reinstated into the area.	Once Construction is completed – during rehabilitation	Monthly	C CECO	SM	ECO	EA EM PM
Operational Phase								
1	Gate Control	Gates must be fitted with Eskom locks.	Permanent	Throughout	C CECO	SM	ECO	EA EM PM
		Such gates shall be clearly marked by painting the posts green.	After construction – once off	Once off	C CECO	SM	ECO	EA EM PM

11.11.3 Water Management (including Storm water, Water Sources, Wet Areas)

TABLE 61: ENVIRONMENTAL MANAGEMENT MEASURES FOR WATER MANAGEMENT.

Objectives	**Storm-water Management** • Effectively control storm water runoff to ensure that impacts to surface water resources are controlled, and erosion is not present on site. **River Crossings** • Minimise damage to river and stream embankments; • No access roads through river and stream banks; • No visible erosion scars on embankments once construction is completed; and • Minimise erosion of embankments and subsequent siltation of rivers, streams and dams. **Wetlands** • No construction activities within designated wetland areas as identified in the EIA; and • No pollution or effluent is to come in contact with wetland areas.							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
1	Water Sources	Should water be required from sources other than Eskom supply, a written agreement shall be reached between the Contractor and the stakeholder involved.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
		Should the Contractor be required to use water from a natural source, the Contractor shall supply a method statement to that effect and obtain the required permits. No construction shall take place	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM

		in the wetland, streams and other river courses without the necessary water license form the Department of Water Affairs and Forestry;						
Construction Phase								
1	Water Sources	Strict control shall be maintained and the ECO shall regularly inspect the abstraction point and methods used.	Throughout Project	Weekly	C CECO	SM	ECO	EA EM PM
2	Wetlands	No construction is to take place in wetland areas. Including no vehicular traffic in wet areas / wetlands.	Throughout Project	Weekly	C CECO	SM	ECO	EA EM PM
		Only existing roads through such areas may be used with the approval of Eskom.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		The contractor shall use alternative methods of construction in such areas. **Refer to TRMSCAAC1 REV 3 section 4.4.1 regarding access through seasonally wet areas.**	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		Berms should be created not closer than 10m from identified wetland areas, so as to ensure that no construction material and/or waste flow into wetland systems.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
3	Dust control	The dust control measures, such as watering, chemical stabilisation and the reduction of	During	Monthly	C CECO	SM	ECO	EA EM PM

		surface wind speed through the use of windbreaks and source enclosures must be put in place during construction activities. Emission control efficiencies of 50% can readily be achieved through the implementation of effective watering programme for unpaved roads and material handling points.	construction					
4	Storm water Management	Storm water shall be channelled away from construction activities.	Prior to commencement of Construction	Once-off	C CECO	SM	ECO	EA EM PM
		No storm water may be discharged into areas where construction is taking place.	Prior to commencement of Construction	Once-off	C CECO	SM	ECO	EA EM PM
		Storm water flowing from the footprint of the proposed development may not be contaminated by any substances, whether the substance is solid, liquid or vapour or any combination thereof.	Throughout Construction	Weekly	C CECO	SM	ECO	EA EM PM
		During construction, the Contractor will protect areas susceptible to erosion by installing necessary temporary and / or permanent drainage works as soon as possible and by taking suitable measures to prevent surface water concentration	Prior to commencement of Construction	Once-off	C CECO	SM	ECO	EA EM PM

		into nearby roadways or river courses.						
		Silt trap mechanisms will be installed on all temporary storm water channels. These silt traps will be regularly checked and serviced as required.	Throughout Construction	Monthly	C CECO	SM	ECO	EA EM PM
		All excavated and filled slopes and stockpiles must be of a stable angle and capable of accommodating normal expected flows.	Throughout Construction	Monthly	C CECO	SM	ECO	EA EM PM
		Stabilisation of cleared areas to prevent and control erosion will be actively managed. The method chosen (e.g. watering, planting, retaining structures, commercial anti-erosion compounds) will be selected according to specifics and ensure acceptable rehabilitation.	Throughout Construction	Monthly	C CECO	SM	ECO	EA EM PM
		Traffic and movement over stabilised areas will be restricted. Any damage to stabilised areas will be repaired and maintained to the satisfaction of the Site Manager.	Throughout Construction	Monthly	C CECO	SM	ECO	EA EM PM
		Where erosion and sedimentation occur, rectification will be carried out in accordance with details specified by the Site Manager.	Throughout Construction	Monthly	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								

1	Storm water Management	Any runnels or erosion channels will be backfilled and compacted, and the areas restored to a proper condition.	Throughout Construction	Monthly	C CECO	SM	ECO	EA EM PM
Operational Phase								
None								

11.11.4 Hazardous Substance Spills

TABLE 62: ENVIRONMENTAL MANAGEMENT MEASURES FOR HAZARDOUS SUBSTANCE SPILLS.

Objectives	• To ensure that spills occurring during the construction phase a suitably managed to reduce potential impacts on the environment.							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
1	Hazardous Spills	Ensure that potential hazardous materials on site are identified and documented in a register.	Throughout Project	Once-off	C CECO	SM	ECO	EA EM PM
		Ensure that suitable spill kits and absorption materials are purchased prior to commencement with construction, and stored suitably in places where there is a high risk of hazardous spills occurring.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Hazardous	All contaminated soil / yard stone shall be	Throughout	When-	C	SM	ECO	EA

	Spills	removed and be placed in containers. Contaminated material can be taken to one central point where bio-remediation can be done.	Project	necessary	CECO			EM PM
		Smaller spills can be treated on site. (ESKASABTO)	Throughout Project	When-necessary	C CECO	SM	ECO	EA EM PM
		A specialist Contractor shall be used for the bio-remediation of contaminated soil where the required remediation material and expertise is not available on site.	Throughout Project	When-necessary	C CECO	SM	ECO	EA EM PM
		All spills of hazardous substances must be reported to the ECO and appointed Transmission Engineering Environmental Advisor (Tx Key Performance Indicator requirement).	Throughout Project	When-necessary	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Hazardous Spills	Ensure that rehabilitated areas are free of visible spills and are suitably vegetated.	Throughout Project	When-necessary	C CECO	SM	ECO	EA EM PM
Operational Phase								
None								

11.11.5 Delivery of Materials

TABLE 63: ENVIRONMENTAL MANAGEMENT MEASURES FOR THE DELIVERY OF MATERIALS.

Objectives	
	• To ensure that all sub-contractors responsible for delivering materials to site operate in an environmentally friendly manner whilst on site; and • To ensure that the activities related to material deliveries do not create an unnecessary impact on the environment.

No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase								
1	Heavy machinery	All drivers and operators must be appropriately licensed.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Heavy machinery	No vehicles coming on sites must spill oil.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		No construction equipment, vehicles or unauthorised personnel will be allowed onto areas that have been re-vegetated.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Heavy Machinery	All areas where heavy machinery has access must be rehabilitated in terms of soil pollution.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
Operational Phase								
1	Heavy	No oil/ petrol spills / leaks may occur.	Throughout	Monthly	C CECO	SM	ECO	EA EM PM

	Machinery		construction					

11.11.6 Building, Civil's and Structural Steel Work

TABLE 64: ENVIRONMENTAL MANAGEMENT MEASURES FOR BUILDING, CIVIL'S AND STRUCTURAL STEEL WORK

Objective	• To ensure that all construction related activities including civils, building erection, and structural steel work is undertaken in such a manner that it reduces unnecessary impact to the environment.							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
None								
Construction Phase								
1	Excavate foundations	During excavations no oil leaks from heavy vehicles may occur.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		PPE must be used by all workers using hand tools during the excavations of foundations.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		Spoil must be evenly spread.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
2	Excavate earth moving materials	During the excavation of earth materials no oil leaks may occur from heavy vehicles.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM

3	Mixing concrete	During the mixing of concrete, concrete dust is emanated. Workers mixing concrete must wear PPE.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		Cement bags must not become litter after use. They must be disposed of in bins/skips (see Waste Management).	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
4	Trenches	All workers using hand tools must make use of PPE.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		No spills may occur. All spills should be reinstated into foundations as backfill.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
5	Cast Blinding Layer	No concrete spills may occur. All spills should be reinstated into foundations as backfill.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
6	Place Copper Earthing	All copper off-cuts must be collected for recycling purposes.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
7	Construct Cable	No concrete spills may occur. All spills should be reinstated into foundations as backfill.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
8	Place steelwork on foundations	All steel off-cuts must be collected for recycling purposes.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		During steel cutting and grinding, all old discs	Throughout	Monthly	C CECO	SM	ECO	EA EM PM

		must be managed and must not become litter.	construction					
9	Connect earthing to steelwork	During welding and brazing, all old welding rods must be managed and must not become litter.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
10	Reinstate yard stone	No oils spills may occur as a result of heavy vehicles.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		Workers with rakes must use PPE at all times.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	De-establish contractors yard / store	All waste, garbage, surplus materials and oils spills to be cleared and site must be rehabilitated.	During Rehabilitation	Weekly	C CECO	SM	ECO	EA EM PM
2	Final inspection	During site inspection the site is to be cleared and rehabilitated back to its original state.	During Rehabilitation	Weekly	C CECO	SM	ECO	EA EM PM
Operational Phase								
1	Take over works	During site take / hand over the site must be accepted from the contractor and handed over.	Operations	Once - off	C CECO	SM	ECO	EA EM PM

11.11.7 Circuit Breakers and Current Transformers

TABLE 65: ENVIRONMENTAL MANAGEMENT MEASURES FOR CIRCUIT BREAKERS AND CURRENT TRANSFORMERS.

Objective	• See deliveries, site establishment, and civils and structural steel work.							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
1	Supply and delivery of new circuit breakers and current transformers	All drivers and operators delivering new circuit breakers and current transformers must be licensed to obey all road and local by-laws.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Establish contractor on site	(See Site Establishment).						
2	Install new cables, clamps and conductors	The crane operators must be licensed in accordance with the OHS Act.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Clear site	The site must be cleared and rehabilitated so that there is no damage to the surrounding	Post construction	Weekly	C CECO	SM	ECO	EA EM PM

		infrastructure.						
		All personal must be suitably accredited to perform duties.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		All cable cut offs must be collected and sent for recycling.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		All waste, garbage, scrap and oil spill must be disposed of (see Waste Management). The site must be cleared and rehabilitated.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
2	Final Inspection	During site inspection the site is to be cleared and rehabilitated back to its original state.	On termination of construction	Weekly	C CECO	SM	ECO	EA EM PM
Operational Phase								
1	Take over works	During site take / hand over the site must be accepted from the contractor and handed over.	On termination of construction	Once-off	C CECO	SM	ECO	EA EM PM

11.11.8 Access Roads

TABLE 66: ENVIRONMENTAL MANAGEMENT MEASURES FOR ACCESS ROADS.

Objectives	• Minimise damage to existing access roads; • Minimise damage to environment due to construction and rehabilitation of new access roads; and • Minimise loss of topsoil and enhancement of erosion.							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
1	Access Roads	If required, planning of access routes must be done in conjunction between the Contractor and Eskom.	Once off	As necessary	C CECO	SM	ECO	EA EM PM
		All agreements reached shall be documented in writing and no verbal agreements should be made.	Throughout Project	Throughout Project	C CECO	SM	ECO	EA EM PM
		The condition of existing access / private roads to be used shall be documented with photographs.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
		The Contractor shall properly mark all access roads.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
		Markers shall show the direction of travel.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM

		Roads not to be used shall be marked with a "**NO ENTRY** "sign (refer also TRMSCAAC1 REV 3).	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
		Where required, speed limits shall be indicated and speed control measures applied on the roads.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
		Water diversion berms shall be installed from the start of the contract in accordance with TRMSCAAC1 REV 3 Section 4.6.	Prior to construction	When necessary	C CECO	SM	ECO	EA EM PM
		Where berms are installed on severe slopes the outflow shall be suitably stone pitched to prevent erosion from starting at the base of the berm.	Prior to construction	When necessary	C CECO	SM	ECO	EA EM PM
		All structures shall be properly designed and drawings shall be available for reference purposes.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
		Permanently wet areas are shown on the profiles. No vehicular traffic shall be allowed in such areas. Only existing roads through such areas may be used with the approval of Eskom and the Landowner.	Throughout construction		C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Access Roads	All speed limits shall be strictly adhered to at all	Throughout	Daily	C CECO	SM	ECO	EA EM PM

		times.	Project					
		Where new access roads are constructed, this must be done in accordance with TRMSCAAC1 REV 3 Section 4.4.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		These berms shall be maintained at all times.	Throughout construction	Monthly inspection	C CECO	SM	ECO	EA EM PM
		No roads shall be constructed on slopes of more than 20% unless such roads follow contours.	Throughout construction	Monthly inspection	C CECO	SM	ECO	EA EM PM
		In such areas the Contractor shall only use existing roads or alternative methods of construction. The Contractor shall take such areas into consideration during the tender.	Throughout construction	Monthly inspection	C CECO	SM	ECO	EA EM PM
		The installation of concrete pipes and drifts, to facilitate access, shall be at the discretion of the Environmental Control Officer on site.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		Any dangerous crossings shall be marked as such and where necessary, speed limits shall be enforced.	Throughout construction	Monthly inspection	C CECO	SM	ECO	EA EM PM
		All existing private access roads used for construction purposes, shall be maintained at all times to ensure that the local people have free	Throughout construction	Monthly inspection	C CECO	SM	ECO	EA EM PM

		access to and from their properties.						
Rehabilitation Phase								
1	Access Roads	Berms must be repaired at the end of the contract.	End of contract	Once off	C CECO	SM	ECO	EA EM PM
		Upon completion of the project all roads shall be repaired to their original state.	End of contract	Once off	C CECO	SM	ECO	EA EM PM
Operational Phase								
None.								

11.11.9 Waste Management

TABLE 67: ENVIRONMENTAL MANAGEMENT MEASURES FOR WASTE MANAGEMENT.

Objectives	• To keep the construction site and servitude neat and clean. • Disposal of rubble and refuse in an appropriate manner • Minimise litigation • Minimise neighbour complaints • No visible concrete spillage on the servitude							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
1	Refuse and Rubble Removal	A method statement is required from the Contractor that includes the layout of the camp, management of ablution facilities and waste management.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
		The Contractor camp shall have the necessary ablution facilities with chemical toilets where such facilities are not available at commencement of construction.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
		The Contractor shall provide a wastewater management system that will comply with legal requirements and be acceptable to Eskom.	Prior to construction	Weekly inspection	C CECO	SM	ECO	EA EM PM
		The Contractor will supply waste collection bins where such is not available and all solid waste	Throughout	Once-off	C CECO	SM	ECO	EA EM PM

		collected shall be disposed of at a registered waste disposal facility.	Project					
		A certificate of disposal shall be obtained by the Contractor and kept on site. All waste generated during construction and operation of the facility must be removed and disposed of at a waste disposal facility permitted in terms of Section 20 of the Environment Conservation Act, 1989 (Act 73 of 1989);	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		In the case where a registered waste site is not available close to the construction site, the Contractor will be responsible to provide a method statement with regard to waste management.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
		Under no circumstances may solid waste be burned on site unless a suitable incinerator is available.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		The Contractor shall supply waste collection bins where such is not available, as approved by the Environmental Control Officer, and all solid waste collected shall be disposed of at a registered waste dump.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		A certificate of disposal shall be obtained by the	Prior to	Monthly	C CECO	SM	ECO	EA EM

		Contractor and kept on file.	construction					PM
		Where a registered waste site is not available close to the construction site, the Contractor shall provide a method statement with regard to waste management.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
		The disposal of waste shall be in accordance with all relevant legislation.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Refuse and Rubble Removal	The Contractor shall dispose of all excess material on site in an appropriate manner and at a designated place.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		All packaging material shall be removed from site and disposed of and not burned on site.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		No landfill may be used without the consent from the Landowner.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		Should a landfill be used for biodegradable materials only, the rubble shall be compacted and at least 1m of soil shall cover the waste material.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		No hazardous material, e.g. oil or diesel fuel shall be disposed of in any unregistered waste site.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM

		No material shall be left on site that may harm man or animals.	Throughout Project	Weekly inspection	C CECO	SM	ECO	EA EM PM
		Any broken insulators shall be removed and all shards picked up.	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
		Broken, damaged and unused nuts, bolts and washers shall be picked up and removed from site.	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
		Surplus concrete may not be dumped indiscriminately on site, but shall be disposed of in designated areas as agreed by the Landowner. Concrete trucks shall not be washed on site after depositing concrete into foundations. Any spilled concrete shall be cleaned up immediately.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		Under no circumstances may solid waste be burned on site unless a suitable incinerator is available.	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
		The Contractor shall dispose of all excess material on site in an appropriate manner and at a designated place.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		All packaging material must be removed from the site and disposal of and not burned on site.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM

		No material shall be left on site that may harm man or animals.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		Any broken insulators shall be removed and all shards picked up.	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
		Broken, damaged and unused nuts, bolts and washers shall be gathered and removed from site.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		Surplus concrete may not be dumped indiscriminately on site and will be disposed of in designated areas as agreed by the Landowner.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		The washing of concrete trucks on site is prohibited. Any spilled concrete shall be cleaned up immediately.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		The Contractor must provide DEAT with proof of confirmation of service provision from waste service providers for the removal of wastes.	Throughout Project		C CECO	SM	ECO	EA EM PM
		A general site-wide litter clean up will occur at least once a week.	Throughout Project	Weekly	C CECO	SM	ECO	EA EM PM
		Waste will be collected from site by a licensed contractor and removed to an appropriate waste disposal facility.	Throughout Project	Weekly	C CECO	SM	ECO	EA EM PM

		Wherever possible, materials will be recycled via a "Greens waste site". To this end, containers for glass, paper, metals, plastics, organic waste and hazardous wastes (e.g. oil rags, paint containers, thinners) will be provided in sufficient quantity on the site.	Throughout Project	Weekly	C CECO	SM	ECO	EA EM PM
		Waste will be removed during off-peak traffic periods to minimise impacts on local traffic patterns.	Throughout Project	Weekly	C CECO	SM	ECO	EA EM PM
		All waste generated during construction and operation of the facility must be removed and disposed of at a waste facility permitted in terms of Section20 of the Environmental Conservation Act, 1989 (Act 73 of 1989).	Throughout Project	Weekly	C CECO	SM	ECO	EA EM PM
		Littering by the employees of the Contractor shall not be allowed (TRMSCAAC1 REV 3 section 4.1.2).	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
		All potentially hazardous and non-degradable waste shall be collected and removed to a registered waste site.	Throughout Project	Weekly	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Refuse and Rubble	Same as construction phase.						

	Removal	
Operational Phase		
1	Refuse and Rubble Removal	Same as construction phase.

11.11.10 Fire Prevention

TABLE 68: ENVIRONMENTAL MANAGEMENT MEASURES FOR FIRE PREVENTION.

Objectives	• No veld fires started by the Contractor's work force. • No claims from Landowners for damages due to veld fires. • No litigation.							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
1	Fire Prevention	The Contractor shall have fire-fighting equipment available on all vehicles working on site, especially during the winter months.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		The Contractor will document a fire reduction management plan. The plan will identify sources of fire hazard, and appropriate management measures to reduce the identified risk. The relevant authority will be notified of such	Prior to commencement of construction	Monthly	C CECO	SM	ECO	EA EM PM

		potential fire hazards.						
Construction Phase								
1	Fire Prevention	Preferentially no fires will be lit on the site, if however required, fires must be limited to use for cooking and heating use only within a designated area. This area will be a suitable distance from fuel sources. A fire will be constantly monitored while present.	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
		In terms of the Atmospheric Pollution Prevention (APPA), burning is not permitted for waste disposal.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		Suitable precautions will be taken (e.g. suitable fire extinguisher, welding curtains) when working with welding or grinding equipment near potential sources of combustion.	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
		All fire control mechanisms (fire fighting equipment) will be routinely inspected by a qualified investigator for efficacy thereof and be approved by local fire services. Such mechanisms will be present and accessible at all times.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		All staff on site will be made aware of general fire prevention and control methods, and the name of the responsible person to alert to the	Throughout Project	Once-off	C CECO	SM	ECO	EA EM PM

		presence of a fire.						
		The Contractor will advise the relevant authority of a fire outside of a demarcated area as soon as it starts and will not wait until he can no longer control it.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Fire Prevention	None.						
Operational Phase								
1	Fire Prevention	None.						

11.11.11 Designated Storage Areas

TABLE 69: ENVIRONMENTAL MANAGEMENT MEASURES FOR DESIGNATED STORAGE AREAS.

Objective	To ensure that cognisance is taken of proper storage of dangerous goods and hazardous materials so as to avoid accidents, spillage, and impacts to the environment.							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
1	Workshop, equipment	Where possible and practical all maintenance of vehicles and equipment shall take place in the	During	Monthly	C CECO	SM	ECO	EA EM PM

	maintenance and storage	workshop area, on a paved or concrete lined surface.	construction					
		All hazardous substances shall be stored in suitable containers and storage areas shall be bunded. This includes all carbon substances like fuel and oil as well as herbicides and battery acid.	During construction	Monthly	C CECO	SM	ECO	EA EM PM
		A register shall be kept on all substances and be available for inspection at all times.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Workshop, equipment maintenance and storage	Servicing of vehicles within Power Station perimeters is strictly prohibited.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		Only emergency repairs shall be allowed on site and a drip tray shall be used to prevent oil spills.	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
		In the event of a breakdown within the substation perimeter, any oil spills shall be cleaned up immediately and appropriate environmental investigations undertaken and recorded.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
		The following shall apply:						
		• All contaminated soil shall be removed and be placed in containers. Contaminated soil can be taken to one	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM

		central point at the Contractors campsite where bio-remediation can be done; • Smaller spills can be treated on site; • A specialist Contractor shall be used for the bio-remediation of contaminated soil; • The area around the fuel storage drum at the Contractor's campsite shall also be re-mediated upon completion of the contract; and • All oil spills must be reported to ECO immediately.						
		Under no circumstances shall such waste be buried on site indiscriminately.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		No maintenance or repair of construction vehicles or machinery will occur on site during the construction phase. Maintenance of equipment and vehicles will be preformed off-site at a suitably designed workshop.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		Movement of construction vehicles and machinery must be restricted to areas outside of sensitive areas on site.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		No washing of plant may occur on the site.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM

		The contractor will ensure that if emergency plant maintenance occurs on site, that there is no contamination of soil or vegetation (e.g. use of drip trays).	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		Drip trays will be provided for the stationary plant and for the "parked" plant.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		All vehicles and equipment will be kept in good working order and serviced regularly. Leaking equipment will be repaired immediately or removed from the site.	Throughout Project	Daily	C CECO	SM	ECO	EA EM PM
		The relevant contractor must ensure that facilities for the collection of hydraulic and other vehicle oils are provided within the hard park area.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
		The repair of construction vehicles must be done on a paved surface to avoid leaking oils sipping into the ground.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
2	Materials use, handling and storage	The Contractor will ensure that delivery drivers are informed of all procedures and restrictions required by this document. Such drivers will be supervised during off-loading, by a person knowledgeable of the requirements.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM

		Materials will be appropriately secured to ensure safe passage between destinations. Loose loads (e.g. sand, stone chip, fine vegetation, refuse, paper and cement) will be covered.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		The Contractor will be responsible for any clean-up resulting from the failure by his employees or suppliers to properly secure transported materials.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
		All material lay-down areas and stockpiles will be subject to the Site Manager's approval.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		Imported fill / soil / sand materials will be free of weeds, litter and contaminants.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
		Storage areas will be roofed in an impervious material, with a suitable overhang or side cladding. Rainwater run-off will be channelled away from the storage area as required.	Throughout Project	Once-off	C CECO	SM	ECO	EA EM PM
		Hydraulic fluids are stored in concrete lined surfaces with bund walls and must be designated in such a manner that any spillages can be contained and reclaimed without any impact on the surrounding environment.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		Hazardous and flammable substances must be stored and used in compliance with applicable	Throughout	Monthly	C CECO	SM	ECO	EA EM PM

		regulations and safety instructions.	Project					
		During servicing of vehicles or equipment, a suitable drip tray shall be used to prevent spills onto the soil, especially where emergency repairs are effected outside the workshop area.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		Leaking equipment shall be repaired immediately or be removed from site to facilitate repair.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
		Areas shall be monitored for spills and any spills shall be contained, cleaned and rehabilitated immediately.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		Any leaking containers shall be repaired or removed from site.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Servicing of Vehicles	None.						
Operational Phase								
1	Servicing of Vehicles	None.						

11.11.12 Tower Positions

TABLE 70: ENVIRONMENTAL MANAGEMENT MEASURES FOR TOWER POSITIONING.

Objectives	• Minimise damage to topsoil and environment at tower positions • Successful rehabilitation of all damaged areas • Prevention of erosion and no visible erosion scars three months after completion of the contract							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
1	Tower positioning	Refer to TRMSCAAC1 REV 3 SECTION 4.4.5 for specifications concerning tower sites on slopes.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Tower Positioning	Disturbance of topsoil on tower sites with severe slopes shall be minimised at all costs.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		At any tower sites where conventional foundations are installed, the Contractor shall remove the topsoil separately and store it for later use during rehabilitation of such tower sites.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
		During backfilling operations, the Contractor shall take care not to dump the topsoil in the bottom of the foundation and then put spoil on top of that.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM

		In accordance with the Conservation of Agricultural Resources Act, No 43 of 1983, slopes in excess of 2% must be contoured and slopes in excess of 12% must be terraced.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
		Contour banks shall be spaced according to the slope on tower sites. The type of soil shall also be taken into consideration.	Throughout Project	Monthly	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Tower Positioning	Re-seeding shall be done on disturbed areas as directed by the Environmental Control Officer.	Post construction	When necessary	C CECO	SM	ECO	EA EM PM
		Other methods of rehabilitation of tower sites may also be used at the discretion of the Environmental Control Officer, e.g. stone pitching, logging, etc.	When necessary	When necessary	C CECO	SM	ECO	EA EM PM
		A mixture of seed can be used provided the mixture is carefully selected to ensure the following: • Annual and perennial plants are chosen; • Pioneer species are included;	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM

		• All the plants shall not be edible; • Species chosen will grow in the area without many problems; • Root systems must have a binding effect on the soil; and • The final product should not cause an ecological imbalance in the area.						
		To get the best results in a specific area, it is a good idea to consult with a vegetation specialist or the local extension officer of the Dept of Agriculture. Seed distributors can also give valuable advice as to the mixtures and amount of seed necessary to seed a certain area. Re-seeding, as well as fencing in of badly damaged areas, will always be at the discretion of the Environmental Control Officer, unless specifically requested by a Landowner.	Post construction	When necessary	C CECO	SM	ECO	EA EM PM
Operational Phase								
1	Tower	None.						

	Positioning	

11.11.13 Claims from Damages

TABLE 71: ENVIRONMENTAL MANAGEMENT MEASURES FOR CLAIMS FROM DAMAGES.

Objectives	
	• Minimise complaints from Landowners • Prevent litigation due to outstanding claims by ensuring that claims are settled within one (1) month. • Successful completion of the contract and all Landowners signing release forms within 6 months of completion of the project.

No.	Activity	Mitigation Measures	Duration	Frequency	Responsibility	Accountable	Contacted	Informed
Pre-Construction Phase								
1	Claims from Damages	None.						
Construction Phase								
1	Claims from Damages	All damage to Eskom property shall be recorded immediately.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		The Environmental Control Officer should also keep a photographic record of such damage.	When necessary	When necessary	C CECO	SM	ECO	EA EM PM
		The date, time of damage, type of damage and reason for the damage shall be recorded in full to ensure the responsible party is held liable.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM

		All claims for damage should be directed to the Environmental Control Officer for appraisal.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		The Contractor shall be held liable for all unnecessary damage to Eskom property.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		A register shall be kept of all complaints from Landowners.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		All claims shall be handled immediately to ensure timeous rectification / payment.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Claims from Damages	None.						
Operational Phase								
1	Claims from Damages	None.						

11.11.14 Erosion, Donga and River Crossings

TABLE 72: ENVIRONMENTAL MANAGEMENT MEASURES FOR EROSION, DONGA AND RIVER CROSSINGS.

Objectives	• Minimise erosion damage on donga crossings and embankments. There should be no visible damage caused by construction activities. • Minimise impeding the natural flow of water • Minimise initiation of erosion through donga embankments							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
1	Erosion and donga Crossings	Crossing of dongas and eroded areas shall be thoroughly planned in accordance with TRMSCAAC1 REV 3 Section 4.4.1.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
		All structures shall be properly designed and drawings shall be available for reference purposes.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
2	River Crossings	Existing drifts and bridges may be used if the Landowner gives his consent. Such structures shall then be thoroughly examined for strength and durability before they are used.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
		New drifts and bridges shall only be constructed with the approval of Eskom and the Landowner and at the discretion of the Environmental Control Officer.	Prior to construction	Monthly	C CECO	SM	ECO	EA EM PM

		All structures constructed for access purposes shall be properly designed and drawings of such structures shall be available for record purposes.	Prior to construction	Once-off	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Erosion and Donga Crossings	Water diversion berms shall be installed at donga crossings to ensure runoff water on the servitude does not run into dongas and cause an erosion hazard.	Throughout construction	Monthly	C			
		Suitable erosion containment structures shall be constructed at donga crossings where required and viable.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		No unplanned / improperly planned cutting of donga embankments is allowed as this leads to erosion and degradation of the environment.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
2	River Crossings	No roads shall be cut through river and stream banks as this may lead to erosion causing siltation of streams and downstream dams.	Prior to construction	Throughout	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Erosion and Donga Crossings	None.						

Operational Phase		
1	Erosion and Donga Crossings	None.

11.11.15 Flora Management (including Vegetation Clearing, General, and Herbicides)

TABLE 73: ENVIRONMENTAL MANAGEMENT MEASURES FOR FLORA MANAGEMENT.

Objective	• Minimise damage to vegetation by only clearing 8m vegetation along the centre of the servitude for access purposes. • Keep servitude as natural looking as possible. • No vegetation interfering with structures and statutory safety requirements upon completion of the contract. • Minimise possibility of erosion due to removal of vegetation by not de-stumping vegetation on river and stream embankments. • Minimise removal of plant material on river and stream embankments. • Eradication of alien invader and densifier species that cause a fire hazard. • No visible herbicide damage to the vegetation along the servitude one year after completion of the contract due to incorrect herbicide use. • No litigation due to unauthorised removal of vegetation.							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
1	Vegetation Clearing	Vegetation clearing shall be done in accordance with ESKASABG3 REV 0 (Standard for bush clearance and maintenance within overhead power line servitudes) and the Vegetation	Prior to construction	Monthly	C CECO	SM	ECO	EA EM PM

		Management Guideline.						
		The removal of all economically valuable trees or vegetation shall be negotiated with the Landowner before such vegetation is removed.	Prior to construction	When necessary	C CECO	SM	ECO	EA EM PM
		The Contractor will remove plants containing any diseases and /or pests fro the site.	Prior to construction	Weekly	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Vegetation Clearing	Only an 8m strip may be cleared flush with the ground to allow vehicular passage during construction.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		The removal of indigenous plant material from the site or surrounding and adjacent land will not be allowed.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		No scalping shall be allowed on any part of the servitude road unless absolutely necessary.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		All trees and vegetation cleared from the site shall be cut into manageable lengths and neatly stacked at regular intervals along the line.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		No vegetation shall be pushed into heaps or left	Throughout	Throughout	C CECO	SM	ECO	EA EM PM

		lying all over the servitude.	construction					
		Vegetation clearing on tower sites must be kept to a minimum.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		Big trees with large root systems shall be cut manually and removed, as the use of a bulldozer will cause major damage to the soil when the root systems are removed.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		Stumps shall be treated with herbicide.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		Smaller vegetation can be flattened with a machine, but the blade should be kept above ground level to prevent scalping.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		Any vegetation cleared on a tower site shall be removed or flattened and not be pushed to form an embankment around the tower.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		No vegetation clearing in the form of de-stumping, scalping or uprooting shall be allowed on river and stream banks.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM

		Vegetation shall only be cut to allow for the passage of the pilot-cables and headboard.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		No vegetation clearing shall be allowed across ravines and gullies, as this vegetation will very rarely interfere with the clearance to the strung conductor.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		Trees and vegetation not interfering with the statutory clearance to the conductors can be left under the line.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		Dense vegetation under the line which could cause a fire hazard, particularly in the middle third of the span in the vicinity of the lowest point of the conductors, will be considered as a separate case.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		With permission of the landowner, the total servitude under the line and up to 5m outside the outer phases can be cleared.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		Protected or endangered species of plants shall not be removed unless they are interfering with a	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM

		structure.						
		Where such species have to be removed due to interference with a structure, the necessary permission and permits shall be obtained from Provincial Nature Conservation.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		All protected species not to be removed must be clearly marked and such areas fenced off if required.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		The use of herbicides shall only be allowed after a proper investigation into the necessity, the type to be used, the long-term effects and the effectiveness of the agent. Eskom's approval for the use of herbicides is mandatory (Contact Dr. Eugene van Rensburg—Vegetation Management).	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		Application shall be under the direct supervision of a qualified technician. All surplus herbicide shall be disposed of in accordance with the supplier’s specifications.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM

		Upon completion of the stringing operations and before handover, the servitude must be inspected and all vegetation interfering with the safe operation of the line shall be removed / cut down.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		All alien vegetation in the total servitude and densifiers creating a fire hazard shall be cleared and treated with herbicides. (Refer to the Vegetation Management Guideline attached). • The application shall be according to set specifications and under supervision of a qualified technician. • The possibility of leaching into the surrounding environment shall be properly investigated and only environmentally friendly herbicides shall be used.	Throughout construction	Weekly	C CECO	SM	ECO	EA EM PM
		It is recommended that a contractor for vegetation clearing should comply with the following parameters: • The contractor must have the necessary	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM

		knowledge to be able to identify protected species as well as species not to be interfering with; • The operation of the line due to their height and growth rate; • The contractor must also be able to identify declared weeds and alien species that can be totally eradicated; and • The contractor must be in possession of a valid herbicide applicators license.						
		The removal of protected vegetation and medicinal plants during construction must be done in consultation with the provincial environmental authorities, and the appropriate post-construction rehabilitation measures must be implemented in cooperation with the provincial environmental authorities.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
2	Harvesting of Medicinal	The removal of protected vegetation and medicinal plants during construction must be	Throughout	When	C CECO	SM	ECO	EA EM PM

	Plants	done in consultation with the provincial environmental authorities, and the appropriate post-construction rehabilitation measures must be implemented in cooperation with the provincial environmental authorities.	construction	necessary				
		Should Medicinal Plants be found on site, these plants will be demarcated and cordoned off.	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		Once demarcated, they will be removed and translocated to an established nursery. The plants shall be removed by a certified Nursery with experience in the handling and translocation of plants. The South African National Biodiversity Institute (SANBI) shall be contacted for assistance should a certified nursery not be available.	Throughout construction	When necessary				
3	Protection of Indigenous Vegetation	Removal of indigenous plant material from the site or surrounding and adjacent land will not be allowed;	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		Only indigenous vegetation is to be used in any landscaping which may be undertaken;	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
4	Search and Rescue of Endangered Plant Species	Should Protected or Endangered Plant Species be found on site they will be demarcated and cordoned off. An Ecological Management Plan will be compiled and submitted to DEAT for approval. The Ecological Management Plan will	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM

		include the following: • Ensure the persistence of the plant species; • Include a monitoring programme that monitors the size, stage structure and vigour of the plant species population and threats to the population; • Facilitate/augment natural ecological processes such as fire and herbivory; • Provide for the habitat and life history needs of important pollinators; • Minimise artificial edge effects (e.g. water runoff from developed areas and application of chemicals; • Include an ongoing monitoring and eradication programme for non-indigenous/alien invasive species; • Result in a Report to be submitted to the relevant authority (GDACE, DEAT, etc) • Where feasible, appropriate genetic material such as seeds or propagules of the plant species shall be collected and stored at a licensed facility.						

		• In situ conservation of Protected and Endangered Plant Species is preferable to ex situ conservation. Thus, should the plant species not "interfere" with the construction of a structure, the area surrounding the plant species shall be declared a "no-go" area as outlined in the Ecological Management Plan; and	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		• The area surrounding the plant species shall be declared a "No-go" area and a buffer zone will be applied as outlined in the Ecological Management Plan;						
5	Alien Plant Control and Monitoring	The Developer will be responsible for controlling all alien invasive species, as per the requirements of the Conservation of Agricultural Resources Act (CARA), during the contract and vegetation establishment period;	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		All exotic trees will be identified and marked;	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		Alien invasive plant material will be preferentially removed in entirety through mechanical means (e.g. chainsaw, bulldozer, hand-pulling of smaller specimens);	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM
		The exotic trees must be cut down leaving the stumps behind to ensure that soil erosion is	Throughout	Throughout	C CECO	SM	ECO	EA EM PM

		prevented; The trees can be chipped on site and the chips seeded with indigenous vegetation and spread over the site to allow for re-growth and to reduce erosion potential;	construction					
		Immediately after being cut, a herbicide solution must be applied to the exotic trees to ensure no further growth. The person applying the herbicide must have read and understood the instructions. Care must be taken that there is no spillage of solution in the wetland and that the correct protective equipment must be used;	After being cut - immediately	Throughout	C CECO	SM	ECO	EA EM PM
		If plants are not removed in entirety but cut-back and systematically treated with approved herbicides, then remaining plant will be monitored for re-growth / re-establishment;	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
		Herbicides used must be approved by authorities and as per the supplier's specifications;	When necessary	Once-off	C CECO	SM	ECO	EA EM PM
		Alien invasive plant material will not be stockpiled. All such material removed will be removed from the site and dumped at an approved disposal site;	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		If during the establishment period any noxious or excessive weed growth occurs, such vegetation	Throughout construction	When necessary	C CECO	SM	ECO	EA EM PM

		will be removed; and						
		It is the developer's responsibility to implement a monitoring programme that will be instituted to ensure that re-growth of alien invasive plants species does not occur, or that such re-growth is controlled.	Throughout construction	Monthly	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Traffic on rehabilitated areas.	If disturbed areas are left to rehabilitate naturally, they must be frequently monitored and interventions put in place immediately should it become necessary. Special attention must be given to the potential for soil erosion and the associated environmental degradation. It is also essential to undertake alien vegetation control and management.	Post construction	Monthly	C CECO	SM	ECO	EA EM PM
		No construction equipment, vehicles or unauthorised personnel will be allowed onto areas that have been re-vegetated	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		Only persons / equipment required for maintenance thereof will be allowed to operate on such areas.	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
2	Plant Material	All plant material used on site will be obtained from an approved nursery;	Post construction	Throughout	C CECO	SM	ECO	EA EM PM

		The Contractor will remove plants containing any diseases and/or pests from the site;	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		Propagation of suitable indigenous vegetation that is quick to establish such as grasses, should be encouraged in areas where vegetation has been removed	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		On planting, there will be sufficient topsoil around each plant to prevent desiccation of the root system. Where plants are stored on site prior to planting they will be maintained to ensure that the root systems remain moist; and	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		Each plant brought onto site will be handled and packed in an approved manner for that species or variety, and that all necessary precautions are taken to ensure that the plants arrive on the site in a proper condition for successful growth (e.g. good plant specimens chosen, disease and/or pest free, potting material weed free, plants covered during transportation, containers in good condition);	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
3	Reseeding of Disturbed Areas	All reseeding activities will be undertaken at the end of the dry season (middle to end September) to ensure optimal conditions for germination and rapid vegetation establishment;	Throughout construction	Wet Season	C CECO	SM	ECO	EA EM PM
		The seed mix will be approved by the ECO prior	Throughout	Wet Season	C CECO	SM	ECO	EA EM

		to seeding;	construction	once-off				PM
		Seeds should be covered by use of an agricultural roller or similar mechanism;	Throughout construction	Throughout	C CECO	SM	ECO	EA EM PM
		Inspect rehabilitated area at three monthly intervals during the first and second growing season to determine the efficacy of rehabilitation measures; and	Throughout construction		C CECO	SM	ECO	EA EM PM
		Take appropriate remedial action where vegetation establishment has not been successful or erosion is evident within the first two growing seasons.	Throughout construction		C CECO	SM	ECO	EA EM PM
4	Alien Plant Control and Monitoring	Alien plant control will be conducted as described in Section 5.14, for a period of two years after the rehabilitation phase is completed.	Throughout construction		C CECO	SM	ECO	EA EM PM
5	Soil and Land Capability	All excess building material and rubble must be collected and disposed of at a suitably registered landfill site.	Throughout construction		C CECO	SM	ECO	EA EM PM
		Soils must be ripped to refusal or a minimum of 300mm prior to seeding.	Throughout construction		C CECO	SM	ECO	EA EM PM
		All areas must be profiled to tie in with adjacent terrain. Where necessary suitable soil must be imported obtain a suitable profile.	Throughout construction		C CECO	SM	ECO	EA EM PM

		Suitable erosion control measures must be installed in areas where erosion may occur;	Throughout construction		C CECO	SM	ECO	EA EM PM
		Apply a suitable mixture of N:P:K fertiliser prior to seeding;	Throughout construction		C CECO	SM	ECO	EA EM PM
		Harrow the disturbed areas after spreading the topsoil and fertilizer uniformly;	Throughout construction		C CECO	SM	ECO	EA EM PM
		Rehabilitated and profiled areas must be inspected for erosion every three months for the first two years. Additional measures must be implemented to remediate erosion where it is observed.	Throughout construction		C CECO	SM	ECO	EA EM PM
Operational Phase								
1	Vegetation Clearing	None						

11.11.16 Fauna Management

TABLE 74: ENVIRONMENTAL MANAGEMENT MEASURES FOR FAUNA MANAGEMENT.

Objectives	• Minimise disruption of farming activities (No stock losses where construction is underway); • Minimise disturbance of animals, especially protected birds in the area; • Minimise interruption of breeding patterns of birds; and • No litigation concerning stock losses and animal deaths.							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
1	Planning	Construction planning must be undertaken prior to construction to ensure that it does not conflict with breeding seasons.	One week	Once off	C CECO	SM	ECO	EA EM PM
		The breeding sites of raptors and other wild bird species shall be taken into consideration during the planning of the construction programme.	One week	Once off	C CECO	SM	ECO	EA EM PM
		There are many instances where protected and endangered species of birds are nesting on our transmission towers without causing any problems to the flow of electricity or network stability. These birds are highly territorial and some have been using the same nests for many years, I.e. Black Eagle (Witkruisarend). They are guarded jealously by the landowners and are	When necessary	When necessary	C CECO	SM	ECO	EA EM PM

		monitored by many groups involved with ensuring their continued existence, including Nature Conservation officials at National and Provincial level. It is therefore imperative that the breeding sites of these birds are kept intact and that the breeding pairs are not disturbed especially where there are young nestlings. The Contractor shall take all the necessary precautions and it is recommended that sites on parallel existing lines be noted, i.e. tower numbers. This information must then be given to the avian specialist via the Environmental Advisor so that the necessary action can be taken timeously.						
2	Fencing	Ensure that suitable fencing is erected prior to the commencement of construction to ensure that live stock does not wonder into dangerous areas.	Throughout the project.	Weekly inspections.	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Construction	The Contractor's workforce will have to be very careful not to disturb the animals as this may lead to fatalities which will give rise to claims from the Landowners.	Throughout the project	Throughout	C CECO	SM	ECO	EA EM PM

		The Contractor shall under no circumstances interfere with livestock without the Landowner being present. This includes the moving of livestock where they interfere with construction activities.	Throughout the project	Throughout	C CECO	SM	ECO	EA EM PM
		Should the Contractors workforce obtain any livestock for eating purposes, they must be in possession of a written note from the Landowner.	Throughout the project	When necessary	C CECO	SM	ECO	EA EM PM
		Should any new sites or nests be found, during the construction process, that was not known or have been noted before, each site shall be assessed for merit and the necessary precautions be taken to ensure the least disturbance.	Throughout the project	When necessary	C CECO	SM	ECO	EA EM PM
		Bird collision prevention measures (Bird Flappers) should be installed on all the lines that form part of the application.	Throughout the project	When necessary	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Construction	Same as construction phase.						
Operational Phase								
1	Construction	Same as construction phase.						

11.11.17 Interaction with adjacent landowners

TABLE 75: ENVIRONMENTAL MANAGEMENT MEASURES FOR INTERACTION WITH ADJACENT LANDOWNERS.

Objectives	• Maintain good relations with Landowners; • No delays in the project due to Landowner interference; and • Landowner signs final release form.							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
1	Interaction with Land Owners	All negotiations for any reason shall be between Eskom, the landowners and the Contractor.	When necessary	Throughout	C CECO	SM	ECO	EA EM PM
		No verbal agreements shall be made. All agreements shall be recorded properly and all parties shall co-sign the documentation. It is proposed that a photographic record of access roads be kept.	Throughout the project	When necessary	C CECO	SM	ECO	EA EM PM
		It is required that the Contractor will supply one person to be the liaison officer (CECO) for the entire contract, and that this person shall be available to investigate all problems arising on the work sites concerning adjacent landowners (TRMSCAAC1 REV 3).	Throughout project	Ongoing.	C CECO	SM	ECO	EA EM PM
Construction Phase								

1	Interaction with Land Owners	The construction process will use the services of the Power Station Environmental Monitoring / Management Committee (EMC) for communication with the land owners.	Throughout the project	Monthly				
		Any claims instituted by the Landowners shall be investigated and treated promptly. Unnecessary delays should be avoided at all costs.	Throughout the project	When necessary	C CECO	SM	ECO	EA EM PM
		Landowners shall always be kept informed about any changes to the construction programme should they be involved. If Eskom's Environmental Control Officer is not on site the Contractor's Environmental Control Officer should keep the Landowners informed.	Throughout the project	Monthly	C CECO	SM	ECO	EA EM PM
		The contact numbers of the Contractor's ECO officer and the Eskom ECO shall be made available to the Landowners.	Throughout the project	Once-off	C CECO	SM	ECO	EA EM PM
		All contact with the Landowners shall be courteous at all times.	Throughout the project	Throughout	C CECO	SM	ECO	EA EM PM
		The rights of the Landowners shall be respected at all times and all staff shall be sensitised to the effect that we are working on private property.	Throughout the project	Throughout	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								

1	Interaction with Land Owners	Same as for construction phase above.						
Operational Phase								
1	Interaction with Land Owners	The rights of the Landowners shall be respected at all times and all staff shall be sensitised to the effect that we are working on private property.	Throughout the project	Throughout	C CECO	SM	ECO	EA EM PM

11.11.18 Noise / Working Hours

TABLE 76: ENVIRONMENTAL MANAGEMENT MEASURES FOR NOISE MANAGEMENT.

Objective	• To ensure that noise is managed in such a manner that no complaints are received.							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
None								
Construction Phase								
1	Noise	In order to prevent noise impacts resulting from construction activities, working hours are to be limited to weekdays between 7h00 to 17h00.	Throughout the project	Throughout	C CECO	SM	ECO	EA EM PM
		If certain construction requires work outside of these hours, all adjacent landowners have to be	When	Once – off, if	C CECO	SM	ECO	EA EM PM

		informed prior to any construction outside of the specified hours commencing.	necessary	necessary				
		If there are complaints about low frequency noise after the refurbishment, Eskom would have to get a noise expert to do measurements and recommend mitigation.	When necessary	If necessary				
Rehabilitation Phase								
1	Noise	Same as Construction Phase.						
Operational Phase								
1	Noise	Same as Construction Phase						

11.11.19 Infrastructure

TABLE 77: ENVIRONMENTAL MANAGEMENT MEASURES FOR INFRASTRUCTURE.

Objectives	• Ensure that existing infrastructure is taken into account during planning and project execution to eliminate impacts to existing infrastructure; and • To avoid claims and litigation.							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
1	Planning	Demarcate all existing infrastructure on site layout plans. Document condition of existing	One day	Monthly	C CECO	SM	ECO	EA EM PM

		infrastructure prior to construction.		Inspections				
Construction Phase								
1	Construction activities	All existing private access roads used for construction purposes, shall be maintained at all times to ensure that the local people have free access to and from their properties.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		Speed limits shall be enforced in such areas and all drivers shall be sensitised to this effect.	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Re-instate all roads and infrastructure.	Upon completion of the project all roads and infrastructure shall be repaired to their original state.	Post construction	Once-off	C CECO	SM	ECO	EA EM PM
Operational Phase								
1	Re-instate all roads and infrastructure.	Same as rehabilitation phase.						

11.11.20 Archaeology

TABLE 78: ENVIRONMENTAL MANAGEMENT MEASURES FOR ARCHAEOLOGY.

Objective	• Protection of archaeological sites and land considered to be of cultural value; • Protection of known sites against vandalism, destruction and theft; and • The preservation and appropriate management of new archaeological finds should these be discovered during construction.							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
1	Planning	Ensure all known sites of cultural, archaeological, and historical significance are demarcated on the site layout plan, and marked as no-go areas.	Throughout Project	Weekly Inspection	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Emergency Response	Should any heritage resources be exposed during excavation for the purpose of construction, construction in the vicinity of the finding must be stopped.	When necessary	Throughout	C CECO	SM	ECO	EA EM PM
		Should any heritage resources be exposed during excavation or be found on site, a registered heritage specialist must be called to site for inspection.	When necessary	Throughout	C CECO	SM	ECO	EA EM PM
		Should any heritage resources be exposed during excavation or be found on site, the relevant heritage resource agency must be informed about the finding;	When necessary	Throughout	C CECO	SM	ECO	EA EM PM

		Under no circumstances may any heritage material be destroyed or removed form site;	Throughout Project	Throughout	C CECO	SM	ECO	EA EM PM
		Should remains and/or artefacts be discovered on the site during earthworks, all work will cease in the area affected and the Contractor will immediately inform the Construction Manager.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
		Should any remains be found on site that is potentially human remains, the South African Police Service should also be contacted.	Throughout Project	When necessary	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
		Same as construction phase.						
Operational Phase								
		Same as construction phase.						

11.11.21 Residential Property

TABLE 79: ENVIRONMENTAL MANAGEMENT MEASURES FOR MANAGEMENT OF RESIDENTIAL PROPERTY.

Objectives	• Control actions and activities in close proximity to inhabited areas; • No complaints from Landowners; • No damage to private property.							
No.	**Activity**	**Mitigation Measures**	**Duration**	**Frequency**	**Responsibility**	**Accountable**	**Contacted**	**Informed**
Pre-Construction Phase								
1	Planning	All private residences will be demarcated on a site layout plan prior to construction phase commencing.	One day	Weekly Inspections	C CECO	SM	ECO	EA EM PM
Construction Phase								
1	Construction execution	The Contractor shall under no circumstances interfere with the property of adjacent landowners.	Throughout project	Weekly Inspections	C CECO	SM	ECO	EA EM PM
		If water is required, the Contractor shall negotiate with the relevant Landowner and a written agreement shall be drawn up (TRMSCAAC1 REV 3 section 4.8).	Throughout Project	Weekly Inspections	C CECO	SM	ECO	EA EM PM
Rehabilitation Phase								
1	Rehabilitation execution	Same as construction phase.						

Operational Phase		
1	Maintenance of the power line	Same as construction phase.

11.12 General Requirements during Construction

- Proper and continuous liaison between Eskom, the contractor and Landowners to ensure everyone is informed at all times.

- A physical access plan shall be compiled and the contractor shall adhere to this plan at all times. Proper planning when the physical access plan is drawn up by the Environmental Control Officer in conjunction with the Contractor shall be necessary to ensure access to all construction areas within the route corridor parameter.

- The adjacent landowners shall be informed of the starting date of construction as well as the phases in which the construction shall take place.

- The Contractor must adhere to all conditions of contract, including the Environmental Management Plan.

- Proper planning of the construction process to allow for disruptions due to rain and very wet conditions.

- Where existing private roads are in a bad state of repair, such roads' condition shall be documented before they are used for construction purposes. If necessary, some repairs should be done to prevent damage to equipment and plant.

- All manmade structures shall be protected against damage at all times and any damage shall be rectified immediately.

- Proper site management and regular monitoring of site works.

- Proper documentation and record keeping of all complaints and actions taken.

- Regular site inspections and good control over the construction process throughout the construction period.

- Appointment of an Environmental Control Officer on behalf of the Contractor to implement this EMP as well as deal with all Landowner related matters.

- Environmental Audits to be carried out during and upon completion of construction (at least three for the project).

- The Contractor shall not be released from site until all Landowners have signed off the release documentation to the satisfaction of the Eskom Environmental Control Officer.

11.13 Scheduling of Management Measures

The construction programme, showing the upfront management measures, and regular audit schedule is attached in Appendix M. It should be noted that the majority of the management measures are incident and control based. Therefore they will not occur in a management schedule but will rather occur in day to day operations. Where such measures occur these will be inspected during the audit activities provided for in the schedule.

11.14 Site Documentation / Monitoring / Reporting

The standard Eskom site documentation shall be used to keep records on site, in addition all non-compliances to the environmental authorisation will be reported to the Director: Environmental Impact Evaluation within 48 hours. All documents shall be kept on site and be available for monitoring and auditing purposes. Site inspections by an Environmental Audit Team may require access to this documentation for auditing purposes. The documentation shall be signed by all parties to ensure that such documents are legitimate. Regular monitoring of all site works by the Environmental Control Officer is imperative to ensure that all problems encountered are solved punctually and amicably. When the Environmental Control Officer is not available, the Contract Manager/Site Supervisor shall keep abreast of all works to ensure no problems arise. The following checklist shall be used as an environmental performance monitoring tool.

TABLE 80: CHECKLIST FOR MONITORING ENVIRONMENTAL PERFORMANCE ON SITE.

Person responsible for this deviation is:
Name:
Designation:
Reporting of environmental performance, problems and priorities are as follows:

Environmental monitoring of the deviation is according to the following schedule:

The following negative environmental impacts have been identified at the site:

Environmental Problem	**Location**

In order to solve (mitigate) the above identified negative environmental impacts, the following plan of action is to be implemented:

Problem	**Solution**	**Date to be Completed**

Monitoring (follow-up) plan of implemented remedial action: **Person responsible for environmental monitoring (follow-up) is:**
Name:
Designation:

Substation Name:
Monitoring Date:

Problem	Solution as implemented	Has the solution worked, if not, what actions are still to be taken

11.15 Environmental Contact Persons

- Vuledzani Thanyani (Land and Rights: Senior Environmental Advisor)

  Tel: 011 800 5601

- Joyce Mashiteng (Land and Rights: EIA Manager)

  Tel: 011 800 4623

- Vishnu Gopal: Project Manager

  Tel: 011800418

11.16 Emergency Numbers

- Eskom Control 0800 037566
- Police 10111

11.17 Oil Spill Contact Numbers

- Drizit Cell: 082 455 7832

APPENDIX A: LIST OF ABBREVIATIONS

APPENDIX B: EIA APPLICATION FORM

APPENDIX C: LIST OF POTENTIALLY AFFECTED LANDOWNERS

APPENDIX D: PROJECT LOCALITY MAP

APPENDIX E: DEAT AUTHORISATION REQUIREMENTS FROM FSR

APPENDIX F: INTERESTED AND AFFECTED PARTIES DATABASE

APPENDIX G: BACKGROUND INFORMATION DOCUMENT

APPENDIX H: SITE NOTICES

APPENDIX I: NEWSPAPER ADVERTISEMENTS

APPENDIX J: PERSONALISED LETTERS TO ALL INDIVIDUALS AND ORGANISATIONS ON THE MAILING LIST

APPENDIX K: ISSUES AND RESPONSE REPORT

APPENDIX L: MINUTES OF PUBLIC MEETING

APPENDIX M: EMP AUDIT INSPECTION PROTOCOL

APPENDIX N: EMP SCHEDULE

APPENDIX O: TRANSMISSION ENVIRONMENTAL POLICY (TPL41-435)

APPENDIX P: TRANSMISSION LINE TOWER AND LINE CONSTRUCTION

APPENDIX Q: STRINGING OF CONDUCTORS AND CONNECTION OF DROPPERS

APPENDIX R: SPECIALIST STUDIES