ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED CONSTRUCTION OF AN ESKOM GENERAL LANDFILL AND A HAZARDOUS WASTE STORAGE FACILITY IN LEPHALALE, LIMPOPO PROVINCE

ENVIRONMENTAL IMPACT REPORT

JULY 2009

DEAT Reference Number: 12/12/20/1399

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ABRREVIATIONS & ACRONYMS

BID	Background Information Document
DEAT	Department of Environment and Tourism
DEDET (DEDET)	Limpopo Department of Economic Development, Environment & Tourism
DSR	Draft Environmental Scoping Report
DWAF	Department of Water Affairs and Forestry
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
IEM	Integrated Environment Management
EMP	Environmental Management Plan
FSR	Final Environmental Scoping Report
NEMA	National Environment Management Act
I & APs	Interested and Affected parties
PPP	Public Participation Process
PoS	Plan of Study of EIA
SR	Scoping Report
ToR	Terms of Reference

EXECUTIVE SUMMARY

1 INTRODUCTION

Envirolution Consulting (Pty) Ltd has been appointed by Eskom Holdings (Pty) Ltd (hereafter Eskom) to undertake the Environmental Impact Assessment process for the proposed construction of a general landfill site, a temporary hazardous waste storage facility and a low hazardous waste cell. The Project aims at accomodating the waste that is generated from the construction of the Medupi Power Station and the proposed coal 3 and 4 powerstations. It is envisaged that the proposed landfill site and the hazardous waste storage facility will reduce the costs associated with the transport of waste from Lephalale (Limpopo Province) for disposal in Johannesburg (Gauteng).

2 ENVIRONMENTAL IMPACT ASSESSMENT AND PUBLIC PARTICIPATION PROCESS

In terms of the Environmental Impact Assessment (EIA) Regulations published in Government Notice No. R. 385 and No. R. 387 of 2006 and read with Section 24 (5) of the National Environmental Management Act (Act No 107 of 1998), the proposed development is subject to Scoping and EIA. An Environmental Impact Assessment was therefore conducted for the proposed landfill site and the hazardous waste storage facility. The findings of the Scoping phase process are included in this report. Interested and Affected Parties (I&APs) including surrounding and affected landowners, provincial, national and local governments departments, NGO's were involved during the Public Participation Process (PPP). The summary of the PPP that commenced on January 2009 is summarised as follows:

- Publication of a media advertisement in the local and regional newspapers, Mogol and Star Newspaper of 30 January 2009
- On-site notices advertising the EIA have been erected on site and at visible and accessible locations close to the site on 29th - 30th January 2009
- Distribution of letters by fax/post/email to I&APs from 29 January - 13 February 2009
- Distribution of Background Information Documents and Registration and Comment sheets by fax/post/email to I&APs from 29 January 2009 to todate
- Placement of Draft Scoping Report for review by public from 20 February - 20 March 2009
- Public and Focus group meetings held on 10 March 2009 (Scoping phase).
- DEAT Approval of the scoping report
- Placement of Draft Environmental Impact Report for review by public as of 26 May - 26 June 2009
- Public and Focus Group Meetings held on 10 June 2009 (EIR Phase)

3 KEY IMPACTS

Potential risks and key issues identified during the Scoping and EIA Phase of the project were based on consultation with the I&APs, through an internal process based on similar developments, specialist investigations, desktop studies and current state of the environment of the site. Specialists' investigations that were undertaken include:

- Ecological Asssesment (Floral, Faunal and AvifaunalAssessment);
- Avifaunal Assessment;
- Wetland Delineation;
- Geohydrological Assessment;
- Geotechnical Assessment;
- Visual Impact Assessment;
- Traffic Impact Assessment;
- Noise Impact Assessment
- Heritage Impact Assessment; and
- Social Impact Assessment.

Specialist findings are assessed and discussed in detail in this Environmental Impact Assessment Report (EIR).

4 ALTERNATIVES

The site proposed as the best alternative has been selected through a site selection and scoping exercise which involved all the relevant specialist during the Scoping phase. Three farms, namely Kromdraai (Site 1), Grootvallei (Site 2) and Hanglip (Site 3) were initially considered in the site selection process. A number of these sites were green field sites, meaning that no development has occurred on these sites. All of the sites belong to Eskom. Following a detailed site selection process supported with input from all the specialists, Grootvallei (Site 2 – for specific sub sites) was chosen as the best possible site.

Four alternative sites within this site were then identified. Shortly after this a new option became available,a portion of land located within the boundaries of the Matimba Power Station was identified. After some investigation it emerged that this option (to be known as Site 5), would be the preferred option. It is situated on an industrial site, in an area which is already disturbed. The area is already fenced off and located within the boundaries of Matimba power station.

Site 5 was therefore selected as the most appropriate site for the proposed landfill. Since the footprint of the landfill will be relatively small, three options within Site 5 were identified to be assessed in the Environmental Impact Assessment phase of the project. Alternatives that were considered for this project are described and assessed in Chapter 6 of this report.

5 CONCLUSIONS AND RECOMMENDATIONS

This EIR has provided a comprehensive assessment of the potential environmental impacts associated with the proposed construction of the landfill site at Matimba Power Station. These impacts have been identified by the EIA team (including specialists) and I&APs. The significance of the potential environmental (biophysical and social) impacts are summarised are discussed in chapter 5 of this report. Alternatives that were identified during the scoping phase were evaluated in detail during the EIA phase and recommendations made thereto. In general, the proposed development will have an impact of low significance provided that there is effective application of the mitigation measures proposed in this EIR. The majority of these impacts are easily mitigated and can be reduced to lower significance through appropriate design and mitigation measures. No unacceptably impacts of unacceptably high significance are foreseen once proper mitigation measures have been implemented.

1 CHAPTER 1 INTRODUCTION

Eskom Holdings Limited (Eskom) is proposing to establish a waste disposal site, a temporary hazardous waste storage facility and a low hazardous waste cell (hereafter, proposed development) on a site located in the Limpopo Province. It is proposed to accommodate waste from the Matimba Power Station, the Medupi Power Station presently under construction and the two Waterberg Coal Fired Stations being proposed. In addition, it will also cater for the waste that will be generated by an Eskom Contractor's Village (accommodation camp for appointed Eskom Contractors based in Lephalale) which will accommodate approximately 8000 contractor personnel. The nature and extent of this facility, as well as potential environmental impacts associated with the construction of a facility of this nature is explored in more detail in this Environmental Impact Report (EIR).

1.1 Need for the project

Eskom is presently constructing a 6 x 800MW (4 800MW total capacity) coal fired power station. The power station is known as the Medupi Power Station, located approximately 15km from the town of Lephalale in the Limpopo Province. The construction of the Medupi Power Station results in the generation of enormous amounts of waste (both general and hazardous). It should be noted that the waste disposal site which exists at the town of Lephalale is not licensed and therefore, in terms of Eskom's Safety Health and Environment (SHE) Policy and commitment to legal compliance, cannot currently be utilised for disposal of the waste generated. As a result Eskom is obliged to have all Medupi waste transported to the Gauteng area to ensure disposal at a licensed site.

During the construction of the Medupi Power Station, it is anticipated that construction waste will be generated until 2014, after which the station will become operational. Approximately half of the construction and operational waste will be hazardous waste, and half general waste. It is anticipated that the existing Matimba Power Station will generate the same amount of waste, with a 50% split between hazardous and general waste for the remainder of its operating life, whereas the two proposed Waterberg Coal Fired Power Stations are anticipated to generate waste volumes that are slightly higher than that of the Medupi Power Station. The Waterberg Power Stations are anticipated to have a life span of approximately 50 years. The total anticipated waste generated from the four power stations over their total life i.e. 50 years, is expected to be approximately 1 200 000m^3 of waste split between general and hazardous waste.

Given the approximate waste volumes that will be generated from the four power stations and the contractor's village, the proposed development is a strategic response to address the following:

- current waste management challenges facing Eskom in the Lephalale area,
- Adherence to the legal requirements, and
- Combating current operating costs.

1.2 Background to the project

As a precursor to initiating an Environmental Impact Assessment (EIA) process, Eskom embarked on a site selection process. This site selection process was to undertake site identification and to determine areas suitable for the accommodation of a waste disposal facility. This site selection process considered the Department of Water and Forestry Affairs (DWAF) Guideline document requirements to ensure that the site was optimally placed.

It was acknowledged that a proactive identification of a location/site appropriate for the introduction of a waste disposal facility would enhance the viability of the project and inform the scope of the EIA.

1.3 Project overview

Through this site selection process Eskom - owned land which falls within the Lephalale Local Municipality in the Limpopo Province (depicted in **Figure 1.1 and Figure 1.2**) was identified by Eskom as potentially suitable for the proposed development and put forward for consideration within an EIA. The area (approximately 3000 ha in extent) comprised the farms:

- Hanglip 508 LQ;
- Kromdraai 513LQ; and
- Grootvallei 515 LQ.

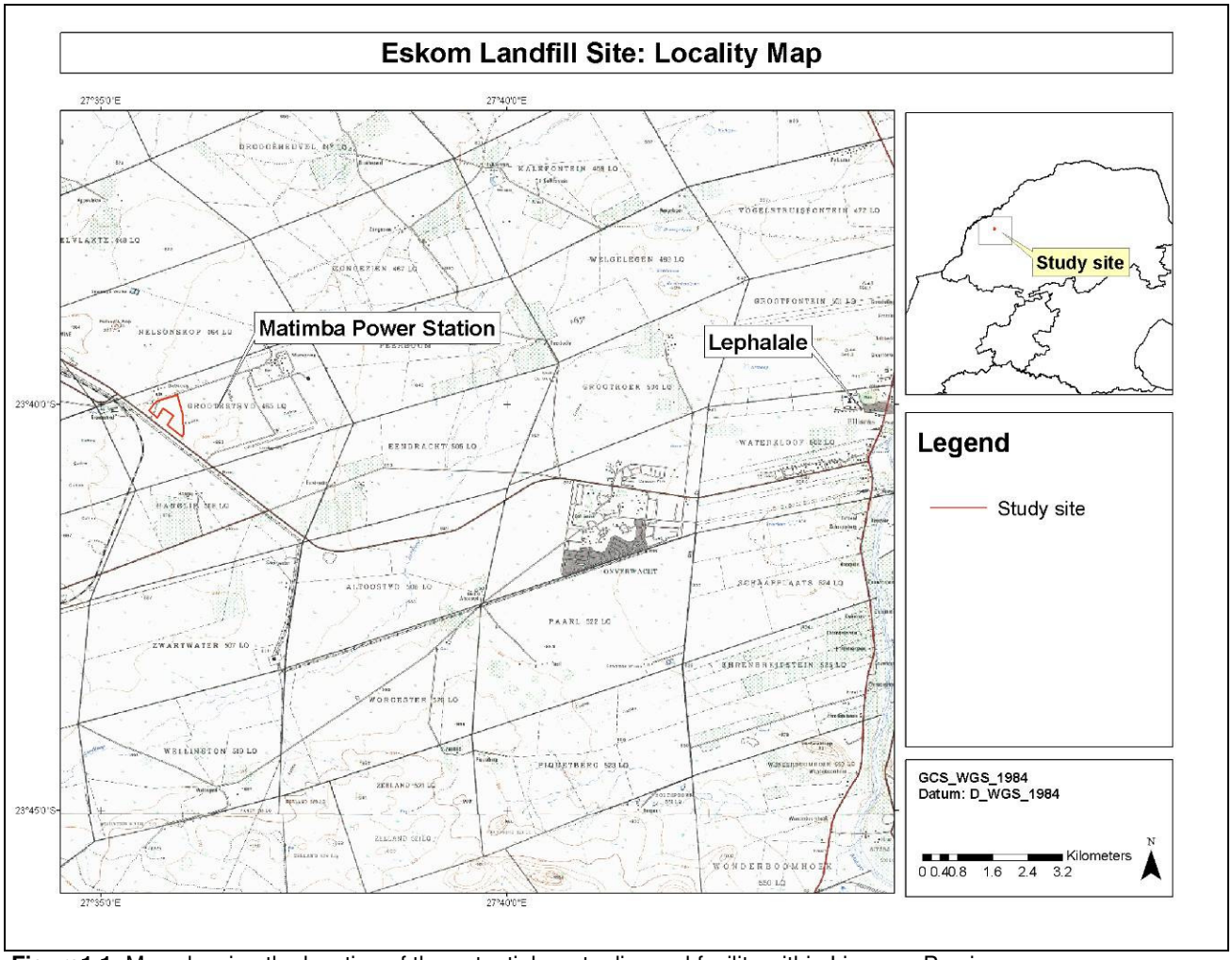

Figure1.1: Map showing the location of the potential waste disposal facility within Limpopo Province.

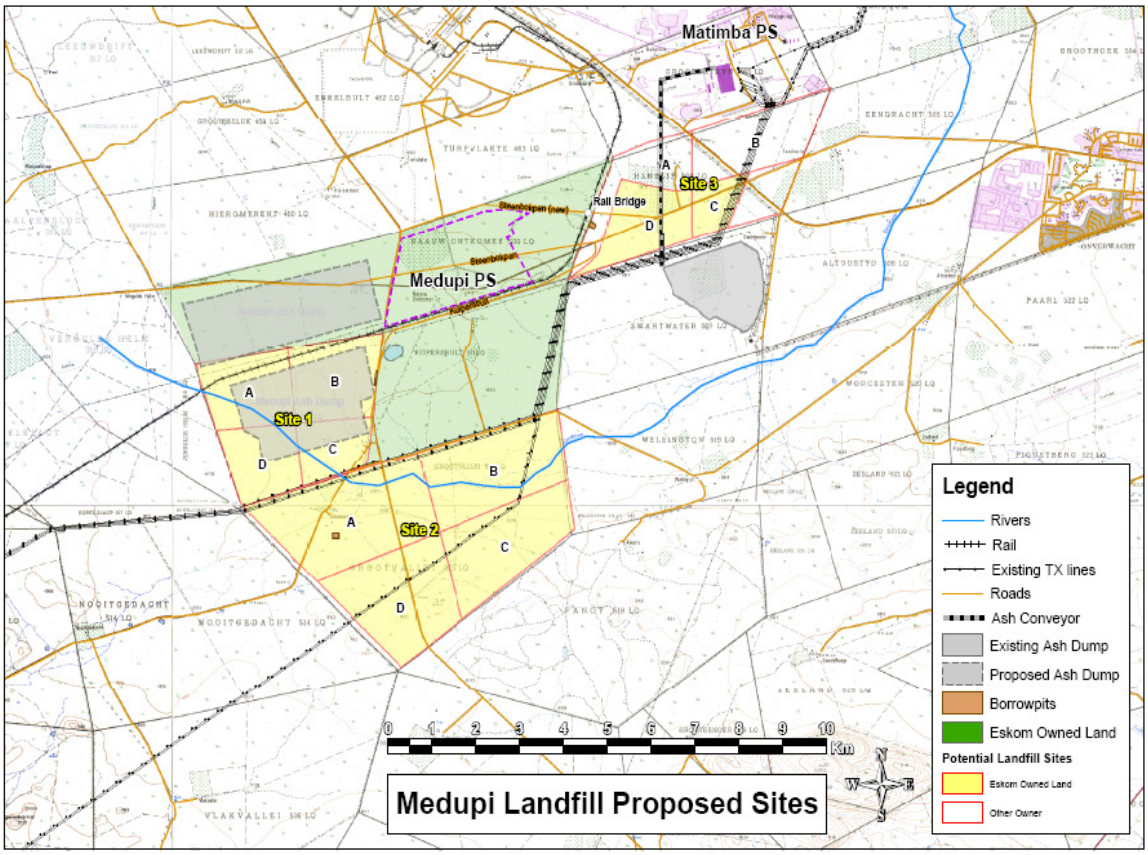

Figure 1.2: Farm Portions subdivided into quadrants. Three portions of land highlighted on the map were originally provided by Eskom which were assessed to choose the preferred site.

Eskom subsequently introduced an additional site that lies within the Matimba Power Station property *viz*. Grootestryd LQ 465 (**Figure 1.3**). This site was comparatively evaluated with the other sites by all the specialists during the scoping phase of the EIA, the result being that the farms Hanglip, Kromdraai and Grootvallei were scoped out in favour of Grootestryd. Grootestryd is known as Site 5. It is situated on an industrial site, in an area which is already disturbed. The area is fenced off and located in the boundaries of Matimba power station.

Site 5 was therefore selected as the most appropriate site for the proposed landfill. Since the footprint of the landfill will be relatively small, three options within Site 5 were identified to be assessed in the Environmental Impact Assessment phase of the EIA for the project. Alternatives that were considered for this project are described and assessed in Chapter 6 of this report. Please refer to **Figure 1.3** for the individual sites that were considered within Site 5.

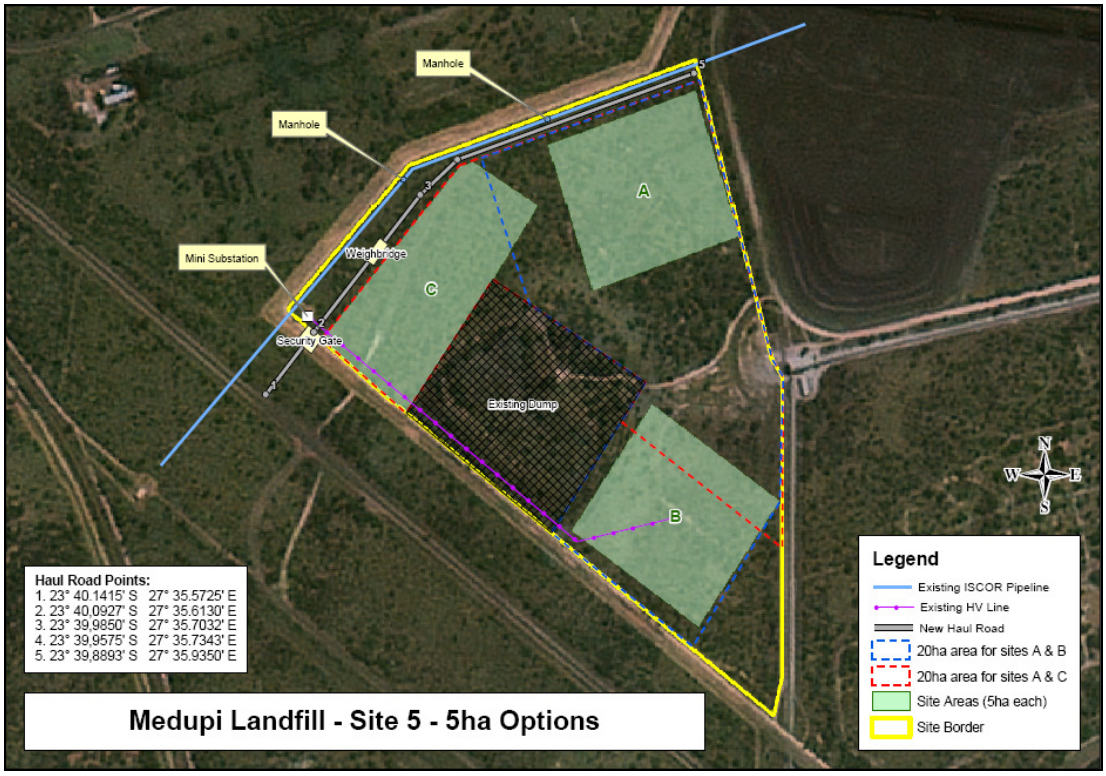

Figure 1.3: A map illustrating the spatial distribution of the three options (each approximately 5 ha in extent) evaluated during the EIA Phase.

As shown in **Figure 1.3**, it is envisaged that a 5 hectare (ha) footprint area will be required for the waste disposal site and a temporary hazardous waste storage facility. However a total of a 20 ha area will require authorisation to include the associated infrastructure. Grootestryd was then divided into three portions of approximately twenty (20) ha each within which the 5 ha footprints will be located. These three areas within the Matimba site thus became the subject for evaluation in this EIR. Each specialist was requested to base their evaluations on these three portions.

The infrastructure associated with the waste disposal site will include:

» A facility within which to temporary store hazardous waste for transfer before disposal;
» A low hazardous waste cell designated for the disposal of low hazardous waste;
» Overhead electrical power lines;
» An access/haul road to the site from the main roads;
» Water supply;
» Sewage and sanitation;
» Internal access road to the waste disposal site, temporary hazardous waste storage facility and office;
» small office building at the facility entrance;
» a waste sorting facility or area for recyclables; and

» Strict security control in order to keep jobless people out of the area (burning of tyres, plastics, etc), is generally a problem at waste disposal sites.

The overarching objective of the site selection process was to ensure that the waste facility is appropriately sited based on the specialists findings specifically the geo-technical and geo-hydrological requirements. The selection process was undertaken in a manner that allowed for the minimisation of infrastructure, operation and maintenance costs, as well as social and biophysical impacts**.** Local level environmental and planning issues were not assessed in detail through the site selection process.

The detailed design, footprint and sizes of the associated infrastructure will be confirmed when the engineering design requirements are finalised. The scope of the waste disposal site, including details of all elements of the project (for the construction, operation and decommissioning phases) is discussed in detail in this Environmental Impact Report.

1.4 Requirements for an Environmental Impact Assessment Process

In terms of the National Environmental Management Act (NEMA) EIA Regulations of 2006, Government Notice No R 387 of 2006, the proposed construction of the landfill site and the hazardous waste storage facility are regarded as listed activities and therefore require environmental assessment prior to authorisation. NEMA is national legislation that provides for the authorisation of certain controlled activities known as “listed activities”. The listed activities relevant for the project are highlighted in **Section 2** of this report.

In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these listed activities must be considered, investigated, assessed and reported on to the competent authority (the decision-maker) charged by NEMA with granting of the relevant environmental authorisation. Since Eskom is a parastatal, the competent authority is the national Department of Environmental Affairs and Tourism (DEAT).

An application for authorisation has been accepted by DEAT. The Application Reference number is **12/12/20/1399**). The EIA was conducted in accordance with Section 24 of the NEMA. The Act requires that an EIA be undertaken in order to inform the authorisation process for a listed activity. Government Notice R. 385 of 2006, published in terms of Chapter 5 of NEMA, defines the manner in which the EIA is to be undertaken. Guideline documents have been published by the Department of Environmental Affairs and Tourism (DEAT) and these provide guidance in implementing the EIA Regulations of 2006. These guideline documents will be used as reference documents as the Limpopo Province has not issued any provincial guidelines pertaining to Section 24 of NEMA.

1.5 Objectives of the Environmental Impact Assessment Process

The Scoping and EIA process for this proposed development has been undertaken in accordance with Government Notice R. 385of 2006, published in terms of Chapter 5 of NEMA.

The objectives of the Environmental Impact Report (EIR) include the following:

- Provide the Interested and Affected Parties as well as the regulatory authorities with enough information as to allow for decision making;
- Ensuring that stakeholders are given the opportunity to verify that the issues they have raised during the process have been recorded and considered;
- Present the findings of the specialist investigations;
- Present all alternatives considered and
- Integrate the findings of the impact assessment in order to mitigate any negative impacts and enhance any positive impacts.

This Draft Impact Assessment Report provided stakeholders with an opportunity to verify that the issues they have raised through the EIA process to date have been captured and considered, and provides a further opportunity for additional key issues for consideration to be raised. The Final Environmental Impact has incorporated all issues and responses raised during the public review of the draft Report prior to submission to DEAT.

The Environmental Impact Report (EIR) consists of the following chapters:

- **Chapter 1: Introduction**

The section provides background to the proposed waste disposal site project and the EIA.

- **Chapter 2: EIA Approach**

This section will describe the methodology and the approach that was employed during the Environmental Impact Assessment.

- **Chapter 3: Scope of Work**

This section provides a detailed project description including the associated infrastructural design specifications.

- **Chapter 4: Description of the Affected Environment**

This chapter describes the key elements of the socio-economic and bio-physical environment. The chapter incorporates the findings of all specialist studies that were undertaken during the Environmental Impact Assessment phase of the EIA.

- **Chapter 5: Assessment of Impacts**

The chapter describes all the potential impacts associated with the construction and operation of the proposed development identified through various specialist investigations

- **Chapter 6: Project Alternatives**

The chapter evaluates and also addresses design options that were considered in order to ensure that the proposed project is technically feasible without significantly impacting on the bio-physical and socio-economic environment. Limitations and advantages of each identified project alternatives will be outlined.

- **Chapter 7: Conclusion and Recommendations**

The chapter highlights the key conclusions drawn from the Environmental Impact Assessment and further provides recommendations based on the investigations undertaken during the Impact Assessment phase.

1.6 Details of Envirolution Environmental Expertise to conduct Scoping Processes

The project team comprises Envirolution Consulting as the lead consultants and various technical specialists and Social Impact Consultants, Technical, Peer and Legal Review advisors that will provide technical input and advice throughout the project.

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1.6.2 Environmental Assessment Practitioner

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Ms. Nkhensani Khandlhela heads the project team and acts as the Project Manager for all phases of the project. Nkhensani holds a M.Sc. (Geographical Sciences). She is an Environmental Scientist with 5 years of experience. Nkhensani specialises in Integrated Environmental Management (IEM), Environmental Impact Assessments (EIAs), rural development, land use issues and socio-economic surveys. Nkhensani has been a project scientist for various EIA's in KwaZulu Natal, Eastern Cape and Gauteng provinces of South Africa. Nkhensani is currently a Project Manager and Environmental Scientist at Envirolution Consulting.

1.6.3 Appointed specialists

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Specialist Field:	**Noise Pollution**
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Specialist Field:	**Wetland Assessment**
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1.6.4 Authority

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2 CHAPTER 2 EIA APPROACH

(The National Environmental Management Act (NEMA) EIA regulations of 2006) identify two separate administrative processes for EIAs, depending on the nature of the activity. A Basic Assessment process is identified for those activities that have less of a possible detrimental impact to the environment. A Scoping and EIA process is necessary for those activities, which are identified as having more significant negative detrimental impact on the environment.

In terms of Government Notice R. 387 of 2006, a Scoping and EIA process is required for this project. The following sections summarise the scoping and the EIA activities that have been undertaken.

2.1 Phase 1: Scoping Phase

2.1.1 Pre-Application Meeting with DEAT

A pre-application meeting was held with Mr. Reggie Nkosi of DEAT on 04 December 2008. The purpose of the meeting was to introduce the project to DEAT and to determine DEAT's requirements for the project. Please refer to **Appendix A** for the Minutes, Agenda and Attendance Register for the Pre-Application Meeting.

2.1.2 Application forms

An application form (**Appendix A**) was completed by Envirolution Consulting and submitted to DEAT on 18 December 2008. The form was submitted together with a Declaration of Interest. DEAT responded to the application in a letter dated 15 January 2008 in which it was indicated that the application was accepted and had been issued with the following reference number: **DEAT** Reference Number**: 12/12/20/1399.**

2.1.3 Public Participation Process (Scoping Phase)

A Public Participation Process (PPP) consistent with Chapter 6 of Government Notice R. 385 of 2006 was undertaken for the proposed development. This included identification of Interested and Affected Parties (I&APs) and the compilation of an I&AP database (**Appendix B**[1]), the placement of site notices at visible and accessible locations close to the site (**Appendix B**[2]) and a newspaper advertisement in a local and regional newspaper (**Appendix B**[3]). The I&AP registration period was 15 days based on permission from DEAT. Background Information Documents (BIDs) (**Appendix B**[4]) were also handed out to identified I&APs located in close proximity to the proposed development. The BID was also distributed on an on-going basis from January 2009 to March 2009. After finalisation of the draft Scoping Report it was made available for public review for 30 days. The purpose of the public review period was to identify any additional environmental issues and concerns for inclusion in the Scoping Report that the environmental practitioners may not have identified. A public meeting and focus group session was held on 10 March 2009.

2.1.4 Authority review and approval of the Scoping Report

In accordance with the requirements of NEMA EIA Regulations, a Scoping Report and a Plan of Study for the proposed project were compiled and submitted to the DEAT on 26 March 2009. In addition to the review of the report, the DEAT assessing officer, Eskom and Envirolution Consulting Project Manager undertook a site inspection on 07 April 2009. DEAT reviewed and accepted the Scoping Report and the Plan of Study for EIA on 07 May 2009. A copy of the approval letter is attached in **Appendix A** of this report.

2.2 Phase 2: Environmental Impact Report

This report represents the EIR for the project and builds on the findings of the Scoping Phase. The EIR contains all information that is necessary for the competent authority to consider the application and to reach a decision. It details the process followed during the EIA Phase including details of the PPP and an assessment of each identified potentially significant impact. A draft Environmental Management Plan (EMP) for the mitigation of impacts is provided within this EIR. The EMP will attempt to mitigate the construction- and operational related impacts of the proposed waste disposal site and the temporary hazardous waste facility.

After finalisation of the draft EIR it was made available for public review for 30 days. A public meeting and focus group meetings were held on 10 June 2009 at Lephalale Palm Park Hotel.

All I&AP comments were incorporated into the EIR. This EIR will be submitted to DEAT for their review. Based on the findings of the EIR, DEAT will advise on any other requirements. Should there be no further requirements DEAT will issue authorisation and the conditions thereto.

2.2.1 Consideration of Alternatives

The NEMA EIA Regulations (2006) require that alternatives be considered. In the context of this project, a number of alternatives were investigated for the location of the waste disposal facility. The consideration of alternatives also requires that the 'No Go' alternative be included.

The site proposed as the best alternative has been selected through a site selection and scoping exercise which involved all the relevant specialists. Three farms, namely Kromdraai (Site 1), Grootvallei (Site 2) and Hanglip (Site 3) were initially considered in the site selection process. A number of these sites were green field sites, meaning that no development has occurred on these sites. All of the sites belong to Eskom. Following a detailed site selection process supported with input from all the specialists, Grootvallei (Site 2 – for specific sub sites) was chosen as the best possible site.

Four alternative sites within this site were then identified shortly after this a new option became available. It was a portion of land located within the boundaries of the Matimba Power Station. After some investigation it emerged that this option (to be known as Site 5), would be the preferred option. It is situated on an industrial site, in an area which is already disturbed. The area is already fenced off and located within the boundaries of Matimba power station.

Site 5 was therefore selected as the most appropriate site for the proposed landfill. Since the footprint of the landfill will be relatively small, three options within Site 5 were identified to be assessed in the Environmental Impact Assessment phase of the project. Alternatives that were considered for this project are described and assessed in **Chapter 6** of this report.

2.2.2 Specialist studies

The EIA process has included a number of specialist investigations into the areas of potentially significant impacts identified by Envirolution Consulting and during the public participation process. Specialists' investigations that were undertaken include:

»Ecological Assessment (Floral, Faunal and Avifaunal Assessment);
»Wetland Delineation;
»Geohydrological Assessment;
»Geotechnical Assessment;
»Visual Impact Assessment;
»Transportation Assessment;
»Noise Impact Assessment;
»Heritage Impact Assessment; and
»Social Impact Assessment.

Specialist findings are assessed and discussed in detail in **Chapters 4** and **5** of this report. Specialist investigation reports are attached in **Appendix C.** In order to comply with the specialist report requirements as per Section 33 of the EIA Regulations **(**Govt. Notice No. R 385 of 2006**)** in terms of the National Environmental Management Act 1998 (Act No. 107 of 1998), each specialist was provided with a checklist (prepared by Envirolution Consulting). The purpose of the checklist was to confirm that the specialist investigations during the Impact Assessment phase were based on the NEMA EIA requirements. An example of the checklist with the declaration of independence is appended to all specialist reports.

In addition, a specialist integration meeting was held on 14 May 2009 at the Envirolution Consulting offices. The main objective of the meeting was to integrate the findings of all specialists and recommend the most suitable site for the location of the proposed development based on the outcome of the specialist investigations undertaken during the EIA phase.

2.2.3 Public Involvement and Consultation (EIA Phase)

Public participation is the involvement of all parties who potentially have an interest in a development or project, or may be affected by it. The principal objective of public participation in an Environmental Impact Assessment (EIA) process, in particular this EIA process, is to inform and enrich decision-making.

The following terminology related to the PPP will be used interchangeably in this section and is briefly defined as follows:

» *Interested and Affected Party (I&AP) and stakeholders,* - refers to individuals or groups concerned with or affected by an activity and its consequences. These may also include the authorities, local communities, investors, customers, consumers, environmental interest groups and the *general public.*

» *Key stakeholder*- The term therefore includes the proponent, authorities and will refer to group of individuals who have a direct or vested interest in the particular development that is being proposed.
» *Authority* refers to the national, provincial or local authorities that have a decision-making role or interest in the proposal or activity. The term includes the lead authority, as well as other authorities.
» *Focus group* refers to a group who have a significant common interest around a particular issue or geographic area, e.g. farmers associations, conservation/ecotourism associations, ratepayers associations, etc.
» *Workshop* refers to a gathering that involves exchange of information between stakeholders, which provides an opportunity for stakeholders to raise concerns and comment on the impacts and merits of a proposal or activity before a decision is made.

The following public participation process which commenced on Thursday, 29 January 2009 to date was undertaken for the project.

- **Public Involvement – Scoping phase**

(a) Newspaper Advertisements

An advertisement notifying the public of the EIA process and requesting Interested and Affected Parties (I&APs) to register with, and submit their comments to Envirolution Consulting was placed in *The Star* newspaper (regional) and *Mogol Post* newspaper (local) on Friday, 30 January 2009. Copies of the advertisement are included in **Appendix B[3].**

(b) Site notices

To inform surrounding communities and immediately adjacent landowners of the proposed development, Envirolution Consulting erected twelve (12) site notices within the boundaries of the proposed development and in strategic positions (roadsides, entrances to main buildings) on 29 January 2009. Please refer to **Appendix B[2]** for examples of the site notice that was placed.

(c) I&APs database and notification of identified I&APs

An I&APs database was developed (see **Appendix B[1]**). This database included identified key stakeholders and the I&APs registered for the project. The database was expanded through networking as new I&APs responded to the advertisement placed in the newspaper for the project. The database totals approximately 525 I&APs and key stakeholders. Identified I&APs representing the various sectors were directly informed of the proposed development by e-mail, post, fax and also through the distribution of the Background Information Documents (BID) from 29 January 2009 to 15 March 2009. The key organisations and stakeholders in the public participation process are:

» Limpopo Department of Economic Development, Environment & Tourism (DEDET);
» Lephalale Municipality;
» Department of Water Affairs and Forestry (Limpopo and Pretoria);
» Department of Mineral and Energy Affairs;
» Department of Agriculture;
» Department of Transport;
» Department of Health;
» Department of Land Affairs;
» Farmers Associations and Unions;
» Affected property owners and direct neighbours
» Ward Councillors;
» Business Associations;
» Residents; Association; and
» Non-governmental organizations.

The Background Information Document (BID) (translated into Sepedi and Afrikaans) was compiled and forwarded to I&APs registered on the database and was also distributed as knock and drops to affected property owners located in the vicinity of the proposed landfill site on Thursday, 29 January 2009 (refer to **Appendix B[6]** for the Knock and Drop Register). The BID was also handed to the local councillors in Lephalale to distribute copies to their members, other organisations and I&APs they are aware of.

The BID introduced the proposed project and contained background information on the development proposal, the applicant, environmental assessment practitioners and proposed process to be followed. Refer to **Appendix B[4]** for a copy of the BID and the comment sheet sent to the identified I&APs. An example of an I&AP Notification letter that was sent and the correspondence with and from I&APs are attached in **Appendix B[7]**.

(d) Concerns raised by I&APs

I&AP's completed registration forms and forwarded comments by email, fax, post and telephonically. I&APs will be given an opportunity to raise further concerns and queries in open public meetings that are to be held during the Scoping phase. Comments that were received from I&APs during the public review of the draft scoping report were captured on a stakeholder database, acknowledged by personal letters and responded to by Envirolution Consulting.

(e) Placement of Draft Scoping Report for public review

The draft scoping report was lodged at the Lephalale Municipality Library for public review. Envirolution Consulting had also placed copies at the Matimba and Medupi power stations for review by Eskom employees based at these places.

The draft scoping report was also placed on the Envirolution Consulting website (www. envirolution.co.za). I&APs were informed about this placement through direct contact and were given an opportunity to review the documentation. After the initial 15 day notification period, a 30 day period was allowed for review and submission of comments. The report was available for review from 20 February 2009 to 20 March 2009.

(f) Public and Focus group meetings

I&APs were invited to the Public and Focus group meetings held at Machauka Lodge, in Lephalale on the 10th March 2009. During the EIA phase, additional public and focus group meetings were held on 10 June 2009 at Palm Park Hotel. The objective of the meetings were to present a background to the project and allow I&APs to raise any initial issues and concerns prior the public comment period ending. Copies of the presentation and minutes and attendance registers for the focus group and public meetings that were held are attached in **Appendix B[8]**. The issues raised in these meetings are reflected in an Issues and Response Report that is attached to this Report (**Appendix B5**). These meetings included a presentation by the Environmental Consultants.

The objective of the public meetings was to formally present the draft scoping report to the public in order to give I&APs an opportunity to provide feedback on the findings of the scoping report. Stakeholders and I&APs were requested to provide comment on the documentation by the end of the comments period.

2.2.4 Identification and Recording of Issues and Comments

Key issues of concern raised by I&APs during the project announcement, review of draft Scoping Report and the meetings held are listed along with the I&AP's name and means of communication in the Issues Response Report in **Appendix B[5].**

2.2.5 Assessment of issues identified through the Scoping Process

- **Public Involvement – EIA Phase**

The PPP was undertaken in accordance with the Plan of Study for EIA. The database of I&APs compiled during the Scoping phase was updated throughout the EIA Phase. A summary of comments received, a summary of issues raised by the registered I&APs, the date of their receipt and responses of the EAP to those comments are provided in the Issues Response Report. All copies of any representations, and comments received have also been included in this report.

This EIR document was made available for review by interested and affected parties for a period of 4 weeks (26 May to 26 June 2009). During the review period one (1) focus group meeting and one (1) public meeting was held to discuss the draft document and obtain comments thereof. Comments received during the review period and from the public meeting have been incorporated into this Final EIR. No significant comments were submitted during these meetings.

2.2.6 Authority Review of the EIR

After the public review, this EIR will be submitted to DEAT for their review and consideration. DEAT as the competent authority for the listed activity, must within 30 days of receipt of the report, in writing, accept the report, if no amendments are required or shortcomings identified therein.

The authority can also reject the EIR for not addressing legislative procedures and requirements if any of the required EIA steps were not undertaken. In terms of Regulation 31 (3) of GN R. 385 of 2006, the EIR may be amended and resubmitted by the EAP should it be rejected. On receipt of the amended EIR, the competent authority will then reconsider the application. Should the EIR be rejected, the amended EIR will then be made available for public review and comment again prior to submission to DEAT.

The authority may also advise the EAP of matters that may hinder the success of the EIA application or matters that may prejudice the success of the application. DEAT will issue an authorisation or a refusal to authorise and communicate the decision to the EAP and the applicant.

2.2.7 Appeal Period

After a decision has been reached by DEAT, Government Notice R. 385 of 2006 makes provision for any affected person to appeal against the decision. Within 10 days of being notified of the decision by the competent authority, the appellant must lodge a notice of intention to appeal the decision. The appeal itself must be submitted to DEAT within 30 days of the lodging of the notice of intention to appeal. An appeal panel may be appointed at the discretion of the delegated organ of state to handle the case and it would then submit its recommendations to that organ of state for a final decision on the appeal to be reached. Envirolution Consulting will communicate the decision of DEAT and the manner in which appeals should be submitted to all I&APs as soon as reasonably possible after the DEAT decision has been received.

2.3 Regulatory and Legal Content

The overarching environmental legislation for the management of the environment in South Africa is the National Environmental Management Act, 1998 (Act No. 107 of 1998 "NEMA"). Its preamble states that sustainable development requires the integration of social, economic and environmental factors in the planning, implementation and evaluation of environmental decisions to ensure that development serves present and future generations.

Chapter 5 of NEMA makes provisions for Regulations to be formulated and published. In April 2006, new EIA Regulations were promulgated and became effective from July 2006. The purpose of these Regulations is "to regulate procedures and criteria as contemplated in Chapter 5 of the National Environmental Management Act for the submission, processing, consideration and decision of applications for environmental authorisation of activities and for matters pertaining thereto."

These EIA regulations replaced the Environmental Impact Assessment Regulations promulgated under the Environment Conservation Act, 1989 (Act No.73 of 1989 "ECA"). One of the major differences between the old and new Regulations is the strict adherence to timeframes required under the new Regulations.

Section 24 (F) of the NEMA prohibits a listed activity from commencing prior to the authorisation thereof by the competent authority. A listed activity is defined in Government Notice No. R. 385 of 2006 as follows:

"(a) *an activity identified in Government Notice No. R. 386 and No. R. 387 of 2006 as a listed activity or (b) in any other notice published by the Minister or MEC in terms of section 24D of the Act as a listed activity or specified activity."*

These activities are listed as a result of their potential to have a significant detrimental impact on the environment. The main listed activities for this project identified in Government Notice R.387 of 2006 are summarised in **Table 2.1** as follows:

Table 2.1: Listed activity for the proposed development as identified in NEMA Regulations (2006**)**

No & date of relevant notice	Activity No (in terms of relevant Regulation/ notice)	Description of listed activity
Government Notice R386 (April 2006)	1(k)	The construction of facilities or infrastructure including associated structures for the bulk transportation of sewage and water, including storm water, in pipelines with an internal diameter of 0.36 metres or more; or a peak throughput of 120 litres per second or more
Government Notice R386 (April 2006)	1(l)	The transmission and distribution of above ground electricity with a capacity of 120 kilovolts or more"
Government Notice R386 (April 2006)	1(m)	Any purpose in the one in ten year flood line of a river or stream, or within 32 metres from the bank of a river or stream where the flood line is unknown, excluding purposes associated with existing residential use, but including canals; channels; bridges; dams; and weirs.
Government Notice R386 (April 2006)	1(p)	The temporary storage of hazardous waste.
Government Notice R386 (April 2006)	7	The above ground storage of a dangerous good, including petrol, diesel, liquid petroleum gas or paraffin, in containers with a combined capacity of more than 30 cubic meters but less than 1000 cubic meters at any one location or site
Government Notice R386 (April 2006)	13	The abstraction of groundwater at a volume where any general authorisation issued in terms of the National Water Act, 1998 (Act No. 36 of 1998) will be exceeded
Government Notice R386 (April 2006)	15	The construction of a road that is wider than 4 metres or that has a reserve wider than 6 metres, excluding roads that fall within the ambit of another listed activity (e.g. national roads) or which are access roads of less than 30 metres long
Government Notice R386 (April 2006)	16	The transformation of undeveloped, vacant or derelict land to residential, mixed, retail, commercial, industrial or institutional use where such development does not constitute infill and where the total area to be transformed is bigger than 1 hectare
Government	1(c)	The construction of facilities or infrastructure including

No & date of relevant notice	Activity No (in terms of relevant Regulation/ notice)	Description of listed activity
Notice R387 (April 2006)		associated structures, for the construction of facilities or infrastructure including associated structures for the above ground storage of a dangerous good, including petrol, diesel, liquid petroleum gas or paraffin, in containers with a combined capacity of 1000 cubic meters or more at any one location or site including the storage of one or more dangerous goods, in a tank farm
Government Notice R387 (April 2006)	1(e)	The construction of facilities or infrastructure including associated structures for any process or activity which requires a permit or license in terms of legislation governing the generation or release of emissions, pollution, effluent or waste and which is not identified in Government Notice No. R. 386 of 2006
Government Notice R387 (April 2006)	1(f)	The recycling, re-use, handling, temporary storage or treatment of general waste with a throughput capacity of 50 tons or more daily average measured over a period of 30 days.
Government Notice R387 (April 2006)	1(g)	The construction of facilities or infrastructure including associated structures for the use, recycling, handling, treatment, storage or final disposal of hazardous waste
Government Notice R387 (April 2006)	1(l)	The construction of facilities or infrastructure including associated structures, for the transmission and distribution of above ground electricity with a capacity of 120 kilovolts or more
Government Notice R387 (April 2006)	1(o)	The final disposal of general waste covering an area of 100 square metres or more or 200 cubic metres or more of airspace

Section 24 of the NEMA requires that an EIA be undertaken in order to inform the authorisation process for a listed activity. Government Notice No R. 385 of 2006, in defines the manner in which the EIA is to be undertaken. Guideline documents have been published by the Department of Environmental Affairs and Tourism (DEAT) and these provide further guidance in implementing the EIA Regulations, 2006. The following national DEAT guideline documents have been considered in the preparation of this report:

» Guideline 3: General guide to EIA regulations;
» Guideline 5: Assessment of Alternatives and Impacts;
» DEAT Public Participation Guidelines as published in Government Gazette No. 28854, 19 May 2006; and
» Detailed Guide to Implementation of the Environmental Impact Assessment Regulations: 2006.

The EIA procedure required by the aforementioned regulations and published guideline documents has been followed in this project. **Figure 2.1** provides an indication of the process that was followed during the Scoping and EIA phases.

The competent authority in respect of the activities listed in this part of the schedule is the provincial environmental authority, the Department of Economic Development, Environment & Tourism (DEDET) in Limpopo province. The national Department of Environment Affairs and Tourism (DEAT) will be the relevant decision-making authority as Eskom is a parastatal and the proposed project has a national significance. The EIA authorisation therefore needs to be granted by DEAT.

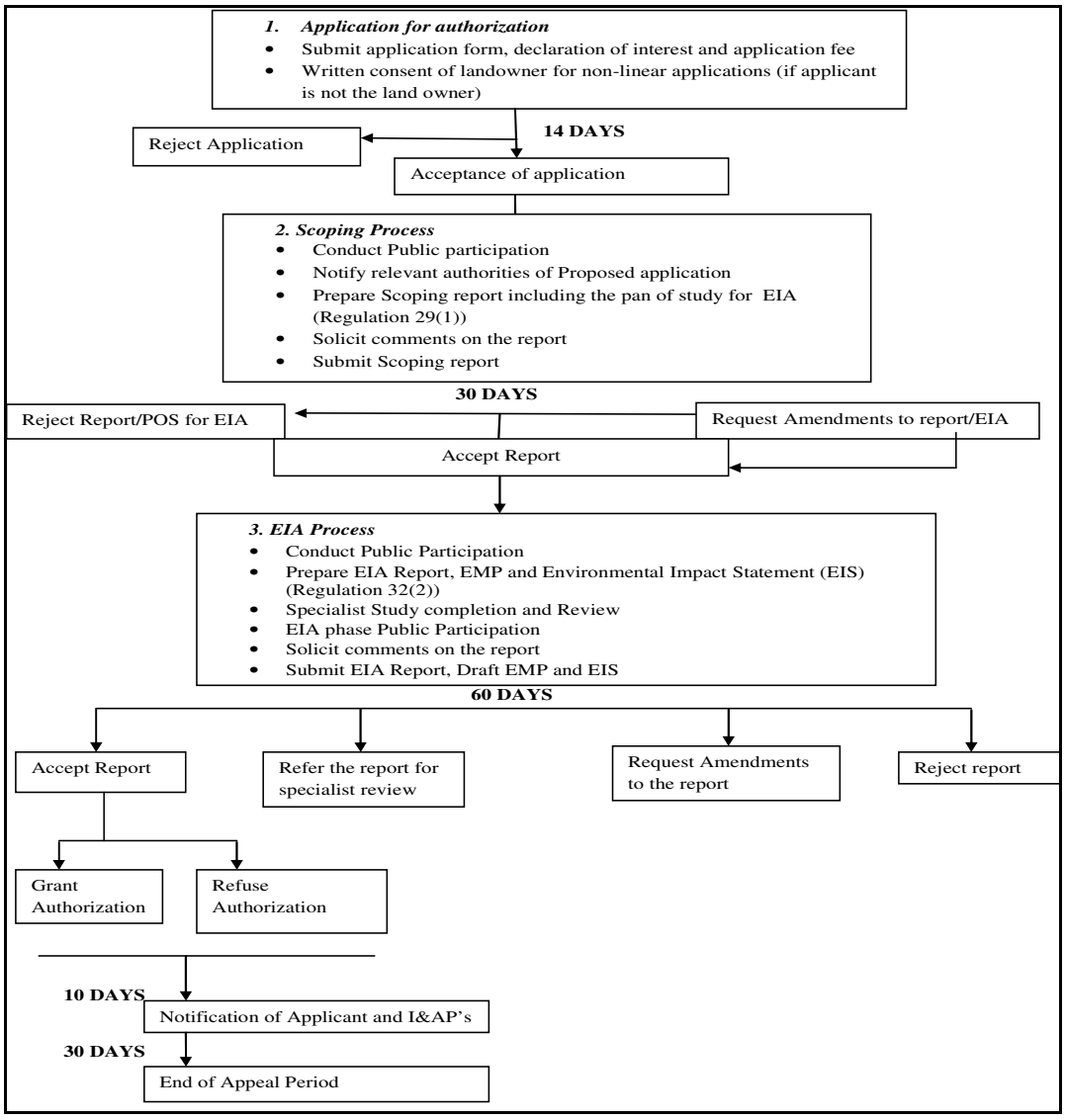

Figure 2.1: Flowchart of the EIA process

2.4 Legislation and Guidelines that have informed the preparation of this Report

The following legislation and guidelines have informed the scope of this Report:

- National Environmental Management Act (Act No 107 of 1998);
- EIA Regulations, published under Chapter 5 of the NEMA (GN R385, GN R386 and GN R387 in Government Gazette 28753 of 21 April 2006);
- DWAF (1998) Minimum Requirements for Waste Disposal by Landfill, Second Edition;
- DWAF (1998) Minimum Requirements for the Monitoring of Water Quality at Waste Management Facilities, Second Edition;
- National Environmental Management: Waste Act 59 of 2008; and
- The National Water Act 36 of 1998, regarding water use licences R 519 of GN 32209 of 6 May 2009 regarding registration of water uses.
- Guidelines published in terms of the NEMA EIA Regulations, in particular:
  - Guideline 3: General Guide to Environmental Impact Assessment Regulations, 2006 (DEAT, June 2006);
  - Guideline 4: Public Participation in support of the Environmental Impact Assessment Regulations, 2006 (DEAT, May 2006);
  - Guideline 5: Assessment of alternatives and impacts in support of the Environmental Impact Assessment Regulations, 2006 (DEAT, June 2006); and
  - The Environment Conservation Act, 2003 (Act 53 of 2003) - Section 20 (1or 5b), permit for closure and or operation of a waste disposal facility, has been repealed as from 1 July 2009).

Several other Acts, standards or guidelines have also informed the project process and the scope of issues evaluated in this report.

2.5 Environmental legal authorisations required for this proposed development

The development of the waste disposal site may require several authorisations that would need to be obtained prior to commencing with construction and operation:

- Authorisation under NEMA section 24, the so called EIA authorisation for listed activities;
- Authorisations under the National Forests Act to remove or destroy protected tree species. The applications need to be lodged on a prescribed application form for every tree to be destroyed or removed. The responsible authority is DWAF;

» Obtaining a water use license under the National Water Act, section 21(g) for the disposal of waste in a manner that may detrimentally impact on a water resource. The Act in section 22 (3) allows for a procedure whereby the licensing requirements may be dispensed with provided that the activity is adequately evaluated for water resource impacts as part of another authorisation. There is no prescribed procedure in this regard and a level of co-operative governance between departments will be required; and

» The water use activity, section 21(g) must be registered independent of whether a license is applied for as required by R 519 of GN 32209 of 6 May 2009.

Several other Acts, standards or guidelines have also informed the project process and the scope of issues evaluated in this report. A listing of relevant legislation is provided in **Table 2.1.**

Table 2.1: Review of relevant policies, legislation, guidelines and standards applicable to the waste disposal facility

Legislation	Applicable Sections
National Legislation	
Constitution of the Republic of South Africa (Act No 108 of 1996)	» Bill of Rights (S2) » Environmental Rights (S24) – i.e. the right to an environment which is not harmful to health and well-being » Rights to freedom of movement and residence (S22) » Property rights (S25) » Access to information (S32) » Right to just administrative action (S33)
National Environmental Management Act (Act No 107 of 1998)	» National environmental principles (S2), providing strategic environmental management goals and objectives of the government applicable throughout the Republic to the actions of all organs of state that may significantly affect the environment » NEMA EIA Regulations (GN R385, 386 & 387 of 21 April 2006) (published in terms of Chapter 5), with effect fro3July2006 » The requirement for potential impact on the environment of listed activities must be considered, investigated, assessed and reported on to the competent authority (S24 – Environmental Authorisations) » Duty of Care (S28) requiring that reasonable measures are taken to prevent pollution or degradation from occurring, continuing or recurring, or, where this is not possible, to minimise & rectify pollution or degradation of the environment » Procedures to be followed in the event of an emergency incident which may impact on the environment (S30)

Legislation	Applicable Sections
Environment Conservation Act (No 73 of 1989)	» Waste disposal practices (S20) » National Noise Control Regulations (GN R154 dated 10 January 1992)
National Heritage Resources Act (Act No 25 of 1999)	» Stipulates assessment criteria and categories of heritage resources according to their significance (S7) » Provides for the protection of all archaeological and palaeontological sites, and meteorites (S35) » Provides for the conservation and care of cemeteries and graves by SAHRA where this is not the responsibility of any other authority (S36) » Lists activities which require developers any person who intends to undertake to notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development (S38) » Requires the compilation of a Conservation Management Plan as well as a permit from SAHRA for the presentation of archaeological sites as part of tourism attraction (S44)
National Environmental Management: Biodiversity Act (Act No 10 of 2004)	» Provides for the MEC/Minister to list ecosystems which are threatened and in need of protection (S52) – none have as yet been published » Provides for the MEC/Minister to identify any process or activity in such a listed ecosystem as a threatening process (S53) - none have as yet been published » A list of threatened & protected species has been published in terms of S 56(1) - Government Gazette 29657. » Three government notices have been published, i.e. GN R 150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R 151 (Lists of critically endangered, vulnerable and protected species) and GN R 152 (Threatened or Protected Species Regulations).
Atmospheric Pollution Prevention Act (Act No 45 of 1965)	» Part IV: Dust control » Part V: Air pollution by fumes emitted by vehicle emissions
National Environmental Management: Air Quality Act (Act No 39 of 2004)	» Measures in respect of dust control (S32) – no regulations promulgated as yet » Measures to control noise (S34) - no regulations promulgated as yet
Conservation of Agricultural Resources Act (Act No 43 of 1983)	» Prohibition of the spreading of weeds (S5) » Classification of categories of weeds & invader plants (Regulation 15 of GN R1048) & restrictions in terms of where these species may occur » Requirement & methods to implement control measures for alien and invasive plant species (Regulation 15E of GN R1048)
National Water Act (Act No 36 of 1998)	» National Government is the public trustee of the

Legislation	Applicable Sections
	Nation's water resources (S3) » Entitlement to use water (S4) – entitles a person to use water in or from a water resource for purposes such as reasonable domestic use, domestic gardening, animal watering, fire fighting and recreational use, as set out in Schedule 1 » Duty of Care to prevent and remedy the effects of pollution to water resources (S19) » Procedures to be followed in the event of an emergency incident which may impact on a water resource (S20) » Definition of water use (S21) » Requirements for registration of water use (S26 and S34) » Definition of offences in terms of the Act (S151)
Provincial Legislation	
Limpopo Environmental Management Act No 7 of 2004	» Limpopo Environment Management Act provides a single, consolidated and complete set of rules for the governance of the environment throughout Limpopo. It forms a vital legal framework for the province's waste management programme. The Act ensures that environmental pollution (littering and waste management) is avoided in order to maintain a healthy environment thereby promote sustainable development. » Sections 89 - 92 of the Act addresses littering and waste management in Limpopo
Guideline Documents	
Nancy Oosthuizen Consulting cc and Judy Bell cc Workshop Draft Document (Nov 2007)	» Guide developed to assist managers in various industries to manage waste by - Complying with legal requirements - Generating less wastes - Safety handling, transporting and storing of wastes - Effectively managing waste contractors'; and - Disposal of wastes to the correct landfill site

3 CHAPTER 3 SCOPE OF WORK

3.1 Project Construction phase

The proposed development will be accommodated on approximately 5 hectares (ha) of land in terms of its footprint size, however a total of approximately 20 ha's (including the 5 ha footprint) will be required to accommodate its associated infrastructure. Access to the facilities will be via the existing access roads located in close proximity to the site.

Prior to the establishment of any landfill, it is required to determine the nature and quantities of the waste that will be deposited into the landfill and the impacts the land filling operation might have on the receiving environment. The Department of Water Affairs and Forestry (DWAF) has developed a series of guidelines that serve as standards for managing waste and sets minimum requirements that an applicant wanting to permit a landfill will have to adhere to be in compliance with prevailing legislation. These minimum requirements comprise three volumes viz.:

- The Minimum Requirements for Waste Disposal by Landfill;
- The Minimum Requirements for the Handling of and Disposal of Hazardous Waste; and
- The Minimum Requirements for Monitoring at Waste Management Facilities.

The Minimum Requirements for Waste Disposal by Landfill (MR) have, as an overall objective of environmentally responsible land filling, the requirement to "**avoid both short or long term impacts and any degradation of the environment in which the landfill is located**." Short term impacts include problems such as noise, flies, odour, air pollution, unsightliness and windblown litter. Long term impacts include potential pollution of the water regime, landfill gas generation and devaluation of adjacent land holdings. These problems can be mitigated by carefully considered landfill site selection, design, preparation or operation and ensuring that there are adequate buffer zones in place.

A Conceptual plan and Conceptual Design are included in this EIR, indicating the main principles and elements of the proposed waste handling facilities. These include the classification of the waste facility in terms of the MR classification system as well as general features of the facilities. Once the preferred alternative has been approved in terms of an Environmental Authorisation for this project, further engineering activities will entail detailed site investigation and final design with technical specifications of the various elements of the facilities.

3.1.1 Site survey

The proposed landfill site is surveyed by a professionally registered surveyor. The survey work is performed in accordance with TMH11-STANDARD SURVEY GUIDELINES. The outcome of the survey is a topographical model of the site for consideration during the design process. Additionally, the co-ordinates and elevations of certain features of the site both natural and man-made are accurately sited. These include:

a) Layouts, including all existing paint markings, centreline and levels of existing roads;
b) Existing buildings and frontages as indicated;
c) Stormwater (manholes, cover & invert levels, diameter of pipes, direction of flow, catch pits, including grid, pavement & invert levels, canals, culverts and any related items);
d) Sewerage (manholes cover & invert levels, diameter of pipes, direction of flow and any related items);
e) Water reticulation (valves, fire hydrants, water meters and any related items).
f) Telkom (manholes, cover and invert levels, junction boxes, telephone poles, kiosks and any related items);
g) Electrical (kiosks, street lights, traffic lights, overhead cables, stay wires, cable/route markers and any related items);
h) General furniture, walls, fences, road signs and trees (specifying type, species and approximate size or planted areas, etc.)
i) Other (any visible items not indicated above);
j) Top of rail, rail reserve and drainage channels;
k) Overhead wires and lines;
l) At the site the surveyor is to clearly demarcate trees on the drawings and which species they are where possible;
m) The surveyor must identify all natural water bodies/wetlands/springs and exposed rock; and
n) The survey must clearly define the edges of the existing site.

Additionally, cadastral services that were sought from the surveyor include:

o) Cadastral information of all properties surveyed on site and adjacent properties to the site;
p) Obtain copies of title deeds and diagrams; and
q) Indicate cadastral boundaries and pegs found.

r) The surveyor is to provide a brief report on any cadastral issues (e.g. buildings encroaching over boundaries, servitudes, rights of way, etc.)

s) For the proposed site, check title deed and comment on any restrictions that might be more onerous or record any other previous approvals, consents, exclusions or departures granted from the zoning scheme regulations.

Once the site has been surveyed, the survey data is used to compile a model for use by the design engineer to optimally site the different elements that comprise the waste disposal facility as described in the conceptual design.

3.1.2 Site Clearing

Site clearing operations will be carried out in a contained and secure manner. The entire area will be cordoned off to control access to the site and all staff will undergo an induction process to familiarise them with site rules, occupational health and safety measures and any special security measures as may be required by Eskom. The site will be cleared of alien vegetation an identification of indigenous trees for relocation/replanting is made. The topsoil at the site is excavated and stockpiled at an identified position on the site to be used for cover during landfilling operations. SABS standards for Clearing and Grubbing are applied to site clearance activities.

3.2 Conceptual Plans and Design Description

The Minimum Requirements for Waste Disposal by landfill (DWAF 2nd edition of 1998) has been used as guideline document to inform the EIA and will also inform the permitting requirements that will be undertaken once the proposed development is approved. The waste disposal site, the associated temporary hazardous waste storage facility, the low hazardous waste cell design are based on the outcome of the specialist investigations undertaken during the Impact Assessment phase. The design will consider cost effective and environmentally acceptable waste handling and disposal facilities. It should be noted that the design engineers will also consider the input from the specialist studies in order to provide an environmentally and aesthetically acceptable landfill.

Once the site has been selected, investigated and assessed, the next step is to carry out the design of the landfill. The landfill design is based on the outcome of the Site Investigation and the EIA. The general objective of landfill design is to provide a cost-effective, environmentally acceptable waste disposal facility.

If the best available site, identified during the site selection process, is sub-optimal from an environmental or geohydrological point of view, the subsequent site design must compensate for these shortcomings by means of appropriate engineering. Where there is an environmental risk associated with the chosen site, the design must be upgraded to compensate. Such compensatory design must be to the satisfaction of the Department, and will usually be in excess of the Minimum Requirements, in order to protect sensitive aspects of the environment.

Two stages of design (conceptual and technical) are summarised as follows:

CONCEPTUAL DESIGN

The Conceptual Design addresses the principles of the intended design, but does not include detailed specifications. It includes all aspects of the design that will affect the successful operation and subsequent closure of the landfill in an environmentally acceptable manner. In the case of most general waste landfills, the design submitted as part of the Permit Application is the Conceptual Design, which may then be upgraded to an 'as-built' technical design, showing measurements and levels.

TECHNICAL DESIGN

The Technical Design is based on the Conceptual Design. The Technical Design includes detailed specifications of materials, measurements and procedures, as well as detailed drawings. In the case of all landfills for which liners are required, a technical design must be submitted as part of the Permit Application. The Technical Design, together with the associated bills of quantities, also forms the basis for contractual tendering and construction.

Appendix C1 provides a conceptual plan for the proposed development whereas **Appendix C2** provides a preliminary conceptual design of the landfill. It should be noted that detailed engineering specifications will be provided once the survey is undertaken. The design drawings and plans are currently being drafted by PDNA Consulting Engineers. Waste streams, anticipated waste volumes, water balance, cover material, contours, topography, available land and space, and the life span of the landfill site will be considered during the design of the landfill.

From the waste stream analysis, discussion with Eskom and climatic water balance calculation, the Eskom landfill classification for general waste handling is GMB-. However the hazardous waste handling also needs to be considered.

Eskom has advised that in order to make allowance for all possible eventualities e.g., extension of some of the activities through possible delays, that the disposal facility be designed for the handling of 1,200,000 m^3 of general and hazardous waste over the lifespan of the landfill. This will account for waste generated during the construction and operation of the Waterberg Coal 3 and Coal 4 powerstations, the remaining period of operations of the Matimba powerstation as well during the remaining period of construction and the full period of operation of the Medupi powerstation. The waste emanating from the construction villages established during the power stations construction will also be deposited into this landfill (assuming 1kg/person/day). For design purposes, it is assumed that the waste comprises equal quantities of general and hazardous waste.

In consideration of the allowance in the MR that certain hazardous waste might be delisted, it is proposed that Eskom adjust the design brief to that of a general waste facility with a cell for disposing low hazard rating waste. As before, the high hazard rating waste would be disposed of at a licensed hazardous H:H facility. The initial indications are that the bulk of the hazardous waste is of low hazard rating, although confirmatory testing will be necessary.

There are very specific requirements that have to be considered as part of the disposal facility design including site classification, site layout, access, hydrology and drainage design, containment, leachate management, leachate detection, monitoring systems and the rehabilitation plan.

3.2.1 Landfill Site, temporary hazardous waste storage facility and low hazardous waste cell

The general landfill and the hazardous waste cell will be physically separated at a distance to be determined in the final design. High hazard rating waste will be temporary stored at the temporary hazardous waste storage facility.

(a) Site services and ancillary infrastructure

Site services will include water and sewerage services, electricity, telephones and security. The permanent infrastructure will include weighbridges, site offices, an ablution block, a workshop, a guardhouse and the recycling facilities discussed in the Engineering report attached in Appendix C. Wastewater treatment might be by installation on site of a septic tank. The entire site will be cordoned off by fencing. Eskom are building a haul road with weighbridges adjacent to the site. Weighbridges are costly to install and expensive to maintain and it might be prudent to utilise the facilities related to the haul road rather than installing weighbridges at the landfill site. However, if this is not a viable option, design considerations will include weighbridge facilities. A weather station will be installed on site to monitor rainfall, temperature, wind speed and wind direction.

(b) Site Laboratory

All waste arriving at the site will be examined by suitably qualified staff to ascertain whether it should be routed to the general or hazardous cells. A site laboratory will be set up with the necessary equipment and suitably qualified personnel for testing the waste if necessary. Alternatively, the precautionary principle will be applied and the waste will be treated as highly hazardous until otherwise determined. The laboratory facility used must be capable of producing accurate and precise results that can, if necessary, withstand scrutiny in a court of law.

(c) Recycling facilities

Large quantities of building rubble will be generated during the construction activities. This valuable material and it is recommended that a facility be established on site or close to the site to maximise the potential to recycle waste and minimise waste needing to be land-filled. Options for the material include using it for rehabilitation in other areas, recycling the crushed material or selling it for use in road construction.

Oil contaminated wastes such as old oil filters and oily rags require collection and specialised treatment and disposal. This can range from small drummed waste collections to large bulk movements. Eskom already has a good record of recycling including paper, printer ink cartridges and oil. It is proposed that a small recycling area be established to temporarily store and sort any recyclables that arrive at the disposal facility. Fluorescent tubes contain mercury and become hazardous wastes when they no longer work. These should be placed in clearly labelled drums for final disposal at an H:H hazardous waste facility.

(d) Access Roads

Access to the site will be provided through existing access roads in order to accommodate the traffic that will be coming in and out of the site during construction and operational phases. The project will also include the construction of roads should new ones be required. The surrounding municipality and district access roads will provide a link between the landfill site and the source of waste. All access roads into the site will be surfaced to minimise dust and will be aesthetically pleasing. A gravel road will also be constructed around the landfill and along the fence perimeter to provide access to security staff for monitoring of breaches of the site. Due to the limited amount of traffic (2-3 vehicles p/day), it is suggested that a single surfaced carriage road is constructed. Adequate side drainage will be provided along the road and the road will be subject to regular maintenance during construction and operational phases.

3.3 Landfill Classification

Permitting of a site for waste disposal by landfill as per the MR requires the determination of waste class, size of operation, and potential for significant leachate generation, all of which influence the risk it poses to the environment. The quantities of various types or categories of waste generated at Medupi Power Station and associated and/or surrounding Eskom activities, developments and facilities, will have a direct impact on the type, class, size and nature of both the landfill site and the transfer station.

Table 3.1 presents the landfill size classification system based on the Maximum Rate of deposition (MRD). General waste landfills are divided into four categories, i.e.: communal; small; medium and large. Landfill size is dependent on the daily rate of deposition which is affected by several factors including the size of the population served. A measure referred to as the 'Maximum Rate of Deposition' or 'MRD' is applied. This is a measure of the projected maximum average annual rate of waste deposition, expressed in tonnes per day, during the expected life of a landfill. The MRD is calculated by establishing the Initial Rate of Deposition (IRD), which is a measurement of the existing waste stream in tonnes per day. The IRD is then escalated at a rate that is usually governed by population growth projections over the anticipated life of the landfill. The maximum average daily rate of deposition is then the MRD.

As per the MR, once the MRD has been calculated, the disposal facility size can be determined (**Table 3.1**). Landfill sites are classified according to the type and volume (volume = maximum amount of waste handled/treated/stored per day for which the facility was designed) of waste handled/treated/stored at the specific facility per day.

Table 3.1 Size Determination

SIZE OF WASTE STREAM			
Communal (C)	Small (S)	Medium (M)	Large (L)
Maximum Rate of Deposition (MRD) in tonnes per day			
<25	>25 <150	>150 <500	>500

NOTE: Assuming a 5-day week and therefore 260 days per year

In the absence of weighbridge figures or estimates of waste, daily tonnages may be arrived at by assuming a per capita waste generation rate and applying this figure to the population served. In general, these rates are very closely tied to socio-economic standing of the population, with generation rates of 0.5 kg per capita per day in poor areas, to as much as 3, 5 kg per capita per day in affluent areas.

Table 3.2 Landfill Classification system

WASTE CLASS	**G** **General Waste**				**H** **Hazardous Waste**	
SIZE OF LANDFILL OPERATION	**C** **Communal Landfill**	**S** **Small Landfill**	**M** **Medium Landfill**	**L** **Large Landfill**	**H:h** **Hazard Rating 3&4**	**H:H** **Hazard Rating 1&2**
SITE WATER BALANCE	**B-**	**B+**	**B-**	**B+**		
MINIMUM REQUIREMENTS						

NOTES

B- = No significant leachate will be generated in terms of the Site Water Balance (Climatic Water Balance calculations plus Site Specific Factors), so that a leachate management system is not required.

B+ = Significant leachate will be generated in terms of the Site Water Balance (Climatic Water Balance calculation and Site Specific Factors), so that a leachate management system is required.

h = A containment landfill which accepts **H**azardous waste with Hazard Ratings 3 and 4.

H = A containment landfill which accepts all **H**azardous waste, i.e. with Hazard Ratings 1, 2, 3 and 4.

In all, ten classes of landfill are possible:

- G:C:B-, G:C:B+(General, communal)
- G:S:B-, G:S:B+ (General, small)
- G:M:B-, G:M:B+ (general, medium)
- G:L:B-, G:L:B+ (general, large)
- H:h and H:H (hazardous)

The rainfall and evaporation figures (using the weather station A4E001, Vaalwater) were examined and negative figures obtained for every season from 1973 to 1966 for which reliable and complete data was kept. The calculations are detailed in **Table 7** of **Appendix C3** of the Engineering Design report. The raw data used to make these calculations is attached as Annexure 2 on the Engineering design report. The proposed site therefore lies in an area where sporadic or no significant leachate is expected to be generated from land filling.

3.4 Waste Stream Survey and Analysis

The NEMA Waste Management Act defines waste as:

"any substance whether solid, liquid or gaseous or any combination thereof which is

- emitted, discharged or deposited in the environment in such volume, constituency or manner as to cause an alteration to the environment,
- a surplus substance or which is discarded, rejected, unwanted or abandoned,
- reused, recycled, reprocessed, recovered or purified by a separate operation from that which produced the substance or which may be or is intended to be re-used, recycled, reprocessed, recovered or purified, or
- identified as waste by prescribed by regulation"

Further to the above, the South African waste classification system divides waste types into two broad types including general waste and hazardous waste. These two are then further broken down into 3 classes derived from the waste source types namely:

- » Domestic;
- » Commercial; and
- » Industrial.

3.4.1 General Waste

General waste includes all urban waste that is produced within the jurisdiction of local authorities. It comprises rubble, garden, domestic, commercial and general industrial waste. It may also contain small quantities of hazardous substances dispersed within it such as batteries, insecticides and weed-killers discarded on domestic and commercial premises. General waste may be disposed of in a permitted landfill and may be equated to what is commonly referred to as domestic solid waste (DSW) and municipal solid waste (MSW) i.e. that which is normally managed by a local authority.

General waste can produce leachate with an unacceptably high pollution potential. This may result from waste decomposition, together with the infiltration and/or percolation of water. Therefore, under certain conditions general waste disposal sites must have leachate management systems.

3.4.2 Hazardous Waste

Hazardous waste is defined as waste that has the potential, even in low concentrations, to have a significant adverse effect on public health and the environment because of its inherent toxicological, chemical and physical characteristics (DWAF 1998).

Hazardous waste can also be defined as: “an inorganic or organic element or compound that, because of its toxicological, physical, chemical or persistency properties, may exercise detrimental acute or chronic impacts on human health and the environment. It can be generated from a wide range of commercial, industrial, agricultural and domestic activities and may take the form of liquid, sludge or solid. These characteristics contribute not only to degree of hazard, but are also of great importance in the ultimate choice of a safe and environmentally acceptable method of disposal. In addition to the above-mentioned, a hazardous waste can be defined as a waste that directly or indirectly represents a threat to human health or the environment by introducing one or more of the following risks:

- » Explosion or fire;
- » Infections, pathogens, parasites or their vectors;
- » Chemical instability, reactions or corrosion;
- » Acute or chronic toxicity;

» Cancer, mutations or birth defects;
» Toxicity, or damage to the ecosystems or natural resources; and
» Accumulation in biological food chains, persistence in the environment, or multiple effects to the extent that it requires special attention and cannot be released into the environment or be added to sewage or be stored in a situation which is either open to air or from which aqueous leachate could emanate.

3.4.3 Classification of Hazardous Waste

The waste generated within the borders of South Africa has been classified firstly in terms of the Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste (DWAF, 1998), hereafter referred to as the Minimum requirements, and then by the SANS 0228 Code of Practice for the identification and classification of dangerous substances and goods.

The initial classification in terms of the Minimum Requirements is to determine if the waste is either general waste or hazardous waste. Hazardous waste is then further classified in terms of SANS 0228:2003. SANS 0228 classifies the waste into nine classes based on the type of risk involved. These classes are as follows:

» Class 1: Explosives;
» Class 2: Gases;
» Class 3: Flammable liquids;
» Class 4: Flammable Solids, substances liable to spontaneous combustion substances that on contact with water, emit flammable gases;
» Class 5: Oxidizing substances and Organic peroxides;
» Class 6: Toxic and infectious substances;
» Class 7: Radioactive material;
» Class 8: Corrosives; and
» Class 9: Miscellaneous dangerous substances and goods.

Further to the above-mentioned, DWAF has a hazard level rating system that is specified in **Sections 2, 6** and **8** of the Minimum Requirements. The rating system enables authorities to categorise waste in terms of quantity and quality and allocate a Hazard Rating in order to safely dispose of the waste.

The following hazard ratings are defined and the correct procedure for allocating hazard rating is specified in the minimum requirements:

Hazard Waste Class	Hazard Rating	Acceptable Landfill Option
Extreme Hazard Waste	Rating 1	H:H Landfill Site
High Hazard Waste	Rating 2	H:H Landfill Site
Moderate Hazard Waste	Rating 3	H:H or H:h Landfill Site
Low Hazard Waste	Rating 4	H:H or H:h Landfill Site
Very Low Hazard Waste	Rating < 4	G:B^+ Landfill (Special)

It is important to note that waste with a higher hazard rating can be delisted such that it can be disposed at a H:h landfill. Wastes with a higher hazard rating can be treated before disposal, such that it becomes less hazardous, thus enabling it to be assigned a lower hazard rating. The procedure for delisting of hazardous waste is specified in **Section 8** of the Minimum requirements.

3.4.4 Implications of Classification of Hazardous Waste (Table 3.3)

Hazardous waste requires stringent control and management, to prevent harm or damage and hence liabilities. It may only be disposed of on a hazardous waste site. Since the precautionary principle is applied, waste must always be regarded as hazardous where there is any doubt about the potential danger of the waste stream to man or the environment.

Table 3.3 Waste Classification system as per National Waste Management Strategy (NWMS)

Source	Domestic	Commercial	Industrial
General:			
Paper	General Domestic Waste	General Commercial Waste	General Industrial Waste
Metals			
Glass			
Plastic			
Organic			
Inert and Builders Rubble			
Hazardous:			
Class1 Explosives	Hazardous Domestic Waste	Hazardous Commercial Waste	Hazardous Industrial Waste
Class 2 Gases			
Class 3 Flammable Liquids			
Class 4 Flammable solids/substances			
Class 5 Oxidizing substances			
Class 6 Poisonous & Infectious Substances			
Class 7 Radioactive Substances			
Class 8 Corrosive Substances			
Class 9 Miscellaneous Substances			
Hazardous waste Ratings:			
HAZARD RATING 1:		High Hazard	
HAZARD RATING 2:		Moderate Hazard	
HAZARD RATING 3:		Low Hazard	

HAZARD RATING 4:	Potential Hazard

» High Hazard Waste requires the strictest control an urgent attention. Contents are deemed to be significantly toxic and persist in the environment and accumulate in biological tissues.
» Moderately Hazardous Waste possesses highly dangerous characteristics and contains significant concentrations of highly/moderately toxic constituents.
» Low Hazardous Waste has dangerous characteristics or with significant concentrations of leachable / biologically available toxic constituents.
» Potentially Hazardous Waste has characteristics of concern or with toxic constituents, which are either in a form that will remain insoluble/ unavailable or are in insignificant concentrations.

Medical Waste is classified as a hazardous waste under the infection category (Class 6). Medical Waste comprises of any waste generated during diagnosis, treatment or immunization of humans or animals and comprises of two main categories:

» Anatomical waste is waste containing human or animal tissues such as body parts, used sanitary towels and used bandages and dressings; and
» Sharps are items that could cause cuts and needlestick injuries including items such as scalpels, hypodermic needles and other blades.

3.4.5 Waste Generation

The quantities of various types or categories of waste generated at the existing Matimba and new Medupi Power Station including two additional future powerstation (Coal 3 and 4) in the area has a direct impact on the type, class, size and nature of both the landfill site and the transfer station. In order to estimate the waste generation at these power stations, waste generation data from other Eskom power stations within South Africa has been utilised coupled with the provided records of current waste generation figures from Matimba power station (operational) and Medupi construction phase. Further to this, projection of future waste generation has been undertaken taking into consideration growth and future potential sources within area.

(a) General Waste Streams

The general waste streams at Eskom Medupi can be directly linked to the various project phases i.e. construction phase, operation phase and decommissioning phase. Currently the Medupi project is in its construction phase and hence the major sources of general waste are construction related waste stream namely:

» Land clearing debris;
» Wood and wooden pallets;
» Broken bricks (builders rubble general);
» Concrete;
» Concrete masonry units;
» Glass;
» Scrap Metal;
» Beverage Cans;
» Plastics;
» Cardboard;
» Paper and Newsprint; and
» Food residue waste.

(b) Hazardous Waste Streams

» Used Oil;
» Oil contaminated waste (Oily rags, tins etc);
» Grease;
» Florescent Tubes;
» Used Chemical;
» Chemical contaminated containers;
» Cleaning liquids and detergents;
» Bituminous substances;
» Paints;
» Thinners;
» Asbestos;
» E-Waste;
» Medical Waste (Health Care Risk Waste);
» Sewage Sludge; and
» Bioremediation residue.

3.4.6 Permitting and Licensing requirements

Section 20 of the Environmental Conservation Act (Act 73 of 1989) requires that all sites that are used for the storage, handling and disposal of waste require a permit prior to their operation. The waste related section of the Environment Conservation Act 73 of 1989 has been repealed by the National Environmental Management Waste Act 59 of 2008 as from the 1st of July 2009. The consequence is that all waste disposal site licensing from that date onwards will be done based on the provisions contained in

chapter 5 of the Waste Act. The type of activities that require a waste license is provided in sections a and b of schedule 1 of the act and include the following:

- **CATEGORY A**

(a) Storage and transfer of waste

1. The temporary storage of general waste at a facility, including a waste transfer facility and container yard, that has the capacity to receive in excess of 30 tonnes of general waste per day or that has a throughput capacity in excess of 20m^3 per day, including the construction of a facility and associated structures and infrastructure for such storage.
2. The temporary storage of hazardous waste at a facility, including a waste transfer facility and container yard, that has the capacity to receive in excess of three tonnes of hazardous waste per day, including the construction of a facility and associated structures and infrastructure for such storage.

Recycling and recovery

3. The sorting and shredding of general waste at a facility that has the capacity to receive in excess of one ton of general waste per day, including the construction of a facility and associated structures and infrastructure for such sorting or shredding.
4. The recovery of waste, excluding recovery that takes place as an integral part of an internal manufacturing process, at a facility that has the capacity to receive in excess of three tonnes of general waste or 100 kilograms of hazardous waste per day, including the construction of a facility and associated structures and infrastructure for such recovery.

Treatment of waste

5. The biological, physical or physicochemical treatment of general waste or the autoclaving, drying or microwaving of general waste at a facility that has the capacity to receive in excess of 10 tonnes of general waste per day, including the construction of a facility and associated structures and infrastructure for such treatment.
6. The biological or physicochemical treatment of hazardous waste or the autoclaving, drying or microwaving of hazardous waste, including the construction of a facility and associated structures and infrastructure for such treatment.
7. The treatment of waste in sludge lagoons.

Disposal of waste on land

8. The disposal of inert waste, excluding the disposal of less than 25 tonnes of inert waste for the purposes of levelling and building that has been authorised by or under legislation, including the construction of a facility and associated structures and infrastructure for such disposal.
9. The disposal of general waste to land covering an area of less than 100 m^2 or 200 m^3 air space, including the construction of a facility and associated structures and infrastructure for such disposal.

Storage, treatment and processing of animal waste

10. The storage, treatment or processing of animal manure, including the composting of animal manure, at a facility that has a throughput capacity in excess of 10 tonnes per month, including the construction of a facility and associated structures and infrastructure for such storage, treatment or processing.
11. The processing of waste at biogas installations with a capacity for receiving five tonnes or more per day of animal waste, animal manure, abattoir waste or vegetable waste, including the construction of a facility and associated structures and infrastructure for such processing animal manure and abattoir waste.

Expansion or decommissioning of facilities and associated structures and infrastructure

12. The expansion or decommissioning of facilities and associated structures and infrastructure for activities listed in this Schedule.

- **CATEGORY B**

(a) Treatment of waste

1. The treatment of general waste by a method other than biological, physical or physicochemical treatment at a facility with the capacity to receive in excess of 10 tonnes of general waste per day, including the construction of a facility and associated structures and infrastructure for such treatment.
2. The treatment of hazardous waste by a method other than biological or physicochemical treatment, including the construction of a facility and associated structures and infrastructure for such treatment.
3. The incineration of waste, including the construction of a facility and associated structures and infrastructure for the incineration of waste.

Disposal of waste on land

4. The disposal of hazardous waste to land, including the construction of a facility and associated structures and infrastructure for such disposal.
5. The disposal of general waste to land covering an area of more than 100 m^2 or 200 m^3 of air space, including the construction of a facility and associated structures and infrastructure for such disposal.

The approval of the proposed development must be in accordance with the requirements of the OHSA Act and must be approved by the Department of Environmental Affairs and Tourism. It must be noted that the Waste Management division within DEAT and the national and provincial department of DWAF has been included as stakeholders during the Public participation process. Both departments indicated that they have no objections to the proposed development, and the issues raised have been responded to in Issues response report attached in **Appendix B5** of this report.

3.4.7 Construction Period

Based on Medupi scenario, it is estimated that the construction peak for the powerstations, will have over 8000 workers on site. Using a conservative rate of 0.75kg/p/day and density of un-compacted waste of 0.131 Tonnes/$m^{3,}$ The existing Matimba, Medupi and Coal 3 and 4 power stations are likely generate in excess of 43m^3 of waste per day which equates to approximately 858m^3 per month. However it should be noted that this will drop significantly once construction has ended.

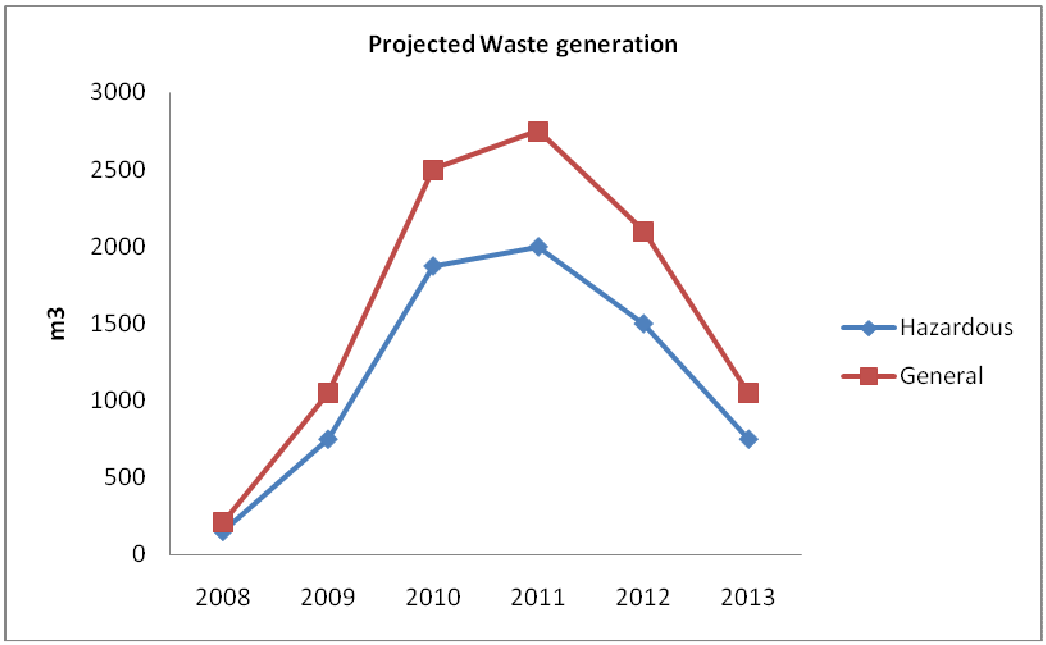

Figure 3.1: Waste generation estimates during the construction phase for Matimba, Medupi and proposed Coal 3 and Coal 4 powerstations (Roshcon)

3.4.8 Operational Phase

The tables below show estimated waste generation during the operation phase of the existing Matimba, Medupi, Coal 3 and Coal 4 powerstations.

General Waste

BU	Ash	Ash	General Waste	Building rubble	Garden Refuse	Paper	Metals
	Kt	tonnes	tonnes	tonnes	tonnes	kg	tonnes
	P	P	P	P	P	R	R
Monthly average	214.6	214550.8	363.9	62.7	15.8	401.5	14867.7
Matimba Monthly	428.8	428794.0	192.3	0.0	0.0	1058.3	119.6
Medupi Estimated	214.6	214550.8	363.9	62.7	15.8	401.5	14867.7
Coal 3 Estimated	214.6	214550.8	363.9	62.7	15.8	401.5	14867.7
Coal 4 Estimated	214.6	214550.8	363.9	62.7	15.8	401.5	14867.7
Total Estimated	**1072.4**	**1072446.3**	**1283.9**	**188.1**	**47.4**	**2262.8**	**44722.6**
Total for Land Filling	**(tonnes)**	**1073965.7**					

Hazardous Waste

BU	Asbestos	Medical Waste	FFB's	Flourescent tubes	Waste oil	Waste Grease
	Tonnes	kg	m3	210 liter drums	Liters	Liters
	P	P	P	P	R	R
Monthly average	10.8	8.3	334.3	1.4	3736.7	427.4
Matimba Monthly	0.0	4.5	0.0	2.6	11100.0	3710.0
Medupi Estimated	10.8	8.3	334.3	1.4	3736.7	427.4
Coal 3	10.8	8.3	334.3	1.4	3736.7	427.4
Coal 4	10.8	8.3	334.3	1.4	3736.7	427.4
Total Estimated	**32.4**	**29.3**	**1002.9**	**6.7**	**22310.2**	**4992.3**
Total for Land Filling	**(tonnes)**	**1035.6**				

Matimba monthly waste generation was compared with the average for all powerstations in South Africa. The waste generation at Medupi, Coal 1 and Coal 3 are based on the above averages

Key Notes and Assumptions

» **Note 1:** The above estimations have been based purely on per capita waste generation and do not include industrial and process general waste.

» **Note 2**: Although all power stations are not the same in size and technologies and project phase, waste generation figures from other Eskom power stations have been included as general guide and information source to project waste generation at Medupi, Coal 3 and 4 power stations.

» **Note 3**: Waste generation figures obtained from the current waste contractor have also been included to estimate the waste generation at Medupi (construction phase only).

» **Note 4:** Consideration of future Eskom power station construction in the area must be taken into account.

4 CHAPTER 4 DESCRIPTION OF AFFECTED ENVIRONMENT

4.1 Introduction

This section briefly outlines the existing biophysical, social and economic environment in the project area. This section will specifically discuss the environmental setting of the site, located on the Farm Grootestryd. The site is approximately 29.6 ha in extent and is located within the fenced property of Matimba Power Station. For the purposes of detailed specialist investigations, the site was divided into three portions of approximately 5 hectares each located in the immediate surroundings of the decommissioned waste dump (**Figure 4.1).**

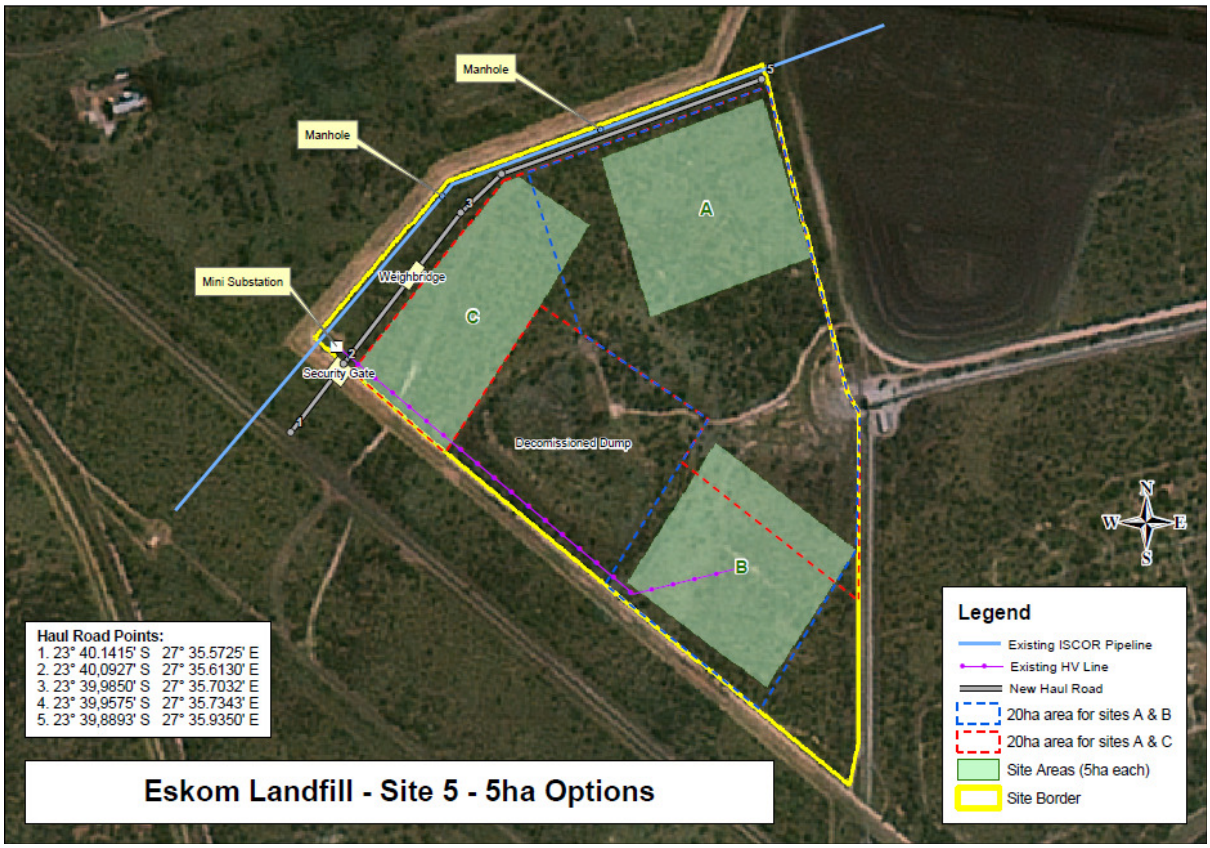

Figure 4.1: Locality map showing the location of the three alternative options in Site 5

Photo plate 4.1 is an indication of the overview of the site viewed from the east.

Plate 4.1: Study area viewed from the coal stock yard on the eastern side

4.2 Biophysical Environment

The environmental sensitivities on site were evaluated by various specialists. The information pertaining to the Biophysical Environment (Geology, Geohydrological conditions, Soils, Drainage and Ecology) has been supplemented with the results of the Specialist Geotechnical, Geohydrological, Ecological and Agricultural Assessments. From a geotechnical and Geohydrological point of view, it is important to note that these sites are located in proximity to the disused waste dump which has since been decommissioned.

4.2.1 Climate

The climatic regime of the study area (Koch, 2005) is characterized by hot, moist summers and mild, dry winters. **Figure 4.2** illustrates the climatic data.

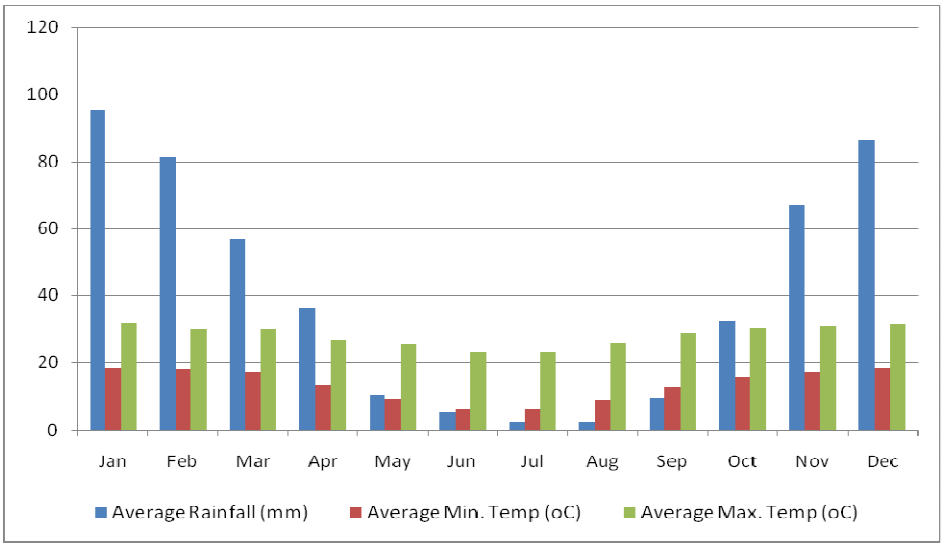

Figure 4.2: Climatic data of the study area (ARC: 2009)

The long-term annual average rainfall is 485.4mm, of which 420mm, or 86.5%, falls between October and March. Temperatures vary from an average monthly maximum and minimum of 37.2ºC and 13.9ºC for January to 27.8ºC and 1.5°C for July respectively. The most extreme high temperatures that have been recorded are 44.5°C and the most extreme low is –4.3ºC. Frost is rare, but occurs occasionally in most years, though not severely.

4.2.2 Geology and Soils

According to the 1: 250 000 scale geological map 2326 Ellisras, sequences of sandstone gritstone mudstone and coal as well as mudstone, carbonaceous shale and coal form the Swartrand and Grootegeluk Formations of the Karoo Supergroup and underlie the farm Grootestryd. The coal situated in these rocks is currently mined at Grootgeluk mine located further west of Site 5. This fuels the Matimba Powerstation and it will also fuel the Medupi Powerstation in the future.

Regional faulting of the rocks has north east-south west and a north west-south east trends. According to the geological map the prominent Daarby Fault is located to the north of Site 5 and strikes in a NE-SW direction almost parallel to the northern boundary. Other subordinate smaller faults with a NW-SE trend occur in the southern portions of the farm Grootestryd. According to the geological map no faults cross Site 5.

At Site 5 the sequence of sandstone and mudstone and shale rocks is overlain by dark brown sandy transported soils that extend to depths of 4m to 5m below the surface level. There are no rock outcrops. Highly to completely weathered soft rock sandstone underlies the soils and extends to depths varying between 13m and 15m. Slightly- to unweathered sandstone and shale occur at depths exceeding 15m.

The geotechnical investigation that was undertaken during the impact assessment phase encountered several subsoils (fill, topsoil, aeolian sand, ferricrete, calcrete, residual sandstone and shale) through the excavation of twenty (20) trial holes. **Figure 4.3** is a map indicating the test pit locations and soil zones that were considered during the site investigation. Detailed descriptions of the soil profiles encountered in the test pits that were excavated using a backactor are presented in **Appendix C** of the geohydrological report.

Figure 4.3 Test pit locations and soil zones identified in Site 5 (Map not to scale)

It is the conclusion of the study that the area is underlain by windblown sands which are potentially collapsible, semi pervious and erodible. According to the geotechnical report, Sites 5A and 5C have extensive sand deposits whilst Site 5B is mainly underlain by thick fill deposits.

According to the agricultural potential assessment (**Appendix D2**) that was undertaken during the Impact Assessment Phase, the area is very homogeneous in terms of texture, structure and soil depth. Two soil units occur in the vicinity, with the only difference between the two being colour. The larger part of the area consists of deep soils, comprising dark reddish brown, apedal, sandy topsoil on reddish brown to yellowish red, apedal loamy sand subsoil. The soils belong to the Hutton soil form.

The other portion of the area has soils with a dark brown, apedal, sandy topsoil on brown to dark brown, apedal loamy sand subsoil, belonging to the Clovelly form.

(a) Subsoil Conditions

The subsoil conditions underlying each of the sub-sites A, B and C (as in **Figure 4.2**) as reflected in the test pits excavated within these areas and illustrated in **Figure 2** of the geotechnical report (**Appendix D1**), is summarised in **Table 4.1**. The calcrete and ferricrete horizons were frequently not penetrated and hence these layers have not been shown.

Table 4.1: Summary of soil conditions within sub sites

Soil Type	Soil Thickness (m)								
	Site A			**Site B**			**Site C**		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Fill	0,05	0,25	0,25	0,75	0,70	1,60	0,30	0,20	0,20
Topsoil	0,17	0,10	0,35	0,05	0,20	0,20	0,18	0,20	0,30
Sand	0,92	0,65	1,95	0,18	0,70	0,70	2,28	1,30	3,30

Table 4.1 illustrates that most of the fill underlies Site B with lesser amounts underlying Site C. Cognisance should however be taken of the presence of mounds of fill covering the area in general and sites A and B in particular.

A substantial thickness of sand underlies Site C with very little in the vicinity of Site B, and estimated quantities of available material from the area, listed in **Table 4.2**, suggests that cover material such as aeolian sand is available from Sites A and C. The availability and easy access of cover material is highlighted as one of the key considerations when deciding on the location of a landfill site.

Table 4.2: Summary of soil volumes available

Soil Type	Volume (m^3)		
	Site A	Site B	Site C
Fill	2 500	37 500	1 667
Topsoil	8 500	2 500	9 167
Sand	46 000	8 750	113 750

Suitability for extension, current state of the site, soil depth, soil quality, and in situ permeability were factors that were considered during the determination of the geotechnical suitability of the area. Specific details on the geotechnical suitability of the area are discussed in **Appendix D1** of this report.

4.2.3 Agricultural Potential

(a) Dryland

The soils of the area are sandy and generally deep (> 1 200mm). They will therefore drain rapidly. Due to this tendency, along with the lack of fertility as shown by the low CEC values, they have a moderate agricultural potential.

However, coupled with the hot and dry nature of the climatic regime, it can be seen that this area is not suited to dryland arable agriculture, and most of the farming enterprises in the vicinity are either game farms or cattle ranches. This is the optimum land use option in this environment.

(b) Irrigation

The soils would have a moderate to high potential for irrigation, due to the lack of any restricting layer, but the sandy nature of the soils would necessitate very careful scheduling. The soils would require a substantial and reliable supply of water to ensure optimum soil moisture at all times.

4.2.4 Geohydrological Conditions

The description of the Geohydrological conditions for Site 5 is based on the detailed Geohydrological assessment (**Appendix D3**) and the geotechnical investigations that were undertaken during the Impact Assessment phases.

Specialist geohydrological assessments have been undertaken during the scoping and EIA phases to determine the potential impact of the landfill on groundwater and the associated risks to groundwater during the construction and operational phases of the project. The scoping phase focused on reviewing available documentation and accumulation of baseline geohydrological data pertaining to the aquifers in the area, whereas the EIA phase focused on detailed investigation of possible groundwater impacts that may result from the proposed development. A more detailed investigation of the aquifers underlying the study area was also conducted. Other studies undertaken during the EIA included detailed geophysical, geological and geohydrological investigations.

The geophysical investigations was aimed at detecting any sub-surface geological structures such as fracture zones and faults that may exist in the bedrock and contact zones between different geological formations that are commonly associated with such aquifers. Detailed methodology on the geophysical investigation is presented in **Appendix 5** of the Geohydrological report.

The geological fieldwork carried out comprised geological surface mapping, the logging of soil profiles exposed in test pits excavated at strategic locations across Site 5 and the logging of drill cuttings derived from boreholes drilled for groundwater monitoring purposes to determine the rock profile at the site. Information from the geotechnical report (**Appendix D3**) was used to support the geological findings for Site 5.

Additional fieldwork and laboratory testing was also carried out in consideration of existing data and recommendations available from the previous investigations and on specific requirements to determine the impact of the proposed facilities at the chosen localities.

- **Geohydrological Conditions**

The geohydrological investigation included the drilling of four rotary percussion boreholes (MBH1 to MBH4) on Site 5 at anomalous locations obtained from the geophysical survey and indicating possible minor faults and fracture zones and geological contacts (Refer to **Figure 4.4**). The specific locations and other specifications associated with the boreholes are discussed in detail in the geohydrological report.

Figure 4.4. Location of ground water monitoring boreholes drilled during the geohydrological investigation

In further understanding the ground water conditions in the area, the existing four groundwater-monitoring boreholes (numbered P4, P5 and P26 and P28) drilled to the north, west and south of the site were considered (**Figure 4.5**). These holes are sampled on a regular basis to determine groundwater quality.

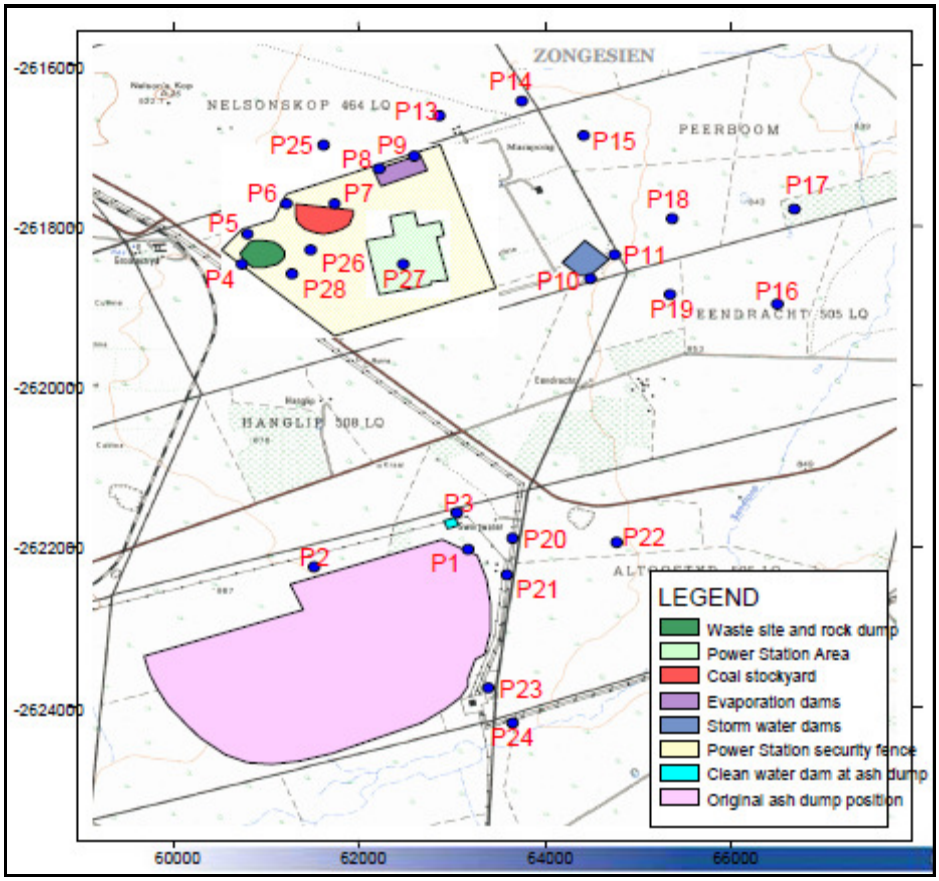

Figure 4.5: Monitoring boreholes and other land uses in Matimba powerstation (Eskom: year unknown)

The results of the water analysis indicate that the monitoring boreholes drilled at Site 5 tended to have low yields and were often dry (boreholes MBH2 and MBH4). In those boreholes where it occurred, water was generally intersected at the base of the transported and pedogenic soil layers and also sporadically in weathered sandstone and mudrock zones encountered at depths between 7m and 10m (Borehole MBH1). Blow yields of 4 l/seconds were recorded from the shallow aquifer intersected in borehole MBH1. Only rarely was water encountered in fracture zones within the carbonaceous shale layers. Borehole MBH3 intersected a fracture zone at 39m depth. The blow yields recorded from this aquifer were in the order of 0.5 l/sec.

An attempt to determine the direction of ground water flow was also considered during the hydro geological investigation. The geohydrological investigation indicated that the flow direction of groundwater at Site 5 is from north to south and from east to west. It is speculated that the elevated shallow water tables in boreholes MBH1 and P26 can be attributed to water seepage originating from the spraying of the coal in the stockyard area.

A mound of elevated groundwater, largely confined to the shallow aquifer located in the transported soils and the residual sandstone and shale layers located to depths of up to 5m below the surface may be situated below the coal stockyard and lateral flow of groundwater away from the coal stockyard area may occur.

According to the groundwater level contour map constructed for the modelling of groundwaterflow around Matimba Power Station (Grobbelaar *et al*, 2000) the groundwater levels in the waste dump area lay between 860 and 865 mass above sea level (masl). From that map it was concluded that the regional groundwater flow was in a south-easterly direction. Also according to this contour map, the water levels do not vary in elevation by more than 5 m. The recent water table measurements further indicate deeper water levels in boreholes P4 and MBH4 than in the other boreholes drilled on site. Depending on the collar elevations of the boreholes, it is therefore possible that the groundwater flow in at least a portion of the site at present is to the west rather than to the southeast, as determined by the Grobbelaar *et al*, 2000.

It is a recommendation of the geohydrological study that elevations of the borehole collar heights be determined in order to verify the present ground water flow. What was discovered from the comparison of previous and current (new) boreholes is that the water tables in boreholes MBH1 and P26 are very shallow compared to the other boreholes located further away from the coal stockyard. It is therefore speculated that the elevated shallow water tables in these two boreholes can be attributed to water seepage originating from the spraying of the coal in the stockyard area. A mound of elevated groundwater, largely confined to the aquifer located in the transported soils and the residual sandstone and shale layers located to depths of up to 5m below the surface may be situated below the coal stockyard and sideways flow of groundwater away from the coal stockyard area may occur.

- **Geochemistry**

In determining the chemistry of the underground water, boreholes were sampled on April 2009 and the samples submitted to UIS Analytical Services (Pty) Ltd in Centurion for chemical analysis. The results of the laboratory analysis were classified according to the drinking water quality guidelines of the South African National Standard (SANS). Refer to **Appendix D3** for detailed results. For the purposes of determining the extent of ground water contamination, a comparative analysis of the existing and new boreholes was undertaken for each of the subsites. Detailed results are discussed in the Geohydrological report. All groundwater samples have some values that fall outside the parameters specified for domestic quality water and are therefore not suitable for use as drinking water. The test results also show that no water sample exactly duplicates another of the ones that were tested. This may imply separate aquifers or very slow movement of water within an aquifer.

A high salinity is displayed in some water samples, particularly those originating from boreholes drilled into the shale formations. This finding was also reported in previous studies (Vermeulen, 2006 and Grobbelaar et al, 2000).

- **Aquifer classification**

The geohydrological investigation also included the evaluation of the underlying aquifers. The aquifers encountered in Site 5 were classified according to the definitions of Parson (1995) in his Aquifer System Management Classification. The results indicate a system of *High Vulnerability* to the entire Site 5, and therefore require a *High Level* of protection. The *High Vulnerability* class allocated to the aquifer system is confirmed by the results of chemical analyses of water samples collected from boreholes located on Site 5. All boreholes show signs of pollution. It is indicated in the geohydrological report that some of this pollution may originate from the shales and mudrocks within which the aquifers are located.

The results also indicate that shallow aquifers confined to the sandy and gravely surface soil deposits encountered on Site 5 have a moderate to high transmissivity and a low storativity and are vulnerable to external influences like pollution associated with water infiltrating the shallow aquifer at the coal stockyard adjacent to Site 5. Therefore, leachates generated from any general or low hazardous waste such as sludge, oil, diesel and gasoline will influence the water quality in the aquifer. The shallow aquifers overlie the deep aquifers in the sandstone, mudrock and shale formations of the Karoo Supergroup and water from the shallow aquifer replenishes water in the deep aquifer in places such as fault lines, fracture zones and weathered rock layers. The reliance on these aquifers for water sources is small at present, particularly in the vicinity of Site 5. Unless adequate linings and collector drains prevent ingress of leachate and contaminated liquids into the underlying soil and rock profiles, the groundwater will be polluted. The water quality in the deep aquifer can therefore be affected by the water quality of the shallow aquifer. It is of vital importance that hazardous substances be effectively managed during construction and operational phases to avoid further pollution.

4.2.5 Flora

A baseline vegetation and faunal investigation was undertaken by Mr. Lukas Niemand of Pachnoda Consulting during the 16th of January 2009 and from the 6th - 7th of April 2009. The main objective of the study was to evaluate the structure, composition and conservation value of the vegetation and faunal assemblages on the study site. The information presented in this section has been supplemented with results of the specialist ecological assessment (**Appendix D4**) undertaken during the Scoping and Impact Assessment Phases.

For the purpose of identifying specific vegetation composition, data collection was primarily plot-based and consisted of 21 vegetation samples (**Figure 4.6**). The sampling plot size was standardised at 100 m^2. A sample entailed the compilation of a list of plant taxa, where each taxon was assigned an estimate (usually a cover-abundance estimate). Therefore, a vegetation sample can be seen as a simplified model of the vegetation stand.

The species composition, as well as the mean percentage cover of each species per sampling plot was measured. Percentage cover was not measured precisely, but was placed in one of seven categories by a visual estimate as described by Braun-Blanquet (in Mueller-Dombois & Ellenberg, 1974). For comparison purposes, both the natural vegetation as well as rehabilitated areas was sampled. In addition, random transect walks were conducted to ensure sampling of less abundant or localised species and to assist with the compilation of a species inventory. Detailed methodology and survey information is contained in **Appendix D4** of this report.

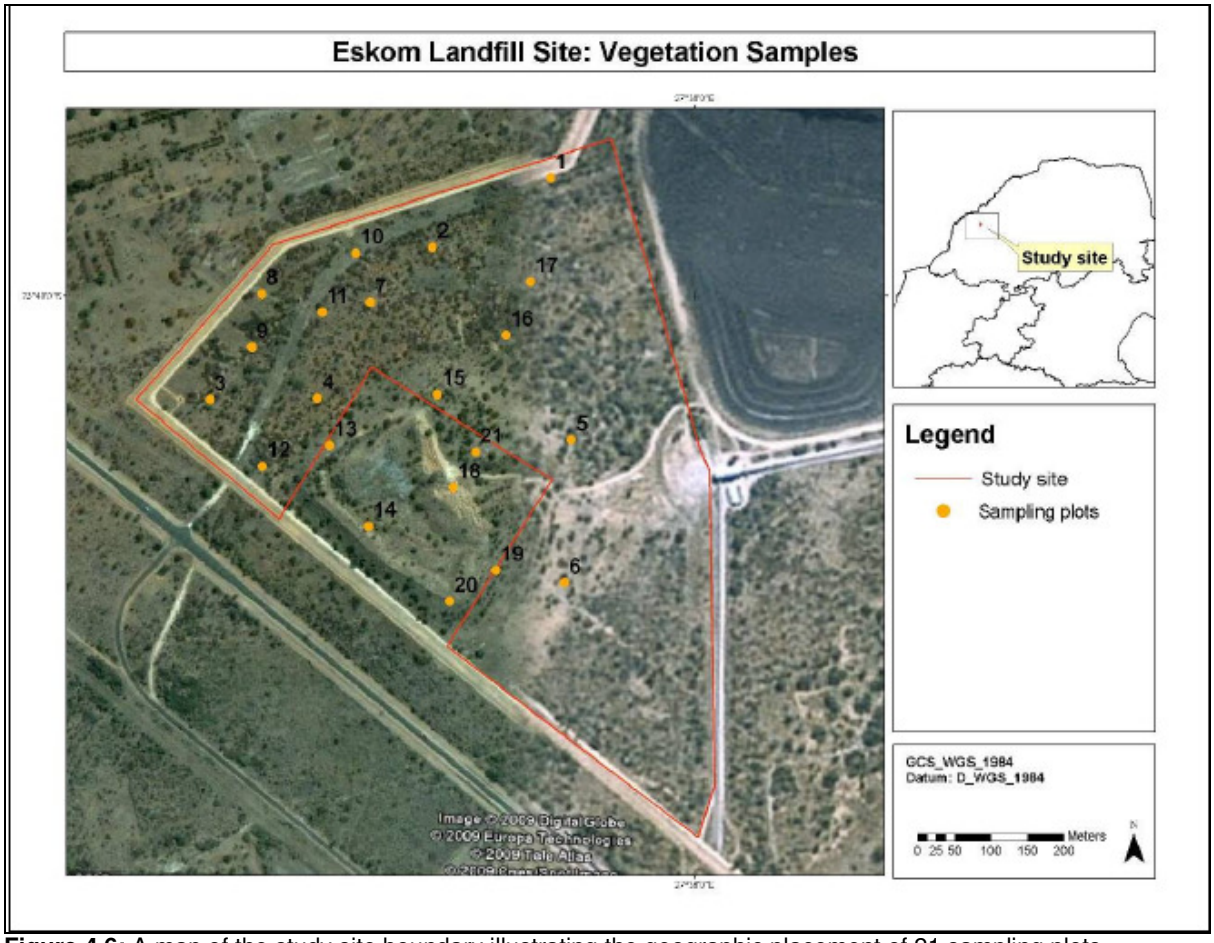

Figure 4.6: A map of the study site boundary illustrating the geographic placement of 21 sampling plots to assist with a baseline vegetation description (Google earth, 2009)

In general, the site is extensively disturbed and result, there are many places covered by alien vegetation and weeds. Dense groves of mature *Acacia* and other trees are present over some portions within Site 5. According to the ecological report, the study site is represented by the following major communities:

(a) *Cenchrus cilliaris* grassland

The above refers to the rehabilitated vegetation associated with an old landfill site and dominated by the grass *Cenchrus ciliaris*. This unit is located along the slopes of the old landfill site (Plate 4.2). It could be described as a monospecific grassland layer dominated by *Cenchrus ciliaris* that was artificially planted during the rehabilitation phase of the decomissioned landfill site.

Plate 4.2 *Cenhrus ciliaris* grassland.

(b) Mixed Woodland

Three vegetation units were identified under the mixed woodland. These include:

- *Indigofera daleoides – Digitaria eriantha* shrub

This unit is patchily distributed on the study site and corresponds to localised disturbances within the *Acacia tortilis – Enneapogon cenhroides* mixed woodland unit (**Plate 4.3**). It is therefore not possible to map this unit based on its scattered distribution. Structurally is a community of shrubs with a dense forb and grassy cover.

Plate 4.3: *Indigofera daleoides – Digitaria eriantha* shrub.

- ***Acacia mellifera – Melhania acuminata*** **thornveld**

This unit is located on the eastern part of the study site and corresponds to areas that were previously cleared of natural vegetation **(Plate 4.4).** It therefore represents a transient composition, consisting mainly of a dense woody canopy of *microphyllous taxa* pertaining to the genus *Acacia*. The graminoid and forb layers are poorly defined and consequently poor in species richness.

Plate 4.4: *Acacia mellifera – Melhania acuminata* thornveld.

- ***Acacia tortilis – Enneapogon*** **cenhroides woodland**

This unit provides an example of the natural vegetation characteristics pertaining to the region. It is essentially an open *Acacia tortilis* and *Grewia monticola* woodland of which the basal layer was dominated by secondary graminoid taxa such as *Urochloa mosambicensis*, *Enneapogon cenchroides* and *Cenchrus ciliaris* **(Plate 4.5)**. The latter species was established during the rehabilitation of the former landfill site.

Other noteworthy woody species include *Combretum apiculatum, Acacia mellifera, Terminalia sericea, Grewia flava* and *Acacia erioloba*. Typical forb species include *Indigofera daleoides*, *Tephrosia purpurea, Waltherica indica* and *Melhania acuminata*. The composition is typical of the regional vegetation type and comprises of a number of tree species protected by national legislation (e.g. *Acacia erioloba, Sclerocarya birrea, Combretum imberbe* and *Boscia albitrunca*). However, these occurred as individuals (as opposed to populations) within a confined (or enclosed) area.

Plate 4.5: *Acacia tortilis – Enneapogon cenhroides* woodland

Secondly, these tree species are all regionally widespread on farms adjacent to the Matimba power station. Although it is anticipated that some individuals of these (if not all) are likely to become lost or removed during the construction phase, effort should be put in place to conserve at least the tall specimens of *Acacia erioloba* (corresponding to option C).

4.2.6 Red Data Plant Species

No threatened, “near-threatened” or any “rare and declining” species as listed by the TSP are expected to occur on the proposed study sites. The PRECIS database of South African National Botanic Institute (SANBI) supported the absence of Red Data species on the quarter-degree grid squares corresponding to the study site.

4.2.7 Protected plant species

One species was observed and listed as protected (**see Table 4.3**) under Schedule 12 of the Limpopo Environmental Management Act (No 7 of 2003).

Table 4.3: Protected plant species recorded from the vegetation units

Species	Status on study site	Vegetation Unit
Spirostachys africana (Euphorbiaceae) – tree	Localised	Mainly recorded from the old landfill site (probably implants used during rehabilitation)

A permit is required to remove or disturb a protected plant. It is recommended that protected plants in danger of becoming destroyed during the construction phase be removed prior to the commencement of construction activities and translocated to suitable habitat, or used during the rehabilitation phase.

Four tree species (**Table 4.4**) appear on the national list of declared protected tree species as promulgated by the National Forests Act, 1998 (No 84 of 1998). The main reasons for this list are to provide strict protection to certain species while others require control over harvesting and utilisation. These species occur widely throughout the study site and is by no means restricted in range. In addition, these species are not threatened (not Red Data listed), but should be considered during the development phase of the project based on their legal status.

In terms of the National Forests Act of 1998, a licence should be granted by the Department of Water Affairs and Forestry (or a delegated authority) prior to the removal, damage or destruction of any individual. Therefore, such activities (as mentioned above) should be directed to the responsible Forestry official in each province or area (please contacts Mr. D. Mavhungu at Private Bag X2413, Louis Trichardt, 0920 or (015) 516 0201 or e-mail him at mavhunguD@dwaf.gov.za).

Table 4.4: Protected tree species recorded from the vegetation units identified from the study site.

Species	Status on study site	Vegetation Unit
Acacia erioloba (Mimosaceae) – Camel Thorn	Widespread	*A. tortilils – E. cenchroides* mixed woodland
Boscia albitrunca (Capparaceae) – Shepard's Tree	Widespread	*A. tortilils – E. cenchroides* mixed woodland
Combretum imberbe (Combretaceae) - Leadwood	Localised	*A. tortilils – E. cenchroides* mixed woodland
Sclerocarya birrea subsp. *caffra* (Anacardiaceae) - Marula	Localised	*A. tortilils – E. cenchroides* mixed woodland *C. ciliaris* grassland (implanted)

4.2.8 Medicinal Plants

It is estimated that the Southern African subcontinent holds approximately 24 300 plant taxa (Arnold & De Wet, 1993), an estimated 10 % of the world's flora. In addition, South Africa is home to a diversity of cultural groups all of which utilises plant species for some purpose. A number of these species are highly prized for their traditional healing properties; especially for "muthi" (they have ethnomedicinal value). It is estimated that more than 28 million people in South Africa consume about 19 500 tonnes of plant material per annum (Mander, 1998). For example, certain popularly traded species have become over-exploited and are now rare or extinct in the wild. This has resulted in the forced use of alternative species and a geographical shift in the harvesting pressure of previously unexploited areas. Although most of these plant species are regionally widespread and abundant, some of the more sought-after plant resources are currently declining and should be envisaged as priority conservation entities. **Table 4.5** lists those species considered to be of economical or cultural value (according to Van Wyk *et al.*, 1997).

Table 4.5: A list of medicinal species observed on the study site (according to Van Wyk *et al.*, 1997). Important (heavily utilised) species are highlighted in grey.

Species	Parts used	Treatment
Elephantorrhiza elephantina	Rhizomes	Treatment of a wide range of ailments including diarrhoea and dysentery.
Euclea undulata	Roots	Used as a remedy for headaches and toothaches.
Sclerocarya birrea subsp. *caffra*	Bark and fruit	Treatment of various ailments, including malaria. Fruit rich in Vitamin C.
Terminalia sericea	Roots	An infusion is made to treat pneumonia and wounds.
Ziziphus mucronata	Roots, leaves and bark	Treatment of respiratory ailments.

4.2.9 Declared weeds and invaders

Invaders and weed species are plants that invade natural or semi-natural habitats; especially areas disturbed by humans and are commonly known as environmental weeds. Weeds that invade severely disturbed areas are known as ruderal and agrestal weeds. Most of these weeds are annuals colonising waste sites and cultivated fields. These weeds only persist on recently disturbed areas and seldom invade established areas (Henderson, 2001). Declared weeds and invaders have the tendency to dominate or replace the canopy or herbaceous layer of natural ecosystems, thereby transforming the structure, composition and function of natural ecosystems.

The study site was relatively free of declared invader and weed species except for the occasional occurrence of annual and ruderal species such as *Bidens bipinnata* and *Tagetes minuta*. *Achyranthes aspera* was the only declared weed observed from the mixed woodland units while the invader *Nicotiana galuca* was observed from the decomissioned site.

4.2.10 Conservation and Protected areas

The location of the proposed development site will not affect any conservation or protected area. The nearest conservation area, D'Nyala Nature Reserve, is approximately 12.5km east of the Matimba power station. However, many of the surrounding farms are utilised as game and hunting farms, including Grootvallei, and support high abundances of free-roaming game (e.g. Impala, Warthog and Kudu).

4.2.11 Wetlands, Rivers, Drainage lines and Impoundments

A Surface Water Resource Assessment (**Appendix D5**) undertaken during the Scoping phase did not identify and sensitive areas within the boundaries of site, thus no wetland assessment was undertaken. Sensitive ecosystems were identified as the wetland areas, river systems and ridges that are located in close proximity to the Site 1, 2, 3 & 4 that have since already been scoped out during the scoping phase of this EIA. Please refer to **Figure 4.7** for further details**.**

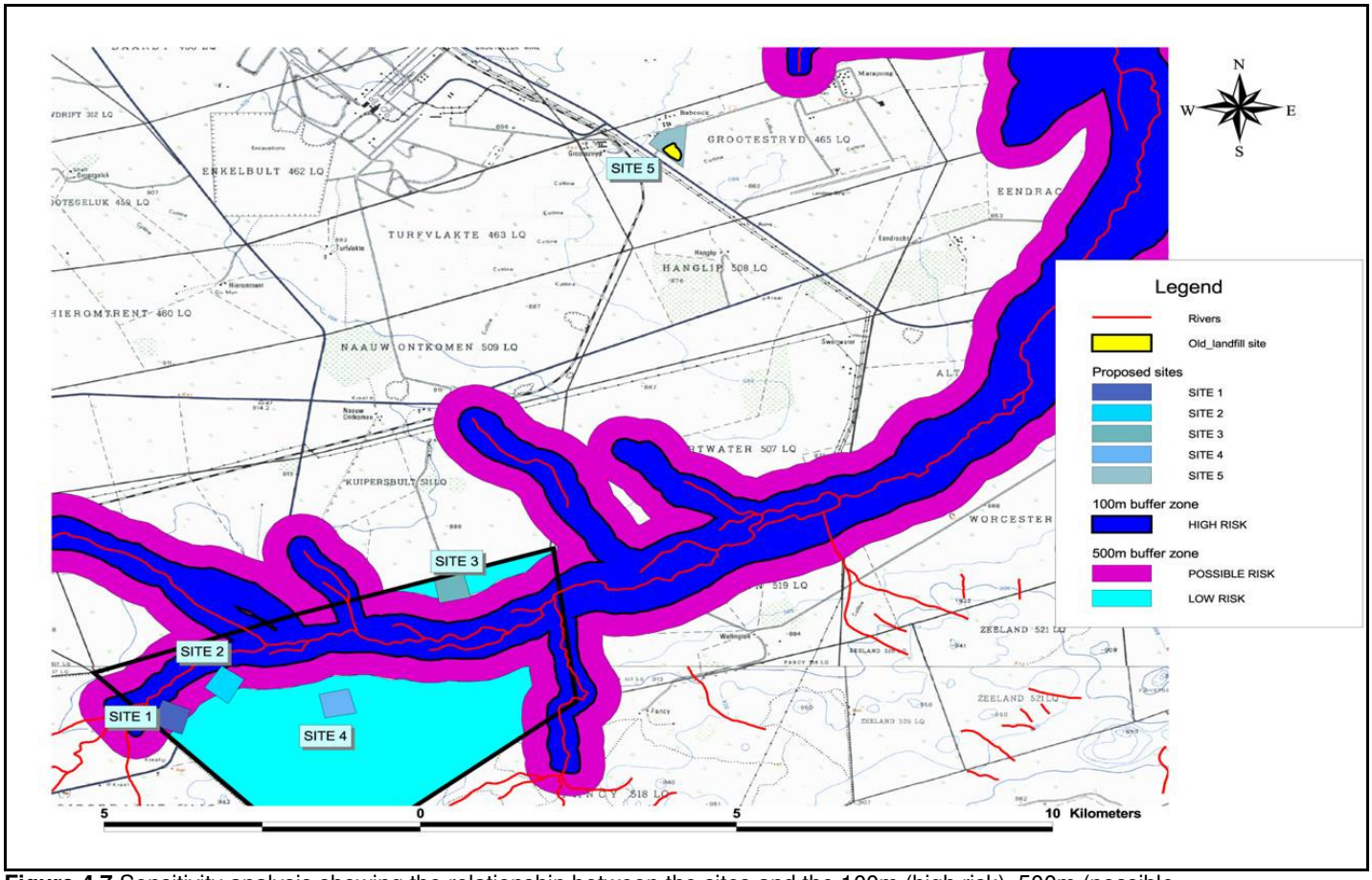

Figure 4.7 Sensitivity analysis showing the relationship between the sites and the 100m (high risk), 500m (possible risk) and > 500m (low risk) buffer zones with respect to surface water resources (Wetland Consulting Services: 2009)

The Ecological specialists did not encounter any sensitive wetland areas on the proposed Matimba site during the Impact Assessment phase.

4.2.12 Faunal Survey

Mammals were identified by visual sightings through random transect walks and by means of an infrared-triggered digital camera. In addition, mammals were also identified by means of spoor, droppings, roosting sites or likely habitat types. The mammal survey was augmented by means of a small mammal trapping session. Five (5) trapping stations **(Plates 4.6 & 4.7)** were placed among natural and rehabilitated vegetation assemblages. Each trapping station consisted of 12 traps spaced 10 m apart. The traps, based on the 'Sherman Trap' design, were baited with a mixture of peanut butter, raisins and rolled oats. According to the Ecological specialist report, the conservation status of mammal taxa was based on Friedmann & Daly (2004). Whereas the mammalian nomenclature was based on Skinner & Chimimba (2005).

Plate 4.6. An example of a small mammal (live) trap used during the assessment

(a) Observed and Expected Richness

Thirty seven (37) mammalian species could occur on the study site (Appendix 2 of Ecological report) of which 10 was confirmed during the site visit (**Table 4.6 & Plate 4.7**). It appears that the most dominant mammalian taxa pertain to the Order *Rodentia* and include *Tatera leucogaster* (Bushveld Gerbil), *Cryptomys hottentotus* (Common Mole-rat), *Hystrix africaeaustralis* (Cape Porcupine) and *Pedetes capensis* (Springhare).

Table 4.6: An inventory of mammalian taxa observed from the study site

Scientific Name	Vernacular Name	Observation Indicators	Observed Habitat
Aethomys ineptus	Tete Veld Rat	Trapped (Trapping station 1)	Fairly common from the study site.
Crocidura sp. nr. *C. hirta*	Musk Shrew	Trapped (Trapping Station 1)	Fairly common from most habitat types on the study site.
Cryptomys hottentotus	Common Molerat	Soil heaps	Dominant and widespread.
Hystrix africaeaustralis	Cape Porcupine	Excavations & quills	Widespread.
Mungos mungo	Banded Mongoose	Visual sightings	Mainly present from the *A. tortilis-E. cenchroides* woodland.
Pedetes capensis	Sprinhare	Droppings & burrows	Widespread on sandy soils.
Potamochoerus larvatus	Bushpig	Visual sightings	Mainly present from the *A. tortilis-E. cenchroides* woodland.
Saccostomus campestris	Pouched Mouse	Dead individual	Mainly present from the *A. tortilis-E. cenchroides* woodland.
Sylvicapra grimmia	Common Duiker	Camera, spoor and droppings	Mainly present from the *A. tortilis-E. cenchroides* woodland.
Tatera leucogaster	Bushveld Gerbil	Burrows & trapped (Trapping station 2, 3 & 4)	Widespread on sandy soils.

Plate 4.7: A series of photographs illustrating some of the mammalian taxa observed on the study site: (a) a *Sylvicapra grimmia* (Common Duiker) captured by means of an infrared camera, (b) *Sylvicapra grimmia* Common Duiker) droppings and (c) a *Crocidura* sp. nr. *C. hirta* (Musk Shrew) individual captured from trapping station 1.

(b) Red listed, "near-threatened" and "data deficient" species

The study site provides potential habitat for one (1) "Near-threatened" species and five (5) "Data Deficient" species. Red list categories were chosen according to Friedmann & Daly (2004).

- South African Hedgehog (*Atelerix frontalis*) - "Near-threatened"

This species occurs in a wide variety of habitat types, which makes prediction regarding its habitat requirements very difficult. It adapts readily to urban environments and is frequently encountered in urban gardens (Skinner & Smithers, 1990; Skinner & Chimimba, 2005), although illegal hunting, habitat transformation to make way for agricultural land, and hard-surfaced infrastructure has contributed towards population declines across its distribution range.

The South African Hedgehog is highly likely to occur on the study site based on its preference for dry open habitat types. Hedgehogs will readily adapt to most types of development, if emphases is placed on preserving the natural function and connectivity of their preferred habitat type.

- Data Deficient taxa

The shrew taxa (*genus Crocidura*), *Tatera leucogaster* (Bushveld Gerbil), *Lemniscomys rosalia* (Single-striped Grass Mouse) and *Elephantulus brachyrhynchus* (Short-snouted Elephant-shrew) and all classified as "Data Deficient" and most of these could occur on the study area. For example, the *genus Tatera* often colonises disturbed areas and was abundant on the study site. However, these species are perceived to be relatively widespread and abundant, but current modifications of suitable habitats and the paucity of scientific information on metapopulation demographics place them in the "Data Deficient" category.

4.2.13 Avifauna

Birds were identified by means of random transect walks while covering as much of the study site as possible. Species, where necessary, were verified using Roberts Birds of Southern Africa, 7th ed. (Hockey *et al*., 2005). Birds were also identified by means of their calls and other signs such as nests, discarded egg shells (Tarboton, 2001) and feathers. The bird survey was also informed through data of the South African Bird Atlas and verified by Harrison *et al*. (1997). Reporting rates were used for bird species recorded for the quarter degree grid cell (QDGC) 2327DA. Reporting rates were calculated as the total number of observer cards on which the species was recorded during the southern African bird atlas project expressed as a percentage of the total number of cards submitted for the particular QDGC. The reporting rate statistic provides a "snapshot" of the thoroughness of which the QDGC was surveyed between the periods of 1987 – 1991. The conservation status of bird species was chosen according to Barnes (2000).

(a) Observed and Expected Richness

A total of 216 bird species could occur in the study area (Appendix 3 of the Ecological Report (**D4**)) of which 100 were recorded during the two site visits. According to the South African Bird Atlas Project (SABAP1) (Harrison *et a*l., 1997), a total of 289 bird species have been recorded from the quarter degree grid cell (QDGC) 2327DA corresponding to that of the study site.

(b) Red Listed species

According to the South African Bird Atlas Project, a total of 13 Red listed species have been recorded from the QDGC 2327DA. **Table 4.7** provides an indication of their occurrence to utilise the study site based on their breeding, roosting and foraging requirements. However, the Atlas data should be used with caution since the observations were made by the lay person. This means that some areas were less sampled than other areas, with the possibility that unknown Red listed populations could have been overlooked in the past for reasons such as popularity (areas frequently visited due to the bird compositions they hold) or due to restricted access. Many of the species as listed in **Table 4.7** are in fact vagrants or irregular visitors (e.g. *Terathopius ecaudatus (*Bateleur*), Aquila rapax (*Tawny Eagle*)* and *Polemaetus bellicosus* (Martial Eagle) to the study site.

Table 4.7: Red Data Bird species assessment (according to Harrison *et al.,* 1997; Barnes, 2000) and an indication of their likelihood of

Scientific Name	Common Name	Conservation Status	Probability of Occurrence	Habitat
Aquila rapax	Tawny Eagle	Vulnerable	Vagrant to study site	Lowveld and Kalahari savanna, especially game farming areas and reserves.
Ardeotis kori	Kori Bustard	Vulnerable	Unlikely to occur	Arid open lowland savanna and karroid shrub.
Buphagus erythrorhynchus	Red-billed Oxpecker	Near-threatened	Co-occur with larger bovine game and cattle; absent from study site	Bushveld areas with game and livestock.
Ciconia nigra	Black Stork	Near-threatened	Vagrant to study site	Wetlands, pans in lowland regions.
Glareola nordmanni	Black-winged Pratincole	Near-threatened	Vagrant to study site	Open grassland and arable land near wetlands
Gyps africanus	White-backed Vulture	Vulnerable	Irregular visitor – unlikely to breed on study site	Breed on tall, flat-topped trees.
Gyps coprotheres	Cape Vulture	Vulnerable	Irregular visitor – unlikely to breed on study site	Breeds on steep south- and east-facing cliffs; foraging habitat varies.
Leptoptilus crumeniferus	Marabou Stork	Near-threatened	Irregular visitor to study site	Varied, from savanna to wetlands, pans and

				floodplains – dependant of game farming areas.
Mycteria ibis	Yellow-billed Stork	Near-threatened	Unlikely to occur	Wetlands, pans and flooded grassland.
Polemaetus bellicosus	Martial Eagle	Vulnerable	Irregular visitor to study site	Varied, from open karroid shrub to lowland savanna.
Saggitarius serpentarius	Secretarybird	Near-threatened	Probably absent from study site	Open woodland and savannoid grassland.
Terathopius ecaudatus	Bateleur	Vulnerable	Irregular visitor to study site	Lowveld and Kalahari savanna; mainly on game farms and reserves.
Torgos tracheliotos	Lappet-faced Vulture	Vulnerable	Irregular visitor – likely to be vagrant to the study site	Lowveld and Kalahari savanna; mainly on game farms and reserves.

The list of "threatened", "near-threatened" and "conservation important" faunal species noted in the immediate surrounding areas within the vicinity are also included in the Ecological Assessment report attached in **Appendix D4.**

4.2.14 Herpetofauna

Possible burrows, or likely reptile habitat (termitaria, stumps or rocks) were inspected for any inhabitants. Amphibians were also identified by their vocalisations (if any) and through likely habitat types (e.g. water features, drainage lines, etc.). However, the current assessment focussed largely on a desktop review.

Although a number of reptile and amphibian species are expected to occur on the study site, the current survey did not pretentiously focus on this rather cryptic group. Few species were observed during the survey and include widespread taxa such as *Schismaderma carens* (Red Toad), *Naja mossambica* (Mozambique Spitting Cobra), *Agama aculeata distanti* (Ground Agama), *Panaspis wahlbergii* (Wahlberg's Snake eyed Skink), *Lygodactylus capensis* (Cape Dwarf Gecko) and *Heliobolus lugubris* (Bushveld Lizard).

Currently, none of the frog species likely to occur are Red listed (Minter *et al*., 2004), although *Python natalensis* (Southern African Python) could occur. The latter species is currently classified as "Vulnerable" (Branch, 1988) and has a distribution range sympatric to that of the study site.

4.2.15 Invertebrates

The invertebrate survey was limited to the presence of conservation dependant taxa, in particular that of scorpions and mygalomorph (e.g. baboon spider taxa) species. The presence of these was verified by intensive searching for burrows from likely habitat types or by means of rock turning.

A number of invertebrate taxa are currently protected by Schedule B1 of the list of threatened and protected species issued in terms of Section 56(1) of the National Environmental Management: Biodiversity Act, 2004 and likely to occur on the study site. **Table 4.8** provides a list of species of conservation concern and their respective probabilities of occurrence.

Table 4.8: A list of invertebrate taxa of conservation concern likely to occur on the study site.

Scientific Name	Common Name	Conservation Status	Probability of Occurrence	Habitat
Mantichora sp.	Monster Tiger Beetle	Protected	Confirmed.	Aggressive predator on sandy plains.
Opistacanthus asper		Protected	Likely to occur.	Arboreal, partial towards *Acacia nigrescens*.
Opistophthalmus "wahlbergii"	Burrowing Scorpion	Protected	Confirmed.	Sandy plains.
Opistophthalmus glabrifrons	Burrowing Scorpion	Protected	High – could occur.	Sandy to loamy soils.
Opistophthalmus carinatus	Burrowing Scorpion	Protected	High – could occur.	Sandy soils along rocks or on plains.
Ceratogyrus darlingi	Horned Baboon Spider	Protected	High – could occur.	Sandy soils.

There are currently no Red List butterfly species likely to occur on the study site.

4.2.16 Ecological Sensitivity

Ecological sensitivity of any piece of land is based on its inherent ecosystem service (e.g. wetlands) and overall preservation of biodiversity. The following was considered as part of ecological sensitivity assessment.

(a) Ecological Function

Ecological function relates to the degree of ecological connectivity between systems within a landscape matrix. Therefore, systems with a high degree of landscape connectivity amongst one another are perceived to be more sensitive and will be those contributing to ecosystem service (e.g. wetlands) or overall preservation of biodiversity.

(b) Conservation Importance

Conservation importance relates to species diversity, endemism (unique species or unique processes) and the high occurrence of threatened and protected species or ecosystems protected by legislation.

(c) Sensitivity Scale

- ***High*** – Sensitive ecosystems with either low inherent resistance or low resilience towards disturbance factors or highly dynamic systems considered being important for the maintenance of ecosystem integrity. Most of these systems represent ecosystems with high connectivity with other important ecological systems OR with high species diversity and usually provide suitable habitat for a number of threatened or rare species. These areas should be protected.

- ***Medium*** – These are slightly modified systems which occur along gradients of disturbances of low-medium intensity with some degree of connectivity with other ecological systems OR ecosystems with intermediate levels of species diversity but may include potential ephemeral habitat for threatened species.

There are no communities that were considered to be high ecological importance.

The following vegetation units were considered to be of medium ecological importance:

• *Acacia tortilis – Enneapogon cenhroides* woodland; and
• *Indigofera daleoides – Digitaria eriantha* shrub

The composition of these units was floristically more diverse when compared to the other units. They were particularly rich in woody taxa and two of the few units hosting more than one protected tree species. In addition, although not of primary condition, the former unit shared many floristic similarities with that of the regional

type, namely the Limpopo Sweet Bushveld. It therefore represents a "snapshot" of the regional vegetation type. In addition, both units host a higher richness of faunal taxa in comparison to the other units due to an improved structural and vertical heterogeneity.

The following vegetation unit was considered to be of medium-low ecological importance:

• *Acacia mellifera – Melhania acuminata* thornveld.

This unit was not considered to be pristine, and occurred on areas where previous disturbances took place in the past (such bush clearing). It provides potential ephemeral foraging habitat for a number of faunal species.

- ***Low*** – Degraded and highly disturbed/transformed systems with little ecological function and are generally very poor in species diversity (most species are usually exotic or weeds).

The following vegetation unit was considered to be of low ecological importance:

• *Cenchrus ciliaris* grassland.

This unit was disturbed or transformed, and was composed of typical pioneer/mid successional species or taxa, many with annual life histories. These species were considered transient and ecologically redundant.

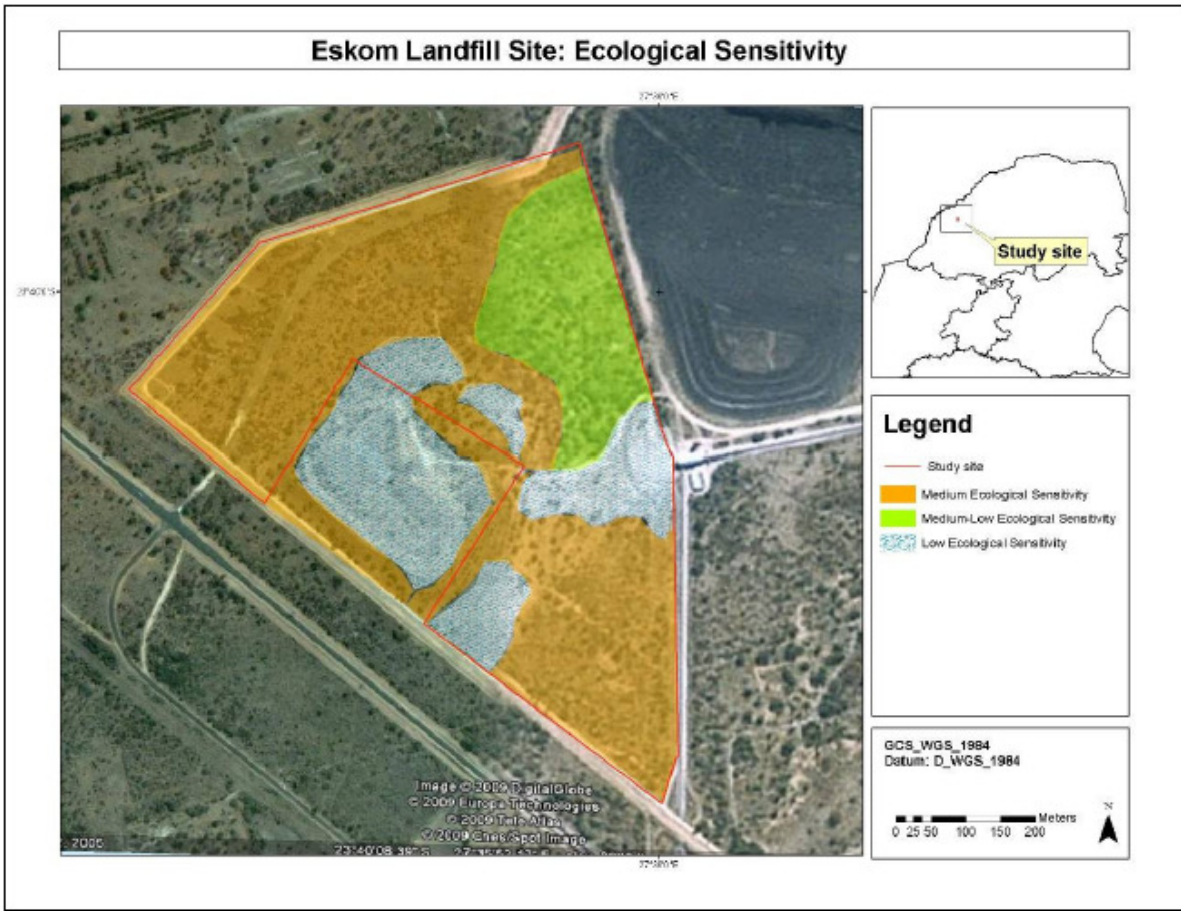

Figure 4.8: A sensitivity map of the study site based vegetation.

The study site shows that Site 5a falls within area of low ecological sensitivity site and Sites 5b and 5c fall in an area of medium ecological sensitivity. No areas of **(Figure 4.8)** of high sensitivity were noted. This is due to the existing fragmentation caused by numerous linear features (e.g. roads, fences and conveyors), all disrupting the natural migration of larger faunal species. In addition, neighbouring activities associated with the power station have all contributed towards disrupting the ecological connectivity of the woodland units with that of adjacent woodland types.

4.3 Human Environment

The information pertaining to the socio economic and demographic profiles in the Lephalale areas provided in these sections is based on the information provided in the Social Impact Assessment (SIA) report (**Appendix D6**) provided by Ms Ilse Aucamp of PTERSA. The demographic, economic, socio cultural, geographic, institutional, legal, and emancipatory and empowerment processes were considered during the Impact Assessment phase. The study approach and methodology of the Social Impact Assessment is detailed in the SIA report.

4.3.1 Socio Economic and Population characteristics

The Waterberg District Municipality is the largest district municipality in the province and consists of six local municipalities, namely Mogalakwena, Lephalale, Bela- Bela, Modimolle, Thabazimbi and Mookgopong. The district is located in the western side of the Limpopo province and borders the neighbouring country of Botswana, as well as the North West and Gauteng provinces. Waterberg district is rural in nature with urban areas that can mostly be described as dispersed and fragmented.

The key pillars of economic development in the Waterberg area are mining, agriculture and tourism. The area has significant mineral zones with the most important mining activities including granite, tin, platinum, iron and coal. About 45% of the total in situ coal reserves of South Africa are in the Waterberg area, although only a fraction of this coal could be considered recoverable because the bulk is too deep to mine economically. In terms of agriculture most of the district is suited for livestock production, but some major cropping is also taking place e.g. cotton, sunflower, tobacco, and soya bean production. The Waterberg region has a competitive edge in terms of tourism because of its close proximity to the Gauteng province, its rich biodiversity, malaria-free areas and its hunting capital status. The area is home to the Macadam's Valley World Heritage Site as well as the provincial Nature Reserve Nylsvley which is internationally known for the wetlands research undertaken there as well as the Marakele National Park near Thabazimbi.

The Waterberg District Municipality sees infrastructure as the cornerstone of social upliftment and economic development (www.waterberg.gov.za), and it claims to have allocated sufficient funding to kick start a basis for the development of proper infrastructure in needy areas. Local Government as the custodian of community infrastructure such as roads, waste disposal sites, water & sanitation systems, and public facilities claimed to have ensured that the bulk of investment is geared towards addressing community needs.

Lephalale is the largest municipality in the Waterberg district and accounts for 39% of the district. It came into being in December 2000 as a result of the amalgamation of the Ellisras/Marapong Transitional Local Council and the Ellisras/Tswelopele Transitional Local Council. The municipality is about 19 605 square kilometres in size and shares an international border with Botswana. The main town in the area is Lephalale (previously known as Ellisras). The area is a prime hunting mecca and prime eco-tourism area that draws thousands of tourists every year. Lephalale forms part of the world-renowned Waterberg Savannah Biosphere and is also well-known for its coal-mining industry which is, besides tourism, the mainstay of the area. Also in the area is the Kumba Grootegeluk mine which is the largest mine of its kind in South Africa and the Matimba powerstation that is currently the largest dry-cooled power station in the world.

Priority issues that have been identified in the Lephalale area (Lephalale Municipality: Spatial Development Framework, 2006) include clinics, roads, water reticulation, sustainable employment projects, acquisition of municipal land, electricity, improved payment of services, schools/training, improvement of bulk water supply and comprehensive community services & facilities.

(a) Population Characteristics

Although the Limpopo province showed a positive growth rate (based on the results of the Census 2001 and Community Survey 2007 data), it was still below the national average (Table 1 - **Appendix D6**). The Waterberg district as well as the Lephalale municipal area both showed a decline in population which was more pronounced in the Lephalale area. As the town of Lephalale has expanded a lot over the past couple of years, it is possible that this phenomenon may relate more to the rural areas of the municipality as most of the people in the municipality live there. It must be mentioned that there is a discrepancy between the population Community Survey 2007 shows for Lephalale (80 141) and the population that Lephalale's website indicates (105 000 – www.lephalale.com). It is anticipated that the urban population will increase over the next years and that the town of Lephalale will expand even more due to the construction of additional power stations and the associated industrial activities. **Table 4.9** is a summary of the population growth and household estimates.

Table 4.9: Community Survey 2007 Population, growth and household estimates

	Limpopo Province	**Waterberg DM**	**Lephalale LM**
Approximate population size	5,238,286	596,092	80,141
Estimated growth in population since 2001	4.86	-2.94	-16.61
Average household size	4.31	3.71	3.38

It must be noted that exact figures are not available, and that even the Census Survey 2007 data is a projection. The Quantec database (www.quantec.co.za), for example, bases its population figures on the Census 2001 data and then applies projection factors based on available economic and demographic data. Their projection for Limpopo is 5,548,548, for the Waterberg District is 686,620 and for the Lephalale Local Municipality is 96,763. Population statistics should thus be interpreted as indicative and used to show patterns and trends.

The population distribution for the area under investigation looks very similar on municipal and district level with the majority belonging to the Black population and a greater proportion whites than on a provincial level.

More than 90% of the people in the Lephalale area belong to the Black population (Community Survey 2007). The White population is the second largest population group in the area with an average age of about 8-10 years higher than the black population in the area. The population in the area is very young, with more than 50% being younger than 24 years of age. About 20% of the population aged 20 years or older has completed Grade 12 or higher. Almost half of the people between the ages of 15 and 65 years have no income at all.

The Community Survey 2007 did not release information on home language, but according to Census 2001, just over half the population in the Lephalale area has Sepedi as home language, followed by almost a third with Setswana as home language. The third most common home language was Afrikaans (9%). Not even a percentage of the population in the Lephalale area had English as home language. This suggests that in addition to English as language of communication, Afrikaans, Sepedi and Setswana should also be included in communication to ensure as wide an audience as possible is reached.

4.3.2 Infrastructure (Water, Sanitation, Electricity, Refuse Removal and Roads)

In the Lephalale area, more than 40% of households have to access water from piped water from an access point outside their yards, with only just below a third having access to piped water inside the dwelling. The Lephalale area also has the greatest proportion of people that get their water from a borehole. Bulk water supply has been identified as an issue in the Lephalale area (Lephalale SDF Report, 2006). The problem has been identified as lack of infrastructure in the sense that the existing reticulation system/s need to be maintained and extended to such an extent that it is not possible to reach the preferred levels of service delivery due to financial constraints experienced by the local authority.

A quarter of the households in the Lephalale area have indicated that their refuse is removed at least once a week by a local authority or a private company, while the bulk of the remaining households have indicated that they have their own refuse dumps. In terms of sanitation, about 50% of the households have pit toilets without ventilation and about 30% have flush toilets that are connected to a sewerage system. Lack of access to basic sanitation services can create massive environmental and health problems in both rural and urban areas in any area. Most of the non-urban/rural settlements do not comply with minimum RDP levels of water supply and sanitation facilities (Lephalale SDF Report, 2006). Low levels of education regarding sanitation and the use of water for personal hygiene is also contributing to the problem.

The roads in the area are in a poor state due to limited maintenance. The poor state of the primary roads is having a detrimental effect on the distribution of goods (Lephalale SDF Report, 2006). Possible causes are lack of funds, human resources and equipment, as well as lack of capacity to maintain existing infrastructure.

4.3.3 Historical and Cultural Features

The Matimba site and immediate surrounds has been used for industrial processes since the 1940'sand there is no indication of any on-site cultural features present prior to development or operation and if any had been present, they were not preserved by the original developers or operators of the site.

According to the Heritage Impact Assessment (**Appendix D7**) report that was undertaken, only a few sites of cultural significance are known to occur in the larger geographical area. This is due to the somewhat inhospitable environment of the area, being very flat with few sources of surface water, which did not allow people to settle in large numbers in this region in the past.

In areas where there are outcrops, especially close to rivers, rock art sites and sites dating to the Late Iron Age have been documented. Further afield, to the south, some Early and Late Iron Age sites are known to exist. The Waterberg, also located to the immediate south of the project area, is particularly rich in archaeological sites. Closer to the project area the town of Lephalale contains a cemetery with the graves of some of the earliest white settlers in the area.

A cultural heritage survey of the Medupi proposed landfill sites, including Site 5, identified no heritage features on the site of the proposed development.

4.3.4 Roads and Traffic

Lephalale area is a vastly growing area due to its riches in coal minerals. It is expected that the population will grow due to the developments in the area i.e. Eskom Medupi power station and other known developments around the study area; the traffic is expected to grow as well. A new haul access road leading to Matimba coal yard will be under construction in the near future. The road will intersect with Nelson Mandela Drive which is a provincial road. Should the road not prove adequate to provide access to the landfill site, it is anticipated that additional roads will be constructed to allow for the transport of waste for disposal from Matimba and Medupi power stations.

A detailed traffic impact analysis was undertaken during the EIA phase to investigate the traffic impact of the proposed development onto the immediate surrounding road network and its site access(s) and further determines whether it is necessary to implement any road and/or intersection improvements to mitigate the anticipated traffic impact. The availability of access road network, transportation and maintenance costs were considered during the study. Specific details on the anticipated road network and challenges are discussed in the Traffic Impact Assessment report attached in **Appendix D8.**

The main roads surrounding the sites include Nelson Mandela Drive (provincial road), Afguns Road and roads to Marapong Township and Grootegeluk Mine. All these roads are expected to be affected with additional traffic relating to the Landfill Site and Hazardous Waste Facility generated traffic**.** Traffic volume on these roads is generally low.

The proposed landfill site will be served by an access road, which will be located along the new haulage road. The proposed access will form a T-Junction with the new haulage road and it will be stop controlled. The access will consist of one entry lane and one exit lane. A security boom gate should be 100m from the provincial road.

4.3.5 Air Quality

The proposed landfill site will obviously have impacts on the current odour levels. Typical problems associated with landfill operations in South Africa which are associated with atmospheric emission potentials include: fires, inadequate daily cover practices and acceptance of hazardous waste types by general landfill operations.

Detailed air quality monitoring assessment to assess the occupational health and safety implications of air quality (dust deposition, PM10 Landfill gas) on the site was undertaken during the Impact Assessment Phase by Gondwana Environmental Solutions (see **Appendix D9**). The baseline assessment included the review of available meteorological data. The potential impact of emissions from the proposed landfill on the surrounding environment was evaluated through the compilation of an emissions inventory and subsequent dispersion modelling. According to the report, wind direction at Lephalale is north-north-east with lesser wind components from the north-east and north. It is predicted that emissions from the proposed Eskom landfill are predicted to be transported a few hundred meters downwind towards the north-west and south east and to a lesser extent, towards the western areas in respect of the landfill. This is due to the prevailing meteorological conditions in Lephalale.

The report further indicates that predicted emissions of PM10 during the construction phase exceed the National daily and annual ambient air quality standards. Predicted emissions of TSP during the construction phase exceed the ambient air quality standards (Schedule 2, Section 63 of the National Air Quality Act of 2004) and pose a short-term health risk to inhabitants in the neighbouring areas. It should be noted that there are no residential areas that are located closer to the landfill site and there will be no direct effects on neighbouring community.

In addition, buffer zones, or set back distances, represent separations between the registered landfill site boundary and any adjacent residential areas or sensitive developments. It is expected that buffer zones will established to ensure that a landfill operation does not have an adverse impact on quality of life and/or public health. The establishment and maintenance of buffer zones is enforceable in terms of the Health Act, 1977 (Act 63 of 1977), which makes provision for measures necessary to prevent any nuisance, unhygienic or offensive condition that is harmful to health (DWAF, 1998a).

Exposure to pollutants and landfill gases such as particulate matter, sulphur dioxide, nitrogen dioxide, carbon monoxide, volatile organic compounds (benzene, toluene) could have impacts on human health.

4.3.6 Noise Environment

The proposed area is adjacent to the powerstation and its supporting infrastructure and therefore already has a degraded ambient noise climate more typical of an industrial area than a rural environment. Daytime noise in the area is expected to be very low. Road traffic noise is significant within 200m of the tar roads in the area. Existing noise sources include:

- Natural sounds of the bush;
- Livestock and agricultural activity on surrounding land;
- Local community and domestic noise; industrial, and
- Vehicles and other transport serving the local community.

Noise impact assessment was undertaken by JH Consulting cc during the Impact Assessment phase in order to estimate any potential noise impact on the existing ambient noise climate in the surrounding area of the proposed landfill operation. Details on the instrumentation and the models that were used to quantify ambient noise levels in the area. Specific findings of the Noise Impact Assessment are contained in **Appendix D10** of this report.

4.3.7 Visual and Aesthetic Features

The description of the visual character of the site is based on the Visual impact assessment that was undertaken during the impact assessment phase. Refer to **Appendix D11**. The study area, which consists of the landscape and its comprising elements, is considered a visual resource. Similar to other natural resources, a visual resource has a value to a group of people/observers, in this case an aesthetic value. The aesthetic value will not be described in terms of monetary quantities, but it is a qualitative value with an underlying social, cultural and/or ecological connotation.

The regional topography is predominantly undulating and very few distinguishing features are visible in proximity to the site. The most dominant topographical features are man-made of which the overburden stockpiles at the Grootgeluk Colliery is most obvious. These man-made mountains tower above the vegetation cover and are even more visible due to its contrasting orange-yellow colour. Other man-made topographical features are the coal stockpile bordering the eastern perimeter of the site and the decommissioned dump on the site itself.

The natural vegetation type, as described by Acocks (1974), is a mixed bushveld comprising of straggly shrubs and large, broad-leaved trees. The vegetation is fairly dense and forms a continuous draping canvas over the undulating terrain. In general, the region still appears to be in a pristine conditions judging by the large areas that consists of natural vegetation.

The area is also renowned for its rich coal reserves. This specific attribute has caused alterations in the natural character of the region. The Grootgeluk Colliery and the existing Matimba Power Station are visible products of the underground coal reserve. Remarkably, the regional character of the landscape is still dominated by its natural features and only in a few isolated instances has the landscape undergone major character alterations.

The site is located west of the Matimba Power Station on a triangular portion of land, still within the boundaries of the power station's property. The western boundary is parallel to the Stockpoort Road with a100m strip vegetation in between, while the northern boundary is against the security fence of the Matimba Power Station. There is approximately a 300 m strip of vegetation between the northern boundary and the D2816 road that leads to Marapong Township.

The character of the site is greatly dominated by the presence of the Matimba Power Station adjacent to it. The sheer scale of the power station is very impressive and makes a bold statement in the undulating and monotonous landscape. The site is currently fenced into the Matimba property and is clearly associated with the power station due to the only access being through the security gates at the Matimba entrance.

The proposed site is located within the site boundaries of the existing Matimba Power Station in the north-western corner of the Matimba site, adjacent to the Stockpoort road. The character of the site is greatly dominated by the presence of the Matimba Power Station adjacent to it. According to the visual specialist, the sheer scale of the power station is very impressive and makes a bold statement in the undulating and monotonous landscape. The site is currently fenced into the Matimba property and is clearly associated with the power station due to the only access being through the security gates at the Matimba entrance.

A section of the site was previously used as a decommissioned dump which has since been rehabilitated. The remainder of the site portrays the typical dense vegetation cover that is found elsewhere. The site is located amongst a number of man-made infrastructures such as roads, railway lines, power lines, conveyor belts and the Matimba Power Station. The region is subject to a visual clutter of overhead transmission lines and telecommunication services. The character of the region is dominated by service delivery infrastructure. Although large areas are still dominated by natural vegetation, it is highly fragmented and the natural character is fairly disturbed.

The presence of an existing man-made landform (decommissioned dump) on the site further reduces the impact on the character of the site. The site is well screened from the road and motorists are expected to experience minimal exposure to the impact (**Figure 4.8**). The likely impacts associated with the project are listed in a visual impact assessment report attached in **Appendix D11** of this report.

4.3.8 Crime

In Limpopo Province as well as at the Lephalale Police Station the most common crime is "All theft not mentioned elsewhere". This category basically refers to all theft excluding theft of motor vehicles and motorcycles, theft out of or from motor vehicles, housebreaking at both residential and non-residential premises and stock-theft. Items most frequently taken in case of other theft are cellular phones, money, jewellery and tools (particularly garden tools). The other most frequent crimes are contact crimes (crimes against the person) as well as contact-related crimes (malicious damage to property).

5 CHAPTER 5 ASSESSMENT OF IMPACTS

5.1 Introduction

The main objective of this section is to provide independent and scientifically sound information on the impacts identified during the Scoping & EIA. Based on the requirements of the impact assessment, and the approved Plan of Study of EIA, impacts identified and issues and concerns raised are assessed with regard to their significance. The impact assessment is aimed at determining the impacts associated with the proposed development and the prescription of mitigatory measures. Other impacts associated with the proposed development are discussed in detail in this section. The significance of the potential impacts is described in terms of their *nature*, *extent*, *duration*, *intensity* and *probability.*

In this report, impacts with a *low* significance are considered to have no influence on the decision to proceed with the proposed development. Impacts with a *moderate* significance will influence the decision unless they can be effectively mitigated to a *low* significance, whereas impacts with a *high* significance despite mitigation would influence the decision to proceed with the proposed development. The impacts listed in this section were identified by the EIA Project Team (including specialists) and were augmented by input from the I&APs during the public review of the Environmental Impact Report.

5.2 Impact Assessment Methodology

Activities within the framework of the proposed development and its construction and operational phases, give rise to certain impacts. For the purpose of assessing these impacts, the project has been divided into phases from which impacting activities can be identified, namely:

a) ***Status Quo***

The site as it currently stands taking cognisance of the disturbance and the impacts remaining, while operating.

b) **Pre-construction phase**

All activities on site up to the start of the construction, not including the transport of materials, but including the initial site preparations. This also includes the impacts, which would be associated with planning.

c) Construction phase

All the construction and construction related activities on site, until the contractor leaves the site.

d) Operational phase

All activities, including the operation and maintenance of the proposed development.

The activities arising from each of the relevant phases have been included in the tables contained in this chapter. The assessment endeavours to identify activities that require certain environmental management actions to mitigate the impacts arising from them. The criteria against which the activities were assessed are given in **Section 5.2.1.**

5.2.1 Assessment Criteria

The assessment of the impacts has been conducted according to a synthesis of criteria required by the guideline documents in terms of the NEMA EIA regulations of 2006.

a) Nature of impact

This is an appraisal of the type of effect the proposed activity would have on the affected environmental component. The description should include what is being affected, and how.

b) Extent

The physical and spatial size of the impact. This is classified as:

i) Site

The impact could affect the whole, or a measurable portion of the above-mentioned properties.

ii) Local

The impacted area extends only as far as the activity, e.g. a footprint.

iii) Regional

The impact could affect the area including the neighbouring farms the transport routes and the adjoining towns.

c) Duration

The lifetime of the impact. This is measured in the context of the lifetime of the proposed base.

I) Short term

The impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than any of the phases.

ii) Medium term

The impact will last up to the end of the phases, where after it will be entirely negated.

iii) Long term

The impact will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter.

iv) Permanent

The only class of impact, which will be non-transitory. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient

d) Intensity

Is the impact destructive or benign? Does it destroy the impacted environment, alter its functioning, or slightly alter it? This is rated as:

i) Low

The impact alters the affected environment in such a way that the natural processes or functions are not affected.

ii) Medium

The affected environment is altered, but function and process continue, albeit in a modified way.

iii) High

Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.

This will be a relative evaluation within the context of all the activities and the other impacts within the framework of the project.

e) Probability

This describes the likelihood of the impacts actually occurring. The impact may occur for any length of time during the life cycle of the activity, and not at any given time. The classes are rated as follows:

i) Improbable

The possibility of the impact occurring is very low, due either to the circumstances, design or experience.

ii) Probable

There is a possibility that the impact will occur to the extent that provisions must be made therefore.

iii) Highly probable

It is most likely that the impacts will occur at some or other stage of the development. Plans must be drawn up before the undertaking of the activity.

iv) Definite

The impact will take place regardless of any prevention plans, and there can only be relied on mitigatory actions or contingency plans to contain the effect.

f) Determination of significance

Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required.

The classes are rated as follows:

i) No significance

The impact is not substantial and does not require any mitigatory action.

ii) Low

The impact is of little importance, but may require limited mitigation.

iii) Medium

The impact is of importance and therefore considered to have a negative impact. Mitigation is required to reduce the negative impacts to acceptable levels.

iv) High

The impact is of great importance. Failure to mitigate, with the objective of reducing the impact to acceptable levels, could render the entire development option or entire project proposal unacceptable. Mitigation is therefore essential.

In order to maintain consistency, all potential impacts that have been identified during the EIA process will be listed in impact assessment tables. The assessment criteria used in the tables will be applied to all of the impacts and a brief descriptive review of the impacts and their significance provided in the text of the report. The overall significance of impacts will be determined by considering consequence and probability.

The potential impacts and key issues identified during the Scoping Phase as per the specialists investigations include:

- Soil and groundwater contamination;
- Geotechnical suitability;
- Disturbance of floral and faunal species;
- Changes in visual and landscape character;
- Social impacts;
- Heritage impacts;
- Transportation requirements;
- Increased noise levels;
- Atmospheric pollution and odours (air emissions); and
- Safety and security.

These impacts are discussed in further detail in the various sections within this chapter. Potential cumulative impacts that may arise from the proposed development have been identified and discussed in this section. Specialists' investigation reports have also been attached in **Appendices D1** to **D11** to support the findings of this EIA.

5.3 Assessment of the impacts

In this EIR, mitigation measures will refer to the precautionary measures that can be implemented in the planning stage in order to avoid, reduce or remedy the impacts of activities from the proposed project. An EMP, specifying the methods and procedures for managing the environmental aspects of the proposed development, during the construction and operational phase is attached in **Appendix E.**

5.4 Biophysical Impacts

5.4.1 Ground water contamination (water quality)

Waste disposal sites are known to influence and have significant potential impacts on ground water. Potential impact of pollutants from the landfill on the groundwater is thus anticipated during both construction and operational phases. A Specialist Geohydrological assessment has been undertaken during the scoping and EIA phases to determine the potential impact of the landfill on groundwater.

A number of factors identified during the Impact assessment phase are likely to increase the risks associated with the construction and operational phases of the proposed development, however with effective mitigation the impacts can be of low significance. The factors that were identified and investigated as part of the geohydrological assessment are as follows:

- Soil permeability;
- Shallow water tables;
- Ground water flow direction;
- Vulnerability of the aquifers;
- The quality of the ground water;
- Chemistry of ground water; and
- Sources of ground water contamination.

The proposed development has the potential for contaminating ground water through the various activities that are associated with the development. One of the key geohydrological concerns relate to the potential impact of pollutants on the groundwater given the shallow and rising water table in the area.

Previous studies undertaken in the area indicated groundwater tables at depths exceeding 10m. At present (based on the findings of the Geohydrology), the average groundwater table at Site 5 is between 4m and 8m. Such findings are indicative of potential pollution problems that will require effective mitigation.

Leachate and polluted water seepage originating from the Coal Stockyard to the east and from decommissioned located on Site 5 affect sites 5a and 5b. Laboratory tests carried out on water samples collected from monitoring boreholes drilled at Sites 5a and 5b show that the groundwater has been affected. The potential impacts from leachate are assessed as follows:

Development Phase	**Impact: Leachate Seepage through porous soil cover into groundwater**					
	Extent	**Duration**	**Intensity**	**Probability**	**Significance**	
					(WM)	**(WOM)**
Site 5a						
Pre-construction	Regional	Long Term	Low		Significance	Significance
Construction	Local	Short Term	Medium	Highly Probable	Low	High - Medium
Operation	Regional	Long Term	Medium	Highly Probable	Low	High - Medium
Development Phase	**Impact: Leachate Seepage through porous soil cover into groundwater**					
	Extent	**Duration**	**Intensity**	**Probability**	**Significance**	
					WM	**WOM**
Site 5b						
Pre-construction	Regional	Long Term	Low			
Construction	Local	Short Term	Medium	Highly Probable	Low	High
Operation	Regional	Long Term	Medium	Highly Probable	Low	High
Development Phase	**Impact: Leachate Seepage through porous soil cover into groundwater**					
	Extent	**Duration**	**Intensity**	**Probability**	**Significance**	
					WM	**WOM**
Site 5c						
Construction	Local	Short Term	Medium	Highly Probable	Low	High
Operation	Regional	Long Term	Medium	Highly Probable	Low	High

WOM – Without mitigation; WM – With mitigation.

It is apparent from this table that the disposal of waste would require careful management and effective mitigation measures in order to avoid impacts on groundwater resources. Although the conclusion of the study is that the groundwater in Site 5a is not affected by polluted leachates seeping from the Coal Stockyard or the decommissioned waste dump on Site 5, robust waste management is still required.

During construction, pollutants may find their way into the surface and underground water systems. Typical sources of pollution include oils and fuels from construction vehicles and construction materials such as cement, detergents, paints and other chemicals. Careful management and implementation of an appropriate EMP at the site, including environmental awareness training for all construction staff, would reduce the risk of pollution. It is therefore desirable that existing areas of pollution be kept as small as possible. To minimise the possibilities of increasing the area potentially exposed to pollution, the following is recommended:

» From a geohydrological viewpoint it is therefore recommended that the proposed general and low hazard waste facilities be located in either Sites 5a or 5b, which are equally favourable and that Site 5c be considered as the least favourable site for development to minimise the risk of further pollution in this area.
» Due to shallow water tables (particularly in Sites 5a and 5b) it is recommended that excavations do not extend deeper than 4m below the present surface level. Deeper excavations may intersect the shallow perched water table that exists at least during the rainy seasons and will affect the design and the construction of the proposed facilities;
» Leachate generated by the general and the low hazard waste should be collected in lined drains and ponds;
» Stormwater should be diverted from the waste sites and runoff stormwater should be collected in lined ponds.
» It is recommended that the four boreholes drilled for this study are included into the monitoring programme for the Matimba Power Station and that this programme is adapted to include recommendations made in the geohydrological report.
» It is also recommended that the proposed landfill be located in an area that has already been affected by water contamination rather than in an area where no water contamination has been identified.
» for this reason, it is therefore advised that new landfills for general and hazardous waste be located in the southern (site 5b) and eastern portions (site 5a) of Site 5; and

» precautionary measures are taken to prevent seepage of leachates and contaminated water from the new landfill into the underlying aquifers.

Other generic mitigation measures to prevent potential ground water contamination are as follows:

» Avoid development within 100 year floodline;
» Use of impermeable liner(HDPE or GCL) to prevent ground water contamination and leachate;
» Conduct regular inspections of infrastructure at regular intervals in order to identify any potential failure of infrastructure and repair immediately;
» Design the landfill to comply with DWAF Minimum requirements for waste disposal by landfill;
» Provision of infrastructure that will minimise potential pollution;
» Run-off drains must be installed leading to a leachate dam on all phases of the landfill;
» Servicing of vehicles must only take place in a workshop area;
» Runoff and storm water must always be diverted around one or both sites of the waste body by a system of berms or cut off drains as per the Minimum requirements; and
» Water contaminated by contact with waste, as well as leachate must be contained within the site.

The impacts on underground water resources will be reduced to *low* significance with mitigation.

5.4.2 Geology and soils

Various construction activities i.e. excavations and earth grading will be undertaken. Depending on location, this may encourage soil erosion, soil compaction, chemical soil pollution and soil degradation. These impacts will be localized as the activities will occur on a footprint or on the development boundaries and also where access roads will be constructed. Major impacts from these activities are anticipated to occur during construction only.

None of the sub-sites exhibit fatal flaws in so far as unstable areas, steep slopes, shallow bedrock or pans and *vleis* are concerned as per the findings of the geotechnical assessment. The environmental impacts and mitigating measures discussed in the section that follows apply equally to the three sub-sites (Sites 5a, 5b and 5c). In determining the suitability of the site for the location of the waste disposal site, several factors highlighted in the section that follows were taken into consideration.

- **Suitability for extension:** The possibility exists that land may be required to increase the capacity of the landfill in the future. Ideally this expansion should take place adjacent to the existing facility since the infrastructure such as roads, weigh bridges and offices will be in place. Site 5a can be extended to the south, land is available to the north and south of Site 5b for expansion, and little land is available for expansion of Site 5c. Site 5b is therefore the more preferable for future expansion.

- **State of the site**: This reflects the degree of disturbance to which the site has been subjected to in the past. Sites A and B have been extensively disturbed, whilst Site C appears to have been less disturbed. Ideally, development on a disturbed site is preferable to that on an undisturbed site, suggesting that Sites 5a and b are preferable for the development.

- **Soil depth:** This refers to the thickness of soil available for use as cover material during operations and at closure. Both sites A and C have approximately 160 000 m^3 of sand available, whilst Site B is blanketed by fill comprising sand and boulders. Ideally the landfill should not be placed within a depression or an excavation lower that the surrounding ground, since water can collect in it. This situation arises when the cover material is excavated from beneath the foot print of the landfill. The optimal siting of the facility is therefore at ground level and sourcing the cover material from a nearby location. Site B is therefore best suited for this.

- **Soil quality:** This reflects the suitability of the available material for use as cover. The laboratory results indicates that the aeolian sand blanketing Sites A and C are classified as a fine silty sand with little, if any, plastic binder. It is considered to be of fair workability as a cover material and its permeability coefficient indicates that it is semi pervious. It is however, considered to be highly erodible due to the lack of plastic fines. No suitable cover material underlies Site B within the depth range investigated where it is blanketed by fill.

- ***In-situ* permeability:** is the ease with which water seeps through the surface soil and into the ground water. All of the sites are blanketed by fairly permeable aeolian sand or fill to depths of between 0,7 and 2,3 m. The calcrete that invariably underlies the sand is marginally less permeable but still occurs within the sub-sites. The ranking for the three sub-sites is therefore of the same order.

The geotechnical impacts that may affect the development are summarised in a **Table 5.1** with mitigating measures.

Table 5.1: Summary of Geotechnical Impacts

Impact	Mitigation measures
Leachate seepage through porous soil cover into groundwater.	Impermeable lining with leachate detection system to be provided beneath landfill.
Availability of cover material.	200 000 m^3 aeolian sand available from within the overall site.
Insufficient quantity of cover material.	Kalahari sand is ubiquitous in the region and borrow pits will have to be identified if volume on site is insufficient.
Potentially collapsible sand blanketing the site.	Raft foundations or stiffened footings will have to be provided for all buildings.
Suitability of *in-situ* material for access road.	The aeolian sand when compacted provides material of G8 quality. A base course and riding surface will have to be provided.

It is to be noted that the effect on the ground water regime is discussed in detail in a Geohydrological report attached in **Appendix D3. Table 5.2** is a summary of the impacts that were identified and their significant rating**.**

Table 5.2: Summary of identified significant impacts with significance rating

Project phase	Extent	Duration	Intensity	Probability	Significance without mitigation	Significance with Mitigation
Impact 1	**Leachate seepage through porous soil cover into ground water**					
Site 5a						
Construction	Local	Short term	Medium	Probable	Low	Low
Operational	Local	Long term	Medium	Probable	Low	Low
Site 5b						
Construction	Local	Short term	Medium	Probable	Low	Low
Operational	Local	Long term	Medium	Probable	Low	Low
Site 5c						
Construction	Local	Short term	Medium	Probable	Low	Low
Operational	Local	Long term	Medium	Probable	Low	Low
Impact 2	**Availability of cover material**					
Site 5a						
Construction	Local	Short term	Medium	Probable	Low	Low
Operational	Local	Long term	Medium	Probable	Low	Low
Site 5b						
Construction	Local	Short term	Medium	Probable	Low	Low
Operational	Local	Long term	Medium	Probable	Low	Low

Site 5c						
Construction	Local	Short term	Medium	Probable	Low	Low
Operational	Local	Long term	Medium	Probable	Low	Low
Impact 3	**Insufficient quantity of cover material**					
Site 5a						
Construction	Local	Short term	Medium	Probable	Low	Low
Operational	Local	Long term	Medium	Probable	Low	Low
Site 5b						
Construction	Local	Short term	Medium	Probable	Low	Low
Operational	Local	Long term	Medium	Probable	Low	Low
Site 5c						
Construction	Local	Short term	Medium	Probable	Low	Low
Operational	Local	Long term	Medium	Probable	Low	Low
Impact 4	**Potentially collapsible sand blanketing the site**					
Site 5a						
Construction	Local	Short term	Medium	Probable	Low	Low
Operational	Local	Long term	Medium	Probable	Low	Low
Site 5b						
Construction	Local	Short term	Medium	Probable	Low	Low
Operational	Local	Long term	Medium	Probable	Low	Low
Site 5c						
Construction	Local	Short term	Medium	Probable	Low	Low
Operational	Local	Long term	Medium	Probable	Low	Low
Impact	**Suitability of in situ material for access road**					
Site 5a						
Construction	Local	Short term	Medium	Probable	Low	Low
Operational	Local	Long term	Medium	Probable	Low	Low
Site 5b						
Construction	Local	Short term	Medium	Probable	Low	Low
Operational	Local	Long term	Medium	Probable	Low	Low
Site 5c						
Construction	Local	Short term	Medium	Probable	Low	Low
Operational	Local	Long term	Medium	Probable	Low	Low

The introduction of new infrastructure associated to the project could potentially lead to soil compaction due to construction traffic. However contractors will in all likelihood make use of existing paved access roads to the site.

Implementing appropriate mitigation measures during construction as well as post construction rehabilitation can reduce the impact. Typical mitigation and rehabilitation measures include the following:

» Construction of anti-erosion berms;
» Linear infrastructure i.e. untarred access roads are inspected quarterly to check that associated water management infrastructure is effective in controlling erosion and eroded areas are repaired;
» Ripping of compacted soil;
» Ensuring that stockpiles are well managed to minimise erosion thereof; and
» Planting of grass.

5.4.3 Ecological Systems

Much of the area within the surroundings of Site 5 in particular, is disturbed and the impacts are expected to be insignificant with mitigation. During the construction period, litter and construction waste could be introduced which could impact on the ecological integrity of the area particularly in the remaining natural environments. Of particular concern would be soil and water contamination that may result from irresponsible management substances such as oils, paints and general waste.

Furthermore, the introduction of this landfill site implies that hazardous waste that was required to be transported and disposed of off site will be deposited close to its area of generation. This hazardous waste can cause ecological and human health problems if transported and disposed of in an unsafe manner.

The impacts of the project activities on the ecological systems are considered to be of *moderate* to *low* significance without mitigation.

Project phase	Extent	Duration	Intensity	Probability	Significance without mitigation	Significance with Mitigation
Impact	Contamination of the surrounding ecological environment					
Site 5a						
Construction	Local	Short term	Medium	Probable	moderate	Low
Operational	Local	Long term	Medium	Probable	moderate	Low
Site 5b						
Construction	Local	Short term	Medium	Probable	moderate	Low
Operational	Local	Long term	Medium	Probable	moderate	Low
Site 5c						
Construction	Local	Short term	Medium	Probable	moderate	Low
Operational	Local	Long term	Medium	Probable	moderate	Low

5.4.4 Surface Water Resources and Wetland Ecosystems

The investigations undertaken by the Ecological and Wetlands and Surface Water resource specialists have highlighted some sensitivities within the boundaries of Grootvallei, This farm was eliminated during the screening phase.

According to the ecological specialists, no drainage line traverses Site 5 and the site falls outside any 500m buffer zones and within areas of Low risk. Further ecological investigation undertaken during the impact assessment phase did not identify any sensitive wetland systems on Site 5. Refer to **Appendix D5**.

Project phase	Extent	Duration	Intensity	Probability	Significance without mitigation	Significance with Mitigation
Impact	Contamination of the surrounding ecological environment					
Site 5a						
Construction	Local	Short term	Medium	Improbable	Low	Low
Operational	Local	Long term	Medium	Improbable	Low	Low
Site 5b						
Construction	Local	Short term	Medium	Improbable	Low	Low
Operational	Local	Long term	Medium	Improbable	Low	Low
Site 5c						
Construction	Local	Short term	Medium	Improbable	Low	Low
Operational	Local	Long term	Medium	Improbable	Low	Low

Good environmental management practices must be followed to prevent potential contamination of soil and water resources. Typical mitigation measures should include the following:

» Avoid impacts on surrounding streams and water courses;
» Carrying out routine vehicle maintenance and washing at a maintenance workshops instead of at the construction site or camps;
» Utilisation of drip trays to prevent oil or fuel spills in case of on-site emergency maintenance;
» Minimisation of quantities of fuel, and other hazardous material kept at the construction site;
» Safeguarding of hazardous substances from being stolen, vandalised, catching fire or spilling on open ground;
» Conducting concrete batching on provided impermeable sheet material;
» Introduction of appropriate waste and sewage collection and disposal procedures and facilities during construction; and
» Safe transportation and disposal of increased amounts of hazardous waste at a licensed hazardous waste disposal facility.

The impacts of the project activities on the surface water resources and wetlands systems are considered to be of *low* to *low* significance without mitigation as there no highly sensitive areas located in closer proximity to the site and the site falls outside the 500m buffer zone of watercourses and wetlands.

5.4.5 Vegetation

(a) Construction Impacts: Vegetation

- **Impact 1** – *Clearing of vegetation*. The development will result in the clearing of a large proportion of vegetation to accommodate the proposed landfill site and associated infrastructure.

In addition, decommissioning (and rehabilitation efforts) of the landfill site will result in the establishment of vegetation that is atypical of the region. This is clearly illustrated by the floristic composition on the current (and derelict) landfill area which was basically merely "stabilised" through the planting of a single *graminoid* species. Included were a number of tree species which were uncommon or rare from the adjacent vegetation communities (e.g. *Spirostachys africana, Acacia burkei* and *Dodonaea angustifolia*). It is also anticipated that the low in plant diversity as evidenced by prior rehabilitation techniques, the occurrence of non-native plant species and the change in structural diversity will result in a corresponding change in the faunal diversity.

- **Impact 2** – *Loss of conservation important plant taxa*. It is possible that sensitive species (e.g. medicinal species and those protected by provincial legislation) may become lost during the construction phase. In addition, the anticipated increase in anthropogenic activities could lead to the uncontrolled and unsustainable harvesting of sensitive/medicinal plant species (by both the labour force and residents).

- **Impact 3 –** *Establishment of alien and invader taxa*. The clearing of vegetation will leave bare patches of soil, thereby enhancing the colonisation by ruderal weeds (mostly annual weeds) or declared alien species that will prohibit the natural succession during rehabilitation activities. Such soil disturbances (as well as the inappropriate handling of topsoil) could enhance the establishment or spread of *Melia azedarach* and *Nicotiana glauca* to natural systems adjacent of the development. The following impact table is a summary outlined in terms of the assessment methodology as per the findings of the ecological specialist. No "no go areas" have been identified.

Issue	Nature	Extent	Duration	Intensity	Probability	Potential Significance	
						WOM	WM
	Site 5a						
Impact 1	*A. mellifera-M. acuminata* thornveld	Local	Permanent	Medium	Highly probable	Medium	Low
	Site 5b						
	C. ciliaris grassland	Local	Permanent	Low	Probable	Low	N/a
	Site 5a, b and c						
	***I. daleoides-D. eriantha* shrub**	Local	Permanent	Medium	Highly probable	Medium	Low
	A. tortilis-E. cenchroides woodland	Local	Permanent	High	Highly probable	Medium	Low

Impact 2	Loss conservation important taxa						
	Site 5 a	Local	Permanent	Medium	Definite	High	Medium
	Site 5b	Local	Permanent	Medium	Definite	High	Medium
	Site 5c	Local	Permanent	Medium	Definite	High	Medium
Impact 3	Establishment of alien & invader taxa	Regional	Long-term	Medium	Highly probable	Medium	Low
	Site 5 a	Regional	Long-term	Medium	Highly probable	Medium	Low
	Site 5b	Regional	Long-term	Medium	Highly probable	Medium	Low
	Site 5c	Regional	Long-term	Medium	Highly probable	Medium	Low

WOM – Without mitigation; WM – With mitigation.

The potential impact on the important conservation taxa is considered to be of high significance without mitigation and with the effective application of mitigation measures impacts can be reduced to medium to *low* significance.

(b) Operational impacts – vegetation

- **Impact 1** - *Loss of conservation important plant taxa*. It is possible that sensitive species (e.g. medicinal species and those protected by provincial legislation) may become lost during the operation phase due to an anticipated increase of anthropogenic activities that could lead to the uncontrolled and unsustainable harvesting of sensitive/medicinal plant species (by both the labour force and local communities).

- **Impact 2** - *Establishment of alien and invader taxa.* The continual clearing of vegetation and disturbances to the soil surface will facilitate the colonisation by ruderal weeds (mostly annual weeds) or declared alien species that will prohibit the natural succession during rehabilitation activities. The anticipated impacts and their significance are summarised below.

Issue	**Nature**	**Extent**	**Duration**	**Intensity**	**Probability**	**Potential Significance**	
						WOM	**WM**
Impact 1	Loss of conservation important plant taxa						
	Site 5a	Local	Long-term	Medium	Probable	Medium	Low
	Site 5b	Local	Long-term	Medium	Probable	Medium	Low
	Site 5c	Local	Long-term	Medium	Probable	Medium	Low
Impact 2	Establishment of alien & invader taxa	Regional	Long-term	High	Definite	Medium	Low
	Site 5a	Regional	Long-term	High	Definite	Medium	Low
	Site 5b	Regional	Long-term	High	Definite	Medium	Low
	Site 5c	Regional	Long-term	High	Definite	Medium	Low

Similarly, no "no go areas" were identified for the operational phase. It is evident from the table that anticipated impacts of loss of important conservation species and establishment of invader species are of *moderate* significance without mitigation and of *low* significance after mitigation.

5.4.6 Fauna

(a) Construction impacts - fauna

Birds in general are highly mobile and therefore able to vacate areas should adverse environmental conditions prevail. Therefore, direct impacts on adult mortality are unlikely to occur, although indirect impacts will have severe consequences on the "fitness" (e.g. the ability of a species to reproduce) of these species. Likely examples include habitat loss and disturbances preventing individuals from breeding successfully. Persistent disturbances across extended temporal scales will eventually affect any population's ability to sustain itself, and will more than likely result in total abandonment of a particular area.

Species most likely to be affected are either K-selected species or habitat specialists. K-selected species are mostly long-lived species with slow reproductive rates while habitat specialists are those restricted to a particular type of microhabitat or niche, being it structurally, altitudinal or floristic. Most of these species are threatened, "near-threatened" or Red Listed, and therefore of conservation importance.

As with the birds, most mammal species are likely to vacate areas when environmental conditions become unfavourable. However, those species most likely to be affected will include subterranean species, species requiring large home ranges or habitat specialists (such as *Opistophthalmus s*corpions). Once again, continual disturbances across both temporal and spatial scales will discourage the colonisation of most species.

- **Impact 1** - *Loss of habitat*. A number of habitat types will be completely removed and transformed to new habitat types consisting of monospecific grasslands (e.g. *Cenchrus ciliaris* grassland). Species most likely to be affected will include habitat specialists or stenotopic taxa (e.g. *Ceratogyrus* spiders, *Opistophthalmus* scorpions and *Mantichora* beetles).

Species that will benefit from the development, more so from the creation of artificial grasslands and bare patches of soil, will include common species such as the Common Mole-rat (*Cryptomys hottentotus*), Bushveld Gerbil (*Tatera leucogaster*) and Cape porcupine (*Hystrix africaeaustralis*).

- **Impact 2** - *Disturbance caused during construction activities*. Although almost all faunal species are to be affected by disturbances, it will be the larger mammal species (e.g. ungulates) and those requiring larger home ranges that will be affected.

Other possible disturbances include killing and snaring of mammal and reptile species by labourers.

- **Impact 3** – Loss of taxa of conservation concern. It is anticipated that many stenotopic and fossorial taxa of conservation concern will become lost during earth-moving activities associated with the construction of the landfill site.

Issue	Nature	Extent	Duration	Intensity	Probability	Potential Significance	
						WOM	WM
Impact 1	Loss of habitat						
	Site 5a	Local	Permanent	High	Definite	High	Medium
	Site 5b	Local	Permanent	High	Definite	High	Medium
	Site 5c	Local	Permanent	High	Definite	High	Medium
Impact 2	Disturbances						
	Site 5a	Regional	Long-term	High	Definite	Medium	Low
	Site 5b	Regional	Long-term	High	Definite	Medium	Low
	Site 5c	Regional	Long-term	High	Definite	Medium	Low
Impact 3	Loss of taxa of conservation concern						
	Site 5a	Local	Permanent	High	Definite	High	Medium
	Site 5b	Local	Permanent	High	Definite	High	Medium
	Site 5c	Local	Permanent	High	Definite	High	Medium

(b) Operational impacts – Fauna

- **Impact 1** – *Disturbances*. Similar to **Section 5.4.6:** Impact 2.

- **Impact 2** – *Changes in community structure*. It is believed that the densities of certain opportunistic species (mainly bird species) could increase tenfold due to the establishment of a landfill site. These taxa could easily out-compete other less resilient taxa in the area. For example, it is believed that the densities of Pied Crows (*Corvus albus*) are likely to increase in the region. These species are aggressive competitors, which will eventually compete with other raptors in the area, leading to an imbalance in the natural food chain.

- **Impact 3** – *Potential introduction of alien species*. Typical landfill environments provide the ideal breeding and roosting habitat for alien or introduced mammalian taxa. It is possible that the landfill site could provide the ideal nucleus for the proliferation of invader species such as *Mus musculus* (House Mouse), *Rattus rattus* (Brown Rat), domestic dogs and cats. However domestic dogs and cats would most likely not be able to gain access to the sites). In addition, many of these species could be host to a number of parasite species or vectors of foreign diseases that could spread to the local indigenous mammal populations – sometimes with disastrous consequences. These species could competitively exclude the indigenous fauna or they could prey on the indigenous taxa, thereby inducing imbalances in the natural food chain. Although many of these species are only able to survive in close association with humans, some are known to take up residence in the field.

  The introduction of a landfill site will obviously cause disturbances to the existing faunal communities and may attract new species in the area. This is expected to have high significance without mitigation. Effective mitigation is therefore recommended.

Issue	Nature	Extent	Duration	Intensity	Probability	Potential Significance	
						WOM	WM
Impact 1	Disturbances						
	Site 5a	Regional	Long-term	Medium	Highly probable	Medium	Low
	Site 5b	Regional	Long-term	Medium	Highly probable	Medium	Low
	Site 5c	Regional	Long-term	Medium	Highly probable	Medium	Low
Impact 2	Changes in community structure						
	Site 5a	Regional	Long-term	High	Highly probable	High	Medium
	Site 5b	Regional	Long-term	High	Highly probable	High	Medium
	Site 5c	Regional	Long-term	High	Highly probable	High	Medium
Impact 3	Potential introduction of alien species						
	Site 5a	Local	Long-term	High	Highly probable	High	Medium
	Site 5b	Local	Long-term	High	Highly probable	High	Medium
	Site 5c	Local	Long-term	High	Highly probable	High	Medium

- **Recommendations and suggested mitigation measures for flora and fauna**

» Option A is preferred since it corresponds to vegetation units (e.g. the *Acacia mellifera – Melhania acuminata* thornveld) of secondary successional stage that is reminiscent of past perturbations. Therefore, where possible, development should be restricted to disturbed areas;

- The development should strive to promote connectivity between the *Acacia tortilis – Enneapogon cenhroides* woodland habitat types. Therefore, natural corridors must be retained where possible to promote the movement of fauna, especially during the construction and operational phase when a high rate of natural disruption is expected;
- The extent of the construction site should be demarcated on site layout plans (preferably on disturbed areas such as the *Cenchrus ciliaris* grassland unit), and no construction personnel or vehicles may leave the demarcated area except those authorised to do so. Those areas surrounding the construction site that are not part of the demarcated development area should be considered as "no-go" areas for employees, machinery or even visitors;
- The impact on natural habitat types can never be completely ameliorated if development proceeds, but can be minimized. Where natural habitat types are to be transformed, especially the *Acacia tortilis – Enneapogon cenhroides* woodland areas, consideration should be given to the quality of the habitat based on the presence of micro-habitats and areas of high quality must be conserved;
- Intentional killing of invertebrates and herpetofauna should be avoided by means of awareness programmes presented to the labour force. The labour force should be made aware of the conservation issues pertaining to the taxa occurring on the study site;
- Any taxa, especially those of conservation concern (as indicated in this document) exposed during the construction activities should be captured for later release or translocation to adjacent suitable habitat;
- A monitoring and eradication programme should be put in place whereby the distribution and abundance of alien and invader fauna are monitored through fixed trapping points. The monitoring programme should be part of the operational EMP;
- All construction activities must be limited to daylight hours;
- All geophytes (if any) and medicinal species (from affected vegetation units) must be removed with the necessary permits and established in a nursery. After construction, the species must be re-planted during the rehabilitation phase. A management plan (to be compiled by the ECO) should be implemented to ensure proper establishment of *ex situ* individuals, and should include a monitoring programme for at least two years after re-establishment (to ensure successful translocation);
- Rehabilitation should consist of indigenous species only, and preferably of species native to the study site and immediate surroundings. The species

selected should strive to represent habitat types typical of the ecological landscape prior to construction. Rehabilitation should strive to increase spatial habitat heterogeneity. A monitoring programme should be implemented to evaluate the success of rehabilitation and to take necessary action if required;

» Post-decommissioning rehabilitation and landscaping along the edges of the landfill site should provide for high structural diversity (mosaic of plant species and grasses). Edges should be curvilinear, complex and soft, but should refrain from straight, simple or hard edges. This will ensure increased movement of fauna across edges and not along edges. Landscaping guidelines should strive to follow ecological principles as set out by Dramstad *et al.*, 1996); and

» It is recommended that a monitoring programme be implemented to enforce continual eradication of alien and invasive plant species.

The potential impact on fauna is considered to be of low significance without mitigation. The impact can be reduced even further if mitigation measures are introduced, which should typically include the following:

» Minimisation of disturbance of trees and construction footprint;
» Responsible environmental management including minimisation of noise. This can be attained through proper maintenance of silencers on diesel-powered equipment, systematic maintenance of all forms of equipment, training of personnel to adhere to operational procedures that reduce the occurrence and magnitude of individual noisy events.
» Prevention of construction and maintenance personnel from setting snares to capture animals; and
» Prevention of runaway fires.

The impacts on fauna will be reduced to *low* significance with mitigation. Other mitigation measures should include the following:

» Refraining from any impact on indigenous trees;
» Refraining from clearing/removal vegetation as much as possible. Where this is not possible cut vegetation such as grass and reeds short, rather than removing it.
» Rehabilitation of areas where soils have been compacted, once construction has been completed;
» Natural regeneration of grass is to be encouraged by reinstating the topsoil originally scraped from the area;
» Controlling of alien vegetation after the removal of grass;

» Prevention of runaway fires by keeping vegetation short in working areas, ensuring that no fires are lit close to the vegetation, ensure that lighting of fires on windy days are prohibited and ensuring that adequate fire fighting equipment and emergency services contact numbers are available at construction sites;
» Should trees be planted for visual mitigation, no alien invasive trees may be used; and Eskom should consider making use of indigenous trees.

5.5 Human Environment

The information pertaining to the socio economic and demographic profiles in the Lephalale areas provided in these sections is based on the information provided in the Social Impact Assessment report (**Appendix D6**) provided by Ms Ilse Aucamp of PTERSA. The demographic, economic, socio cultural, geographic, institutional, legal, emancipatory and empowerment processes were considered during the Social Impact Assessment phase.

In order to conduct an objective and representative social impact assessment, it is important to clearly identify the groups of people who may be affected by the proposed development. These groups have been identified using information obtained in the public participation process provided by Envirolution Consulting's environmental and public participation team, a baseline study and field work conducted in the area between November 2008 and March 2009.

The study approach and methodology of the Social Impact Assessment is detailed in the SIA report The SIA report identifies five levels of communities that will potentially be affected by the proposed development. The report categorises the community as the Wider Lephalale community, Lephalale municipality, Marapong village, Eskom employees (on site) and other industries that are based in the area. Specific detailed description of these communities is contained in **Appendix D6** of this report.

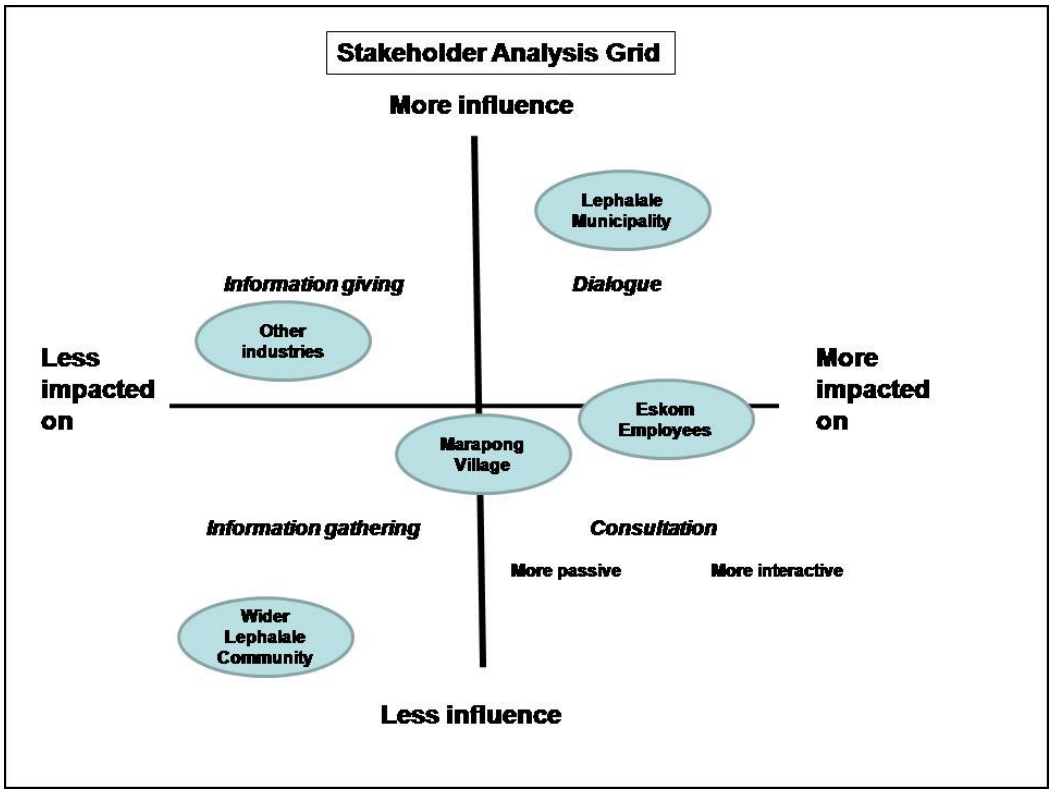

Figure 5.1: Stakeholders identified for the proposed Eskom Landfill Site

The stakeholder analysis was done to determine what the levels of interaction with each stakeholder group should be, not only for the purpose of the EIA process, but rather for the purpose of the lifecycle of the development – especially in the first phases of the development. It must be emphasised that the lines of the grid on **Figure 5.1** are not hard and fast boundaries, but are used as guidance only. The vertical line represents the line of influence the stakeholders may have on the project, and the horizontal line represent the magnitude of the potential impacts. If a stakeholder is seen as very influential, but the impact on him would not be great, it is sufficient to provide them with information about the project. If a stakeholder is influential and the magnitude of the impact is high, the proponent should engage in a dialogue with that stakeholder. If the stakeholder group is not very influential on the proposed project, and the magnitude of the impacts on the group is low, comments can be obtained from this group by giving them basic information. If a group are not very influential, but the impact on them may be high, they should be consulted with. The higher the impact the more intense the level of consultation should be.

From the stakeholder analysis it is clear that Eskom should engage in a dialogue with the Lephalale Municipality regarding this project. Eskom has already started this process. The other industries need to be informed about Eskom's plans, but since the project will not directly affect them in a negative way, they do not need to be consulted specially. It would be sufficient to inform the wider Lephalale community about the proposed project, and to keep them informed about the process.

In order to identify the potential social impact of the project, the affected areas were scoped in terms of the demographic processes, economic processes, geographic processes, institutional and legal processes. Other possible impacts were identified by using the information obtained in the public participation process provided by Envirolution Consulting's environmental and public participation team, issues mentioned in meetings, personal interviews, studying secondary data, consulting SIA literature, demographic data and personal experience in the field of social impact assessment.

5.5.1 Potential impacts on the social environment

Figure 5.2 represents the possible social impacts that may occur as a result of the proposed project during different stages of the project. It should be noted that public interest in the project is low, and given the fact that no public properties will be affected and the proposed site is in an existing industrial area, possible impacts on the community has been minimised to a large extent. Comparatively, the number if impacts that were identified during the Impact Assessment phase are low than those identified during the scoping phase. This is due to the fact that the site (Site 5) that is being assessed in this report has been chosen from the initial five candidate sites. The low number of social impacts identified in this report can be ascribed to the site selection process that assisted in excluding unsuitable sites from the assessment. The section that follows highlights the social impacts that were identified as part of the Impact Assessment process:

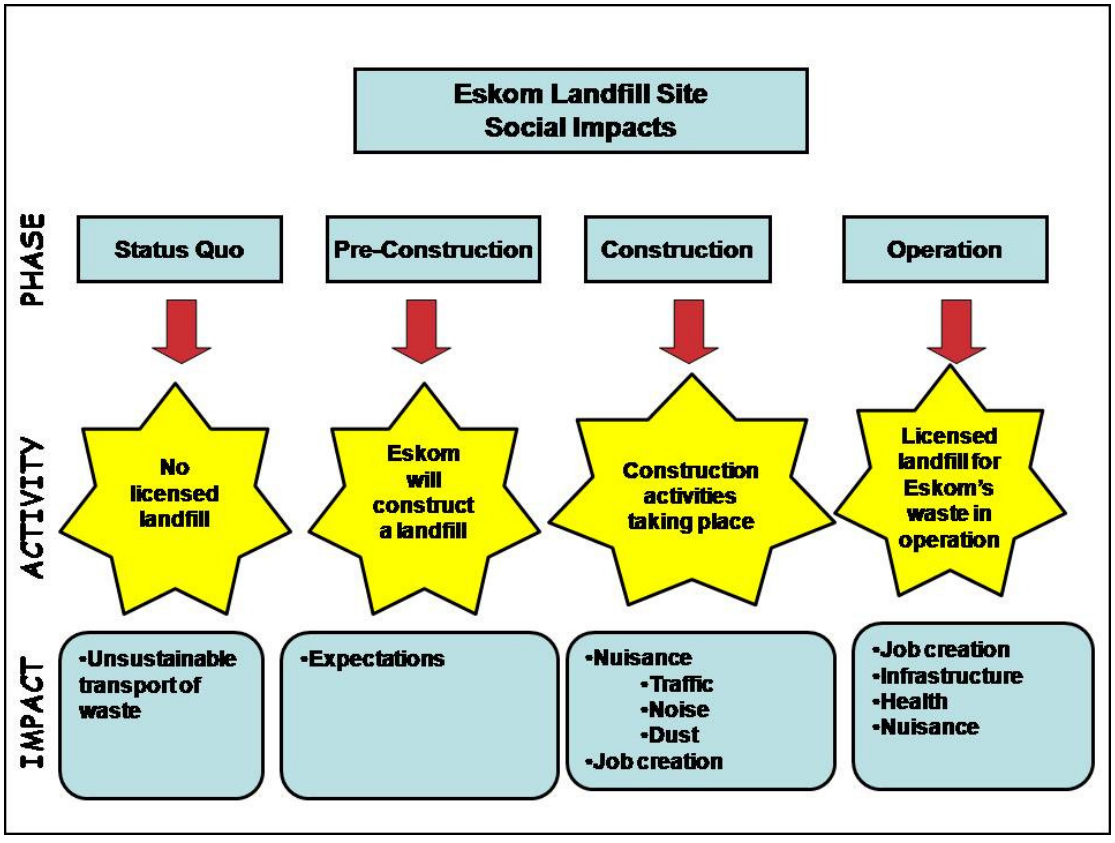

Figure 5 2: Social impacts associated with the proposed Eskom Landfill Site

(a) Status Quo

- **Impact 1: Unsustainable transport of waste**

The status quo is that Eskom transport all its waste by road to licensed landfills, mostly in Gauteng. The reason for this is that the current landfill in Lephalale is not licensed, and therefore Eskom cannot use it, as their SHE policy commits them to use a licensed landfill. They also need to comply with the legal requirements as set out in the policy.

There are two impacts which may occur as a result of the transport of waste to Gauteng. The first impact is related to the additional traffic that is generated by the transport of the waste. The road infrastructure between Gauteng and Lephalale is already under pressure as a result of the traffic generated by the industrial activities in the Lephalale area. The condition of the road is deteriorating rapidly. Additional heavy vehicles travelling on the road will add to this problem. If the transport of waste to Gauteng is no longer necessary, the additional pressure that this practice put on the road infrastructure will be taken away.

The second impact that is already taking place is that the transport of waste is a costly procedure. Given the fact that Eskom is a parastatal organisation, it can be seen indirectly as a price being paid by the taxpayers. The money Eskom is spending on transporting waste could be utilised for other purposes – given the electricity crisis that South Africa is faced with, it would be irresponsible of Eskom to continue with the status quo.

Project phase	Extent	Duration	Intensity	Probability	Significance without mitigation	Significance with Mitigation
Impact 1	More heavy vehicles on the road cause a deterioration of the road surface.					
Status quo	Regional	Short term	Medium	Highly probable	Medium	Low

This impact could be mitigated by the construction of a licensed landfill in close proximity of Lephalale. The status quo of the situation is not sustainable and it is important that a sustainable solution must be found.

(b) Pre construction phase

This is the phase of the project before the construction activities start. Unlike bio-physical impacts, social impacts can start before any physical change to the environment has been made.

- **Impact 1: Expectations**

The landfill in Lephalale is reaching the end of its capacity and it is not licensed. There is an expectation that Eskom should allow the municipality to utilise their new landfill, since many of the drastic changes in the Lephalale area has been caused by the presence of Eskom. Many of the members of civil society are Eskom employees and therefore Eskom should contribute to the physical infrastructure in the area. Eskom made it clear that the proposed landfill would be exclusively for the use of Eskom. Only waste generated by Eskom and by people in residential areas living in Eskom facilities would be disposed of at the proposed landfill. There is a risk that Eskom, and some of the other industries in the area, can be seen as a "surrogate" municipality if they take over the responsibilities of the municipality. Eskom, as a member of the community, pays rates and taxes. This rates and taxes should be used for the improvement of infrastructure. They do have a social responsibility to the society, and Eskom does contribute to infrastructure (i.e. the upgrade of the sewage system) in the area from that point of view.

Project phase	Extent	Duration	Intensity	Probability	Significance without mitigation	Significance with Mitigation
Impact	The municipality and other industries expect to utilise the landfill					
Pre Construction	Local	Short term	Medium	Probable	Medium	Low

It is difficult to manage expectations. It must be communicated clearly from the start that the proposed landfill would be for exclusive use by Eskom. Eskom is not responsible for municipal waste, and there should be clear boundaries and role clarification.

(c) Construction phase

In this phase of the project the construction activities commence.

- **Impact 1: Nuisance**

The proposed landfill will be situated on an industrial site where industrial activities causing noise and dust already occur. The noise and dust resulting from the construction activities will be cumulative to the impacts already occurring. From a nuisance perspective it would not be a significant additional impact. Additional traffic on the roads and especially for the entrance into the site may cause some discomfort to the employees of Eskom and the residents of Marapong who travel into town or to the Medupi site.

Project phase	Extent	Duration	Intensity	Probability	Significance without mitigation	Significance with Mitigation
Impact 1	Increase in traffic on road accessing the site.					
Site 5a						
Construction	Local	Short term	Medium	Highly Probable	Medium	Low
Site 5b						
Construction	Local	Short term	Medium	Highly Probable	Medium	Low
Site 5c						
Construction	Local	Short term	Medium	Highly Probable	Medium	Low
Impact 2	Increase in dust in the area.					
Site 5a						
Construction	Local	Short term	Medium	Highly Probable	Low	Low
Site 5b						
Construction	Local	Short term	Medium	Highly Probable	Low	Low
Site 5c						
Construction	Local	Short term	Medium	Highly Probable	Low	Low
Impact 3	Noise resulting from ground removal work and construction activities					
Site 5a						
Construction	Local	Short term	Medium	Highly Probable	Low	Low
Site 5b						
Construction	Local	Short term	Medium	Highly Probable	Low	Low
Site 5c						
Construction	Local	Short term	Medium	Highly Probable	Low	Low

The impacts of noise and dust on the social environment would not need additional mitigation. According to the State of the Environment Report nuisance dust impacts are usually limited to the boundaries of the site. In an environment where there is an open cast coal mine and operating power station, the noise created by the construction of the landfill would in all likelihood not be significant. Refer Noise impact report in **Appendix D10**. Traffic Impact Assessment is attached in **Appendix D8**. It is recommended that construction traffic should not be allowed on the road during peak hours – that is when people arrive for and leave from work. Access control is already taking place at the gate, and construction vehicles should use a separate entrance. The impacts on nuisances that may arise from the proposed development are of low significance with mitigation.

- **Impact 2: Job creation**

There are a number of construction activities taking place in the Lephalale area. The number of jobs that will be created by this project are small in comparison to the other opportunities currently available in the area. It is also likely that people who are currently working for Eskom on one of the other big projects in the area will be used for this project, since they are already trained and reside locally. There will be some employment opportunities created for local people by the project during the construction phase of the project.

The impact of the construction activities leading to the creation of jobs during the construction phase is regarded as having *a moderate* (positive) significance without mitigation.

Project phase	Extent	Duration	Intensity	Probability	Significance without mitigation	Significance with Mitigation
Impact 1	Increase in job opportunities in the area.					
Site 5a						
Construction	Local	Short term	High	Highly Probable	Medium (+)	Low
Site 5b						
Construction	Local	Short term	High	Highly Probable	Medium (+)	Low
Site 5c						
Construction	Local	Short term	High	Highly Probable	Medium (+)	Low
Site 5c						
Construction	Local	Short term	High	Highly Probable	Medium (+)	Low

Typical mitigation measures should include the following:

» As far as possible, preference should be given to local labour;
» Procurement should also be done locally as far as possible; and

The project will thus have an *overall positive impact* on the economic viability in terms of job creation for the local people, which can be considered as of high significance.

(d) Operational phase

This phase entails all the activities on the site for the entire lifespan of the project.

- **Impact 1: Nuisance**

The most important nuisance factor associated with a landfill site is bad odours. Depending on the management of the landfill, odours could be smelled from anywhere between 200m and 5km (http://soer.deat.gov.za/themes.aspx?m=261). There are Eskom employees whom will be working on the landfill site, and in offices in close proximity to the landfill. There is also a community (Marapong) which may be affected by this impact should the landfill not be managed properly.

The impacts on nuisances that may arise from the proposed development are of *moderate* significance without mitigation.

Project phase	Extent	Duration	Intensity	Probability	Significance without mitigation	Significance with Mitigation
Impact 1	Bad odours resulting from the operational activities associated with the landfill					
Site 5a						
Operational	Local	Long term	Medium	Highly Probable	Medium	Low
Site 5b						
Operational	Local	Long term	Medium	Highly Probable	Medium	Low
Site 5c						
Operational	Local	Long term	Medium	Highly Probable	Medium	Low

Typical mitigation measures should include the following:

» Eskom must ensure that the landfill is managed properly and that bad odours are limited. This impact can be managed to a great extent; and
» Eskom should also have a complaints register where complaints about any activities associated with the landfill can be lodged. The complaints register should be accessible to surrounding communities as well as Eskom employees. There should be a specific procedure in place that indicates how and in what timeframe any complaint should be addressed. These procedures must be communicated to all Eskom employees, as well as to the public via publication on local news papers.

The impacts caused from the nuisances are reduced to *low* significance with effective mitigation.

- **Impact 2: Job creation**

A number of permanent jobs will be created by this project. This will have a high positive impact on the individuals and their families. Secondary jobs involving recycling practices may also be created, but this option need to be investigated in more detail to ensure it is practical and viable. Ideally recycling should be done at the source of the waste stream. The project will thus have an overall positive socio-economic impact for the Lephalale community, which can be considered as of high significance.

Project phase	Extent	Duration	Intensity	Probability	Significance without mitigation	Significance with Mitigation
Impact 1	Increase in permanent job opportunities in the area					
Operational	Local	Long term	High	Highly Probable	High (+)	High (+)

In mitigating the impact as far as possible, preference should be given to local labour. Procurement should also be done locally as far as possible. Eskom should consider using their internal recruitment procedures and labour desks to popularise the project. Eskom should encourage all the people contributing to the waste stream to recycle at the source of the waste. They should make the sorting of rubbish a pre-requirement for accepting any household waste. Eskom have the opportunity to institutionalise recycling in the organisation, and this should be from the offices to the construction sites, with the Eskom Landfill serving as a practical example for all South Africans.

- **Impact 3: Infrastructure**

Eskom will take a lot of pressure from the existing landfill infrastructure by building and maintaining its own landfill. Although external parties will not be able to utilise the Eskom Landfill, Eskom is taking responsibility for its own waste.

Project phase	Extent	Duration	Intensity	Probability	Significance without mitigation	Significance with Mitigation
Impact 1	Relief pressure from existing landfill sites					
Site 5a						
Operational	Local	Long term	High	Highly Probable	High (+)	High (+)
Site 5b						
Operational	Local	Long term	High	Highly Probable	High (+)	High (+)
Site 5c						
Operational	Local	Long term	High	Highly Probable	High (+)	High (+)

This impact will be a positive impact on the area, and therefore no mitigation is needed.

- **Impact 4: Health**

There is some health risks associated with landfill sites. These risks vary from the impact of pollution (air and water) on human health, to infectious diseases spread by rodents who came and scavenge on the landfill sites. These risks can be managed and if the site is managed properly the risk decrease significantly. The biggest health risk would be to the employees working on the landfill. According to the State of the Environment Report of South Africa significant health risks, given good landfill facility management, are restricted to within 500m of the landfill boundary (http://soer.deat.gov.za/themes.aspx?m=261).

The effect of hazardous waste exposure on workers was raised as an issue during the publication participation meeting. It was requested during the meeting that input on hazardous waste exposure be considered during the EIA phase. An exposure risk analysis was therefore undertaken. **Section 5.5.2 (a)** highlights the potential risks that may occur as a result of exposure to hazardous waste.

Project phase	Extent	Duration	Intensity	Probability	Significance without mitigation	Significance with Mitigation
Impact 1	Health impacts on Eskom employees and surrounding communities					
Site 5a						
Operational	Local	Long term	High	Highly Probable	High	Medium
Site 5b						
Operational	Local	Long term	High	Highly Probable	High	Medium
Site 5c						
Operational	Local	Long term	High	Highly Probable	High	Medium

Mitigation measures should include the following:

» The boundaries of the landfill must be at least 500m from the existing offices of the Matimba Power Station, and from the Marapong community;
» All employees working on the landfill site must be regularly go for health checkups in line with Eskom Safety, Health and Environmental policy
» Employees must wear protective gear, including dust masks, boots, overalls and gloves; and
» The site must be managed in such a way that risks are minimised as far as possible.

5.5.2 Environmental Quality

(a) Human Health Impacts

As has already been mentioned, an exposure risk analysis was undertaken as part of the study. The study considered the potential exposure and ecological risk that may be associated with the proposed development. It should be noted that the exposure analysis undertaken does not constitute a full Ecological Risk Assessment; it does however highlight the principles and potential exposure sources and makes a preliminary judgment on significance of the exposure levels and ecological risks of the proposed development. It is advised that a comprehensive risk assessment be undertaken before the landfill is in operation to determine the exposure and ecological risk associated with the proposed development. In order to contextual and explain the effect and the significance of exposure to the development, the following principles of exposure risk assessment were considered.

- **What is a risk assessment**

Risk Assessment generally considers the likelihood of occurrence and the consequences of the occurrence of an event and systematically evaluates the nature, effect and extent of exposure a vulnerable receptor may experience in relation to a particular hazard. It informs the management and communication of risk. An environmental hazard is an event, or continuing process, which if realized will lead to circumstances having the potential to degrade, directly or indirectly, the quality of the environment (Royal Society, 1992).

- **Pathways**

A pathway is a route by which a particle of water, substance or contaminant moves though the environment and comes into contact with, or otherwise, affects a receptor (EA, 2001).

- **Risk**

For a risk to exist there must be a source (or hazard or environmental pressure), a pathway and a receptor or target (Daly, 2004).

- **Source- Pathway-Receptor (S-P-R) conceptual model**

This is the basis for the Source- Pathway-Receptor (S-P-R) conceptual model for environmental risk assessment and management. In addition, a conceptual model also provides information useful to the scoping of any investigation as it identifies the sites that pose the greatest risk to the environment and human beings and also identifies the S-P-R linkages that have the highest risk associated with them.

- **Applicable Mitigation Measures and Remediation**

The above principles of exposure and risk assessment aim at facilitating a clear decision-making process in devising mitigation measures to control any potential risks evident in the conceptual model. The detailed information obtained through the investigative programme will inform the decision on the extent of measures which are required to manage the risk, which may involve breaking the pathway or removal of the source or in some cases monitoring of the receptor.

- **Source –Pathway–Receptor Analysis for the proposed development**

The following table summarizes the potential Source–Pathway–Receptor Analysis for the proposed development.

Source	Pathway	Receptor/Exposure
Waste Types	Process of handling and disposal of the various waste streams at the landfill site and transfer station.	• Humans
Leachate	Leachate Migration: • Vertically to the water table or top of an aquifer, where groundwater is the receptor being considered; • Vertically to an aquifer and then horizontally in the aquifer to a receptor, such as a well, spring or stream; • Horizontally at the ground surface or at shallow depth to a surface receptor.	• Humans • Surface water • Groundwater • Sensitive Environments • Fauna and Flora
Contaminated Storm water	Migration of contaminants in storm water : • Vertically to the water table or top of an aquifer, where groundwater is the receptor being considered; • Vertically to an aquifer and then horizontally in the aquifer to a receptor, such as a well, spring or stream; • Horizontally at the ground surface or at shallow depth to a surface receptor.	• Humans • Surface • Groundwater • Sensitive Environments • Fauna and Flora
Landfill Gas, Dust and Odours	Landfill Gas Migration: • Sub surface soil. • Air • Pipelines • drainage systems • Manholes. • Dissolved in groundwater.	• Humans

- **Significance**

Given the above the significance of the exposure risk posed by the proposed development will be determined by the following factors:

» Type of Waste Handled (general waste, mixed waste or hazardous waste);
» The civil and environmental engineering controls in place to curb and manage the sources (pollutant sources). This includes liners, geo-membranes, storm water controls, landfill gas management infrastructure, leachate management systems etc.
» The geological and hydro geological setting of the landfill site;
» The location in proximity of human receptors such as residential areas; and
» Number of employees and number of people accessing the site.

The major contaminants or pollutants of concerns that may pose risk to both humans and ecosystems associated with development include the following pollutants:

- Metals;
- Total petroleum hydrocarbons;
- Polycyclic aromatic hydrocarbons;
- Chlorinated hydrocarbons;
- Polychlorinated biphenyls;
- Pesticides;
- Methane;
- Dioxins;
- Asbestos;
- Pharmaceuticals;
- Pathogens;
- Dust and Particulate Matter;
- Volatile Organic Compounds; and
- Landfill Gas (Methane, Carbon dioxide and non-methane organic compounds

Other Occupational Hazards may include:

- Accidents;
- Musculoskeletal problems;
- Respiratory symptoms and diseases;
- Gastro-intestinal problems; and
- Skin problems.

- **Significance and Level Exposure**

Workers and personnel on the landfill site and the temporary hazardous waste storage facility may be exposed to the same potential hazards outlined above, although the risk and amount of exposure may differ depending on the type of work they do, the number of exposure hours, and personal protection equipment (PPE) used.

The significance of this exposure can be rated moderate to high if no mitigation measures are employed to manage the potential risks and hazards. However if the mitigation measures and operational controls stipulated in the Environmental Management Plan, the Operational Plan, and the requirements of the Occupational, Health and Safety Management Plan are implemented then the significance of the exposure and human and ecological risk is likely to be reduced to *low*.

It is of utmost significance that that a proper hazardous waste classification and hazard rating exercise must be conducted to determine if the waste contains carcinogenic, teratogenic and mutagenic substances and toxicity of the waste. This will have to be undertaken particularly for the hazardous waste storage facility. Such information will need to accompany the Section 20 application that will be undertaken following a positive authorisation of this development.

(b) Air Quality Impacts

The air quality impact assessment was undertaken through the compilation of an emissions inventory and subsequent dispersion modelling simulations. Please refer to **Appendix D9** for details on the models that were used to predict impacts on air quality. Predicted emissions from the landfill were evaluated to determine the impact of the construction and operations of the proposed landfill on the surrounding air quality and the following conclusions were made.

» It is anticipated that significant amounts of dust will be eroded from the open areas at the Eskom site under wind speeds of greater than 5.4 m/s (i.e. threshold friction velocity of 0.26 m/s). Fugitive dust generation resulting from wind erosion under high winds (i.e. > 5.4 m/s) is directly proportional to the wind speed.
» Emissions from the proposed Eskom Landfill are predicted to be transported a few hundred meters downwind towards the north-west and south-east and in a lesser extent towards the western areas in respect of the landfill, due to the meteorological impact.
» Predicted emissions of PM10 and Total suspended particulates (TSP) exceed the National Ambient air quality Standards during the construction phase, and will pose a short-term threat to human health. The implementation of control technologies and mitigation measures on should ensure that pollutant levels remain below concentrations at which health effects are observed.
» Predicted emissions of PM10 and TSP during the operational phase are below the national ambient air quality standards and do not pose a health risk to inhabitants in the neighbouring areas.

These impacts are summarised as follows:

Project phase	Extent	Duration	Intensity	Probability	Significance without mitigation	Significance with Mitigation
Impact 1	Vehicle Tailpipe Emissions					
Site 5a						
Pre Construction	N/A	N/A	N/A	N/A	N/A	N/A
Construction	Local	Short-term	Low	Definite	Low	Low
Operational	Site	Long-term	Low	Definite	Low	Low
Site 5b						
Pre Construction	N/A	N/A	N/A	N/A	N/A	N/A
Construction	Local	Short-term	Low	Definite	Low	Low
Operational	Site	Long-term	Low	Definite	Low	Low
Site 5c						
Pre Construction	N/A	N/A	N/A	N/A	N/A	N/A
Construction	Local	Short-term	Low	Definite	Low	Low
Operational	Site	Long-term	Low	Definite	Low	Low
Impact 2	Wind Erosion of open areas					
Site 5a						
Pre Construction	N/A	N/A	N/A	N/A	N/A	N/A
Construction	Site	Short	Low	Definite	Low	Low
Operational	Site	Long	Low	Definite	Low	Low
Site 5b						
Pre Construction	N/A	N/A	N/A	N/A	N/A	N/A
Construction	Site	Short	Low	Definite	Low	Low
Operational	Site	Long	Low	Definite	Low	Low
Site 5c						
Pre Construction	N/A	N/A	N/A	N/A	N/A	N/A
Construction	Site	Short	Low	Definite	Low	Low
Operational	Site	Long	Low	Definite	Low	Low
Impact 3	Materials Handling					
Site 5 a						
Pre Construction	N/A	N/A	N/A	N/A	N/A	N/A
Construction	Site	Short	Low	Definite	Low	Low
Operational	Site	Long	Low	Definite	Low	Low
Site 5 b						
Pre Construction	N/A	N/A	N/A	N/A	N/A	N/A
Construction	Site	Short	Low	Definite	Low	Low
Operational	Site	Long	Low	Definite	Low	Low
Site 5 c						
Pre Construction	N/A	N/A	N/A	N/A	N/A	N/A
Construction	Site	Short	Low	Definite	Low	Low
Operational	Site	Long	Low	Definite	Low	Low
Impact 4	Vehicle entrainment from on-site unpaved roads					
Site 5 a						
Pre Construction	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Construction	Local	Short	Medium	Definite	Low	Low
Operational	Local	Long	Low	Definite	Low	Low
Site 5 b						
Pre Construction	N/A	N/A	N/A	N/A	N/A	N/A
Construction	Local	Short	Medium	Definite	Low	Low
Operational	Local	Long	Low	Definite	Low	Low
Site 5 c						
Pre Construction	N/A	N/A	N/A	N/A	N/A	N/A
Construction	Local	Short	Medium	Definite	Low	Low
Operational	Local	Long	Low	Definite	Low	Low

In general, predicted emissions from the landfill are not considered to influence the ambient air quality within the surrounding areas in a way that would pose a threat to human health. The pollution from the proposed landfill largely depends on the manner in which the facility is managed, specifically with regard to the effective design, implementation and ongoing review of landfill gas and fugitive dust mitigation and monitoring systems. The impact of the construction activities leading to air pollution is regarded as having a low significance without mitigation.

Proposed management, mitigation and monitoring requirements for the operational, closure and post-closure phases of the landfill are discussed in the subsequent subsections. Typical mitigation measures during preconstruction and construction phases include:

» ensure full compliance with DWAF Minimum Requirements;
» landfill operator must ensure that a register is kept throughout the life of the facility of the quantities and characteristics of the waste deposited. Information collated should indicate origin of the waste, type of waste, date of delivery, identity of the producer or collector in the case of municipal waste. This information should be made available to the competent local, provincial and national authorities when requested;
» in addition to registering the waste at the site access, regular visual inspection of the waste at the point of deposit should be undertaken to ensure that only non-hazardous waste is being accepted at the site; and
» control measures which should be adopted during the operational period to reduce the potential for fugitive dust emissions outlined in **Table 5.3.**

Table 5. 3: Summary of the impacts that may occur during the construction and operational phases and the recommended mitigation measures

Activity	Recommended Control Measure(s)
Material handling (soil, waste)	Mass transfer reduction
	Drop height reduction
	Wind speed reduction through sheltering
	Wet suppression
Vehicle entrainment from unpaved roads	Wet suppression or chemical stabilisation of unpaved roads
	Reduction of unnecessary traffic
	Strict speed control
	Avoid track-on onto neighbouring paved roads
Vehicle entrainment from the paved access road	Regular sweeping or vacuuming of the paved access road to restrict the silt loading on the roadway
	Avoidance of track on from unpaved roads (e.g. wheel wash bays)
	Avoidance of spillage of waste onto road surface through ensuring waste haul trucks maintain the necessary freeboard
Open areas – wind erosion	Reduction of extent of open areas through careful planning and progressive vegetation
	Reduction of frequency of disturbance

Activity	Recommended Control Measure(s)
	Compaction and stabilisation (chemical or vegetative) of disturbed soil
	Introduction of wind-breaks

(a) Roads and Traffic impacts

In order to ascertain the impact of a development, on the congestion and level of service on roads surrounding the site, critical intersection movements were analysed. This according to the traffic impact assessment report, are areas where the bottlenecks are found. Specific details for all scenarios are described in the traffic impact assessment report (refer to **Table 3 of Appendix D9**).

The impact on the road network relating to construction activities mainly concerns Nelson Mandela Drive. It is expected that construction vehicles will use Nelson Mandela Drive to haul construction materials. The lesser impact expected will be slowing down of traffic flows along Nelson Mandela Drive due to the trucks transporting construction material from a quarry or a borrow pit or even the transportation of big heavy construction equipment by road.

Most of the trips due to construction will travel during off peak hours. The impact due to construction is temporal and minimal. Pro active planning with reference to the undertaking of the construction activities outside peak hours will mitigate against the potential traffic congestion that may result since most traffic is encountered in early mornings (07h00 – 08h00) impacts.

Traffic Impact Assessment undertaken by Goba Consulting Engineers for the Medupi Power Station proposed that the Nelson Mandela Drive from Lephalale to Marapong should be rehabilitated not later than June 2010. This therefore implies that no additional rehabilitation will be requires for the purpose of this proposed development.

Traffic safety was highlighted as one of the concern that may be experienced during both construction and operational phases. According to the report, the impact of construction traffic is normally high due to high differences in the travelling speeds of each associated vehicle. This means that the probability of accidents occurring is significantly increased and therefore must be adequately addressed as part of the construction management process in order to minimise the probability of potential accidents occurring.

The operational-related traffic is anticipated not to be high and is not expected to cause problems. The reason provided is that congestion will only result if the capacity available is less than the expected traffic demand throughout. Similarly, the traffic delays often cause changes in driver behaviour patterns leading to driving that is negative since the driver is frustrated. This type of driving can often lead to serious or fatal accidents. The table that follows is a summary of the anticipated impacts and their significance rating. It is to be noted the impacts from the traffic are mainly based on the road network and other transport and traffic logistics outside the site boundaries and for the purposes of the study, the impacts were not assessed at site specific levels.

	Source of impact	Nature of impact	Scale	Duration	Intensity	Probability	Confidence	Significance	
								Without mitigation	With mitigation
Construction	Manoeuvrability of construction vehicles and pedestrians during construction will have to be monitored.	Safety will be the most important factor.	Local	Construction Period	Medium to high	Definite	High	High	Low
	Construction vehicles on the surrounding road network	Traffic congestion and road safety	Network	Construction Period	Medium to high	Definite	High	High	Low
Operational	Throughput (volume to capacity ratio)	Traffic congestion	Local,	Permanent	Low to medium	Definite	High	High	Low
	Delay to vehicles (Level of service)	Driver frustration and unsafe driving behaviour potentially occurring	Local	Permanent	High	Definite	High	High	Low

The traffic volume within the study area is fairly average. All the intersections that were analysed in this report were not badly affected except for one Nelson Mandela / Afguns Road intersection. This was due to the growth in through background traffic from the east to west along Nelson Mandela Drive. A traffic signal is proposed as a mitigation measure in order to reduce the delays on this intersection.

A short right turning lane from the eastern approach and the re-alignment of the road leading to Grootgeluk Mine on the south of Matimba is further proposed at intersection Nelson Mandela Drive / the new Haulage Road. The Limpopo Road Agency (LRA) will be fully responsible for the upgrade at Nelson Mandela Drive / Afguns Roads.

It is a recommendation of the traffic impact assessment that a traffic management plan be provided during the construction phase to address issues related to traffic safety.

(c) Visual impacts

The visibility of the project is based on the viewshed analyses undertaken for the project. The methodology, discrepancies, assumptions and limitations that was used during the viewshed analyses are highlighted in **Appendix 2** of the Visual impact report. The visual analysis represents two scenarios; the first ignoring the effect of vegetation on the visibility of the project and the second assuming an average vegetation height of 5 m. The difference is quite significant but some discrepancies exist between the computer based analyses and the true scenario. The effect of the vegetation as a visual buffer between the observers and the alternative sites is much greater and is discussed in detail in **Appendix 2** of the Visual Impact Report

The conclusion of the viewshed analyses, as based on the available datasets, show minor differences between the three alternative sites. This can be attributed to their close proximity to each other and the lack of detailed contour data for the study area. The conclusion that can be drawn is that the vegetation plays a great role in reducing the visibility of the project and that preservation of the existing vegetation is paramount in limiting the associated visual impacts. Establishing additional planting in strategic areas will be an effective mitigation measure, but should be done as soon as possible for the trees to reach maturity.

Based on the assessment of the visual resource and the discussion on the site as a fragment in the greater region, it can be concluded that the site comprises no distinguishing factors that makes it more appreciative or gives it a higher visual value than other areas with similar characteristics. The site shows signs of previous disturbance and the presence of the decommissioned waste dump is proof of that. The site is visually perceived as being part of the Matimba Power Station as it is fenced in and the road infrastructure detaches it from other natural areas north and west of it. The visual value of the site lies in the tree rich environment that is present and the perception that it is still an undeveloped and natural area. This value bares little significance, considering the larger Ferroland Private Nature Reserve to the north and the regional character that is very much dominated by small game farms.

Generally, specific observers experience different views of the visual resource and value it differently in the study area. They will be affected by the proposed development because of alterations to the landscape or specific elements in the landscape which will in turn influence their value of their views. The following typical, general visual impacts can be expected as a result of the construction and operation of the proposed development:

» project activities or components noticeably change the existing features or qualities of the landscape;
» project introduces new features which are uncharacteristic or in contrast with the existing character of the landscape; and/or
» project removes or blocks aesthetic features of the landscape which subsequently affects the scenic quality of the visual resource.

The observers are regarded as receptors that will be affected by the proposed project. A dramatic change to the baseline conditions of a landscape could potentially cause a dramatic change to the observers' views and affect their appreciation thereof. The significance of this change/impact is a function of:

» magnitude of the impact;
» sensitivity of the observer which is impacted on; and
» exposure of the observer to the impact.

Detailed definitions of the significance are detailed in the Visual Impact Assessment report attached in **Appendix D11**.

(i) Construction phase impacts

During construction, the bulk of the activities will be concentrated in the 5 ha footprint of one of the three sites. It is expected that vegetation clearing will occur and that the site will be prepared for the operations to follow. The construction activities will cause a degree of vegetation destruction and therefore remove these elements that contribute to the existing character of the site and the associated visual value. The existing vegetation cover is also a very effective visual buffer between certain viewpoints and the three proposed landfill locations. Removal of the vegetation may compromise the natural screening capacity of the site.

The scale, extent and intensity, i.e. the magnitude, of the visual impact associated with the construction phase at the three alternative sites, will be fairly similar. The construction activities will be unsightly and cause a reduction in the value of the views to the site. However, the only observers that may be affected by the construction activities will be those that travel on the local road network, more specifically the Stockpoort Road (D2001) and the D2816 road that enters the Marapong Township. Commuters and motorists are classified as observers of a moderate sensitivity. Their frequent use of the roads passing the sites increases their exposure to the potential visual impacts.

The magnitude of the impact will be greatly limited due to the inherent Visual Absorption Capacity (VAC) of the site. Between the Stockpoort Road and the boundary line of the property, a ±100 m vegetation buffer exists which ranges between mature trees and low-growing shrubs. This creates a very dense visual screen that will reduce visibility of the potential impacts considerably. Commuters and motorists on the Stockpoort Road are expected to experience a very limited exposure to the construction activities of sites B & C. Site A is located much further from the Stockpoort Road and no visual connection is possible between the observers and site A.

Motorists on the D2816 will have a slightly elevated view over the site where the road crosses over a conveyor belt. The vantage point enables the observers to be slightly above the canopy of the vegetation and potentially increases visibility of the activities and footprint clearing. These observers will only have partial views of the construction activities at sites A & C. Site B is located behind the existing landfill and no visual connection is possible. Their exposure to the impact will be brief as only a short section of the road is elevated.

The significance of the visual impact during the construction phase is expected to be low. The magnitude of the impact will be greatly limited due to the existing VAC of the site and the restricted visibility of the activities behind the vegetation buffer. The impacts associated with each of the specific sites (A, B, and C) and summarised as follows:

Project phase	Extent	Duration	Intensity	Probability	Significance without mitigation	Significance with Mitigation
Impact 1: Surface disturbances impact on the character of the site and reduce the value of the visual resource						
Site A						
Construction	Local	Short term	Medium	Highly Probable	Low	Low
Site B						
Construction	Local	Short term	Medium	Highly Probable	Low	Low
SITE C						
Construction	Site	Short	Low	Definite	Low	Low
Impact 2: Surface disturbances can be limited and additional screening will minimise visibility of the impacts.						
Site A						
Construction	Local	Short term	Low	Highly Probable	Low	Low
Site B						
Construction	Local	Short term	Low	Highly Probable	Low	Low
SITE C						
Construction	Local	Short term	Low	Highly Probable	Low	Low

The following mitigation measures should be applied:

» limit the extent of disturbance to as small an area as possible;

» maintain a vegetation buffer between the activity area and the roads of at least 50 m; and

» use the natural screening capacity of the site to position the construction camp and to prevent views from the local roads looking into the camp;

(ii) Operational phase impacts

During the initial stages of the operational phase the activities will be limited to the ground level. Waste will be brought into the site at regular intervals and dumped into cells. A day cover of soil will be put over the waste to prevent it from being exposed to the atmosphere for too long. The soil cap will contrast with the colour of the vegetation surrounding it, making it noticeably visible among the trees.

The landfill will progressively become higher over time until it exceeds the average height of the tree canopy. The average height of the trees in the area is approximately 4 – 6 m high with the exception of a few larger trees such as the Marula Tree that can reach heights of 15 – 18 m. Once the landfill reaches a height of approximately 5 m, motorists on the Stockpoort Road may be able to catch glimpses of the landfill which protrudes above the canopy on sites B & C. Motorists and commuters on the D2816 will have a slightly higher vantage point onto sites A & C and will most probably be exposed to the visual impacts at an earlier stage.

As can be expected, the motorists' exposure to the impact will again be brief and the magnitude of the impact will be limited. The significance of the visual impact as summarised on the table that follows is expected to be low, but certain mitigation measures are recommended to reduce the visibility of the landfill.

Project phase	Extent	Duration	Intensity	Probability	Significance without mitigation	Significance with Mitigation
Impact 1: A change in land use causes an alteration in the character of the site.						
Site A						
Operational	Local	Long term	Medium	Highly probable	Low	Low
Site B						
Operational	Local	Long term	Medium	Highly probable	Low	Low
SITE C						
Operational	Local	Long term	Medium	Highly probable	Low	Low
Impact 2: Location of the site is important to make maximum use of the screening capacity of the site. Additional planting will enhance the effectiveness of the site's screening capacity.						
Site A						
Operational	Local	Long term	Low	Highly probable	Low	Low
Site B						
Operational	Local	Long term	Low	Highly probable	Low	Low
SITE C						
Operational	Local	Long term	Low	Highly probable	Low	Low

The following typical mitigation measures should be implemented:

» Plant additional trees on the perimeter of the site that can reach a height of 10 m or more within the next 20 – 30 years;
» Keep the active dumping face of the landfill on the side of the Matimba Power Station. By doing this the unsightly façade of the landfill will be facing away from the observers; and
» Implement progressive rehabilitation on the side slopes of the landfill in order to reduce the contrast of the bare soil to the vegetated areas around the site.

(iii) Decommissioning phase impacts

Once the facility is decommissioned, many of the ancillary infrastructure will be removed and the only remaining project features will be landfill. The final landform has not been established by the time of the completion of the report. The landfill will be rehabilitated which mean that it will be vegetated with a grass layer to stabilise the surface. By rehabilitating the landfill the conspicuousness of the man-made landform will be reduced. It can be expected that the visual impact will be much reduced and that the significance will be low as summarised.

Project phase	Extent	Duration	Intensity	Probability	Significance without mitigation	Significance with Mitigation
Site5 A						
Impact 1: The final landfill will be distinguishable as a man-made landform and detract from the overall character of the site						
Decommissioning	Local	Permanent	Low	Highly probable	Low	Low
Impact 2: Proper rehabilitation can blend the landfill into the surrounding environment.						
Decommissioning	Local	Permanent	Low	Highly probable	Low	**Low**
Site 5B						
Impact 1: A change in land use causes an alteration in the character of the site.						
Decommissioning	Local	Permanent	Low	Highly probable	Low	
Impact 2: Location of the site is important to make maximum use of the screening capacity of the site. Additional planting will enhance the effectiveness of the site's screening capacity.						
Decommissioning	Local	Permanent	Low	Highly probable	Low	Low
SITE5 C						
Impact 1: A change in land use causes an alteration in the character of the site.						
Decommissioning	Local	Permanent	Low	Highly probable	Low	Low
Impact 2: Location of the site is important to make maximum use of the screening capacity of the site. Additional planting will enhance the effectiveness of the site's screening capacity.						
Decommissioning	Local	Permanent	Low	Highly probable	Low	Low

Mitigation measures applicable to the decommissioning phase include:

» Implement a rehabilitation strategy in which the landfill is shaped to a sustainable form and endemic vegetation is replanted on the landfill; and
» Implement alien vegetation eradication program.

(d) Heritage

Construction activities such as clearing, grading, excavation could expose or damage features of heritage and cultural value beneath the surface. Although no significant heritage features were identified by the heritage specialist or are known to exist in the study area, mitigation measures included in the preliminary heritage report must be adhered to.

Project phase	Extent	Duration	Intensity	Probability	Significance without mitigation	Significance with Mitigation
Impact	Impact on heritage, cultural and archaeological resources					
Site 5a						
Construction	Local	Short term	Medium	Probable	Low	Low
Operational	Local	Long term	Medium	Probable	Low	Low
Site 5b						
Construction	Local	Short term	Medium	Probable	Low	Low
Operational	Local	Long term	Medium	Probable	Low	Low
Site 5c						
Construction	Local	Short term	Medium	Probable	Low	Low
Operational	Local	Long term	Medium	Probable	Low	Low

(e) Noise

Noise measurements were carried out at positions remote from the site to assess likely response at remote dwellings to noise from the proposed landfill. They agreed well with the SANS 10103 recommendations for rural areas.

According to the noise impact report, the two primary noise sources within the site are the delivery vehicles and the bulldozing of received and cover material. The investigation shows that the proposed site will have a minor impact on the noise climate of the surrounding environment. The daytime impact will be none beyond a distance of 700m from the active front and low at 400m from the active front. There are no dwellings indicated within this distance from the nearest property boundary at any of the three potential sites, the nearest dwelling being at 450m. The impact of the increase in noise caused by transportation by internal gravel road to the landfill site is classed as very low. These impacts are summarised and assessed as follows:

Site	Phase	Impact: Noise						
		Nature	Extent	Duration	Intensity	Probability	Significance	
							WM	WOM
Site 5a	Construction	Noise	Site local	Short term	Low Negative	Probable	None	Low
	Operation	Noise	Site local	Long term	Low Negative	Probable	None	Low
	Decommissioning	Noise	Site local	Short term	Low Negative	Possible	None	V Low
	Residual	None	n/a	n/a	n/a	n/a	n/a	n/a
	Latent	None	n/a	n/a	n/a	n/a	n/a	n/a
Site 5b	Construction	Noise	Site local	Short term	Low Negative	Probable	None	Low
	Operation	Noise	Site local	Long term	Low Negative	Probable	None	Low
	Decommissioning	Noise	Site local	Short term	Low Negative	Possible	None	V Low
	Residual	None	n/a	n/a	n/a	n/a	n/a	n/a
	Latent							
Site 5c	Construction	Noise	Site local	Short term	Low Negative	Probable	None	Low
	Operation	Noise	Site local	Long term	Low Negative	Probable	None	Low
	Decommissioning	Noise	Site local	Short term	Low Negative	Possible	None	V Low
	Residual	None	n/a	n/a	n/a	n/a	n/a	n/a

Typical mitigation measures will include the following:

» *Maintenance of equipment and operational procedures:* Proper design and maintenance of silencers on diesel-powered equipment, systematic maintenance of all forms of equipment, training of personnel to adhere to operational procedures that reduce the occurrence and magnitude of individual noisy events.
» *Placement of material stockpiles:* Where possible material stockpiles should be placed so as to protect the boundaries from noise from individual operations and especially from internal roads, which for greatest effect should be placed directly behind them In particular, the erection of suitable earth berms around fixed plant such as compressors can significantly reduce the noise by up to 15dB.
» *Equipment noise audits:* Standardised noise measurements should be carried out on individual equipment at the delivery to site to construct a reference data-base and regular checks carried out to ensure that equipment is not deteriorating and to detect increases which could lead to increase in the noise impact over time and increased complaints.
» *Environmental noise monitoring:* Should be carried out at regularly to detect deviations from predicted noise levels and enable corrective measures to be taken where warranted.

The noise impact during construction could thus be considered as of *low* to *moderate* significance without mitigation. Noise impact during the operational phase of the proposed development is considered to be of *low* significance if proper management is implemented. Typical mitigation measures during the construction phase include the following:

» Restriction of construction activities to daytime;
» Ensuring that all vehicles are fitted with silencers that are properly maintained;
» Ensuring that all equipment, such as pumps, are specified for acceptable low noise emission and impact on local communities;
» Ensuring that once in place equipment is adequately maintained;
» Investigations of all complaints and if possible address any operational or maintenance aspect that result in unacceptable high noise levels; and
» Maintaining the buffer area around the facility.

The impacts on noise levels will be reduced to a low significance with mitigation

(f) Land use and Zoning

The proposed development supports existing land use by making use of vacant land within the existing Matimba Power Station located closer to the old waste dump. This limits the impact on land use and zoning on all sub sites within Site 5.

The proposed infrastructure is planned for long term use. Once constructed, the landfill and the waste disposal facility may thus limit development or change of land use of the proposed site. The proposed development will not hamper existing surrounding land use and is unlikely to hamper any potential expansion of the surrounding areas.

Project phase	Extent	Duration	Intensity	Probability	Significance without mitigation	Significance with Mitigation
Impact						
Construction	Local	Short term	Medium	Probable	Low	Low
Operational	Local	Long term	Medium	Probable	Low	Low

Typical mitigation measures include:

» Avoiding impact on existing services and infrastructure;
» Minimising impact on surrounding environments; and
» Prevention of runaway fires; and

» The construction camp should be sited away from any sensitive environments, should it be necessary.

The impacts on land use will be reduced to *low* significance with mitigation.

From the preceding discussions and from the tables below, it is notable that the impacts from each specific site are similar and there are no major differences. The key impacts that were identified as part of this EIA relate to geology & soils, soil and water contamination, flora and fauna, air quality, land use & zoning, visual, noise; social and heritage and are summarised in **Tables 5.4 and 5.5**. It should be noted that the impacts identified in **Tables 5.4** and **5.5** have not necessarily been evaluated as listed and discussed in the preceding section. This is due to the fact that some of the impacts are interrelated and are likely to have similar impacts on the environment. The majority of the impacts have a *low* significance, which implies that they will not influence the decision to proceed with the proposed development, provided they can be effectively mitigated. Mitigating measures to address these impacts are already described in this Section.

Table 5.4: Evaluation of potential impacts associated with the **construction phase** of the land fill site

Impact on:	**Criteria**				**Description**	**Significance (Without mitigation)**	**Significance (With mitigation)**
	Extent	*Duration*	*Intensity*	*Probability*			
Geology & Soils	Local	Short term	Medium	Definite	Alteration of the geology and soil conditions through excavation activities and removal of large volumes of soil (cover material) associated with construction of the landfill site	Medium	Low
Soil and Water resources	Regional	Medium term	High	Probable	Potential impact of pollutants from the landfill may impact on the groundwater. Any hazardous substances (e.g. diesel) used during construction could potentially result in soil and underground water contamination unless good management practices are adhered to.	Medium	Low
Topography & Drainage	Local	Short term	Medium	Probable	The removal of rock outcrops and vegetation during the foundation excavation and acquisition of cover material can alter the topography and the drainage pattern in the area	Low	Low

Flora	Local	Short term	Medium	Definite	Areas cleared to accommodate the landfill and other waste facility and infrastructure might be invaded by alien vegetation	Medium	Low
Fauna	Local	Short term	Low	Probable	Mammals, reptiles and birds in the area are likely to leave the area or displaced during the construction phase	Medium	Low
Air Quality	Local	Short term	Low	Probable	Emissions from construction vehicles and other activities will influence the existing air quality	Low	Low
Public Health & Safety (access control)	Local	Short term	High	Probable	Eskom Matimba already has standards with regards to strict access control into the Power station. Eskom will comply with requirements of OHSA in order to reduce exposure risks of workers and the public.	High (negative)	Low
Land use and Zoning	Site	Long term	Low	Probable	Existing services and other infrastructure within the boundaries of the proposed may affect the development	Low	Low
Visual	Local	Short term	Low	Improbable	The construction activities will cause a degree of vegetation destruction and therefore remove these elements that contribute to the existing character of the site and the associated visual value.	Low	Low
Noise	Local	Short term	Low	Probable	Construction noise can be a nuisance to the workers located in close proximity to the construction site	Medium	Low
Social	Local	Short term	High	Highly probable	Proposed project will create employment opportunities for the local people	Medium	Medium
Heritage	L, R ,N & I	Short term	Medium	Improbable	The construction activity may impact on unknown cultural and heritage features beneath the earth surface	High	Low
Roads & Traffic	Regional	Short term	Medium	Highly probable	Construction traffic may impact on access roads leading to Matimba Power Station and may further damage road infrastructure	Medium	Low

Table 5.5: Evaluation of potential impacts associated with the **operational phase** of the land fill site

Impact on:	**Criteria**				**Description**	**Significance (Without mitigation)**	**Significance (With mitigation)**
	Extent	*Duration*	*Intensity*	*Probability*			
Air Quality (dust, landfill gases and vehicular emissions)	Local	Long term	Low	Definite	Odour resulting from operational activities associated with the landfill	Low	Low
Noise	Local	Long term	Low	Highly Probable	Increase noise levels from spreading and compacting of waste	Medium	Low
Ground water contamination	Local	Long term	Medium	Probable	Contamination of groundwater and surface water by leachate generated from landfill site	High	Low
Flora	Local	Short term	Low	Probable	Introduction of new flora (invader species) and faunal species from operational activities	Low	Low
Fauna	Local	Short term	Low	Probable		Low	Low
Visual	Local	Long term	Low	Highly probable	Cumulative visual impacts due to landfill activities	Low	High negative
Infrastructural development	Regional	Long term	High	Highly probable	Provision of a new landfill site for Eskom projects in the Waterberg region	High	High positive
Roads and traffic	Local	Long term	Low	Probable	Limited increase in traffic is anticipated due to the scale of proposed development and operation	Low	Low

5.6 Proposed management of impacts and mitigation

During the planning and construction phases, Eskom will be responsible for the monitoring of environmental impacts and for the management of mitigation strategies as prescribed in the EMP compiled for the project. The Environmental Control Officer (ECO) that has been appointed for the greater Medupi Project will also be responsible for the monitoring of the environmental impact and management of this project. Eskom will also conduct some environmental audit and apply for relevant permits in accordance with the legislation. A draft Environmental Management Plan (**Appendix D11**) for the use during construction and operation phases subject to the review and approval has been compiled for the project. The proposed mitigating measures are considered to be sufficient to effectively mitigate the low and moderate significance impacts and thus the decision can be made to proceed with the construction of the landfill and the temporary hazardous waste storage facility.

The Contractors that will be appointed by Eskom are required to strictly adhere to the requirements of the EMP. It is however important to introduce mitigation measures amongst others that a waste management plan is put in practice. The waste management plan must consider the waste stream and roles and responsibilities of Eskom in the management and monitoring of the incoming and outgoing waste from different power stations. The plan must also address the issue of waste reduction as there are certain measures that could be included in the current waste reduction plan. Waste minimisation programs would have benefits in terms cost saving and minimal impact on the environment.

5.7 Impact Statement

Due to the relative homogeneity of the study area and the fact that none of the sites were classified as being fatally flawed by the specialists, it was a challenge to categorise the sites and recommend the most preferred one since all the individual sites within site 5 could be proposed with appropriate mitigation measures and can be successfully managed with no significant detrimental effect to the environment. The proposed development is a footprint development and environmental impacts are localised with the exception of the geohydrological conditions. The geohydrological conditions associated with the landfill operation can also be successfully managed if mitigated accordingly.

5.8 Cumulative impacts

The Environmental impact regulations (2006) require that cumulative impacts of the proposed be considered during the EIA process. This is required on the basis that individual sites may have insignificant environmental impact, but when these sites are considered in relation to other existing and proposed development, significant impacts may occur.

The environmental impacts of the proposed development for each of the individual sites (Site 5a, b and c) within Site 5 have been discussed in this EIR and by each specialist that was involved. Therefore the cumulative impacts refer to Site 5 at large. The ecological environment (floral, faunal, avifaunal and wetland), geohydrology and geotechnical conditions are considered to have insignificant cumulative impacts as the impacts are localised and the region of influence is the immediate area of vicinity.

Impacts that are considered to have potential cumulative impacts include:

» Environmental nuisances (noise, dust, traffic and air quality)

» Visual; and

» Anticipated future developments.

Mitigation measures to ameliorate these impacts during the construction and operational phases have been discussed in some sections of this chapter and are prescribed in detail in the Draft Environmental Management Plan attached as **Appendix E** of this report and the Operational Management Plan (**Appendix E**).

5.8.1 Environmental Nuisances (Noise, Dust, Odour, Traffic and Air Quality)

The proposed landfill is located on an industrial site where industrial activities are already causing several nuisances. The Medupi Power station that is under construction is located approximately 4km from the study site. It has been indicated that Eskom will consider initiating construction of the landfill by end of 2009 following the issuing of positive authorisation and relevant permits. Additional traffic on the roads that is commonly used by the surrounding industries (including the proposed development) may cause some discomfort and inconveniences to employees working in other industries. Construction activities that will be ongoing in both areas will have cumulative impacts in terms of noise and dust generation. This has implications in terms of the deterioration of air quality and environmental quality from the construction activities. The impact of these nuisances on the environment during the construction and operational phases has already been assessed in the preceding sections. These impacts are however considered to be low with effective implementation of mitigation measures.

5.8.2 Visual and Landscape character

The proposed site is located within the boundaries of Matimba power station and other industries. Similarly, cumulative visual impacts from the surrounding industrial developments in the area, when considered collectively are worth noting. In order to avoid any visual issues the mitigation measures proposed in this report and in the Draft Environmental Management Plan must be implemented. The landfill and the associated infrastructure will not add much to the existing visual character of the area. The impact on the visual character is also considered to be insignificant.

5.8.3 Anticipated and future development

It has been indicated in the report that the landfill will also accommodate waste from the two proposed Eskom coal fired power stations in the Waterberg development, Matimba Power Station and the Contractors Village. This on its own implies that the landfill must have capacity to accommodate waste for the life span of these proposed power stations.

In addition, the municipality has during the public meeting indicated that they are in partnership with other industries to develop an alternate landfill site that will accommodate municipality waste and waste from the industries. This has implications in terms of development of an additional landfill site that may have similar impacts as those identified in this EIR.

The cumulative impact from known and anticipated development is considered to be low as the Lephalale area has been targeted by various industries for future developments. These industries will obviously require a licensed waste disposal site.

6 CHAPTER 6 PROJECT ALTERNATIVES

Consideration of alternatives is a key element of the EIA process and is a requirement of the scoping process as defined in the EIA Regulations (DEAT, 1998). The goal of evaluating alternatives is to find the most effective way of meeting the need and purpose of the project either through enhancing the environmental benefits of the proposed activity, or through reducing or avoiding potentially significant negative impacts.

During the Scoping and Screening phases, a number of alternative sites were initially investigated, but some were rejected as being not feasible. Of the five sites originally chosen for investigation, one potential site has been found to be the most suitable and was subject to investigation during the EIA phase (the other four having been eliminated in the Scoping Report). Refer to **Chapter 2** for a summary of the site selection process undertaken. It was a common recommendation from all specialist studies that due to the disturbed nature of Site 5 it would be appropriate that the site be investigated for suitable location of the proposed development.

For the purpose of the Impact Assessment phase, the specialist studies identified potential significant impacts for the development of Site 5 as a whole and thereafter individually assessed the potential significant impacts likely to occur from each of the individual sites (Sites 5a, b & c – figure 6.1). Sensitivities within each individual site in Site 5 were identified and considered. As part of the alternative assessment and site selection, specialists were also requested to make recommendations in terms of preferences for each of the 3 sites (sites 5a, b & c). It emerged from the specialist inputs that Site 5b is the most preferred, Site 5c being least preferred. The specialists also confirmed that due to the homogenous nature of the study area, any of the sites (Sites 5a, b & c) could be considered as the impacts of the proposed development in the long term will be minimal. It is however suggested that the areas located closer to the decommissioned dump be avoided due to the previous history and current conditions of the decommissioned dump.

For the purposes of this study, only two alternatives were considered during the impact assessment phase. These alternatives include the location (site) and design alternatives.

6.1 *Status quo*/No go alternatives

The no-go option would entail maintaining the *status quo.* This is not considered a viable alternative as Eskom do not want to use the unlicensed decommissioned dump in Lephalale for the disposal of the waste (since this represent a legal non conformance) or continue transporting the waste to Gauteng, the proposed construction of the waste disposal site will be a cost saving option for Eskom as trips and loads for the transport of waste generated from the existing Matimba and Medupi Power Stations will be significantly reduced. In addition, the road infrastructure between Gauteng and Lephalale is already under pressure as a result of the traffic generated by the ongoing industrial activities in Lephalale. The condition of the road is deteriorating rapidly. Additional heavy vehicles travelling on the road will add to this problem. If the transport of waste to Gauteng is no longer necessary, the additional pressure that this practice puts on the road infrastructure is taken away.

6.2 Location alternatives

A number of properties which are currently owned by Eskom were subject to a screening and scoping process by various specialists. It emerged that not all these farm properties are available and suitable for location of the proposed landfill site. Although four sites within Grootvallei were originally earmarked for consideration for the location of the proposed development, the sites were not very suitable and ideal due to the sensitivities around them; they were eliminated on this basis. Site 5 located within the Eskom Matimba Power station was subject to investigation during the Impact Assessment phase. For the purposes of the EIA investigations, Site 5 was divided into three candidate sub sites (Site 5a, b & c) which were considered as site alternatives. Site 5 and the alternatives considered are described as follows:

6.2.1 Site 5

The site is located on the Farm Grootestryd in the north western corner of Matimba Power Station, adjacent to the Stockpoort road. The site is currently vacant and situated adjacent to a dysfunctional and decomissioned landfill site. The size of the property is approximately 29.62 ha in extent of which approximately 5 ha are required to accommodate the landfill site footprint; a total of 20 Ha (including the 5 ha footprint) will be required for authorisation to cater for the associated infrastructure. **Figure 6.1** shows the three options (each 5 ha in extent) that were subject to evaluation during this assessment.

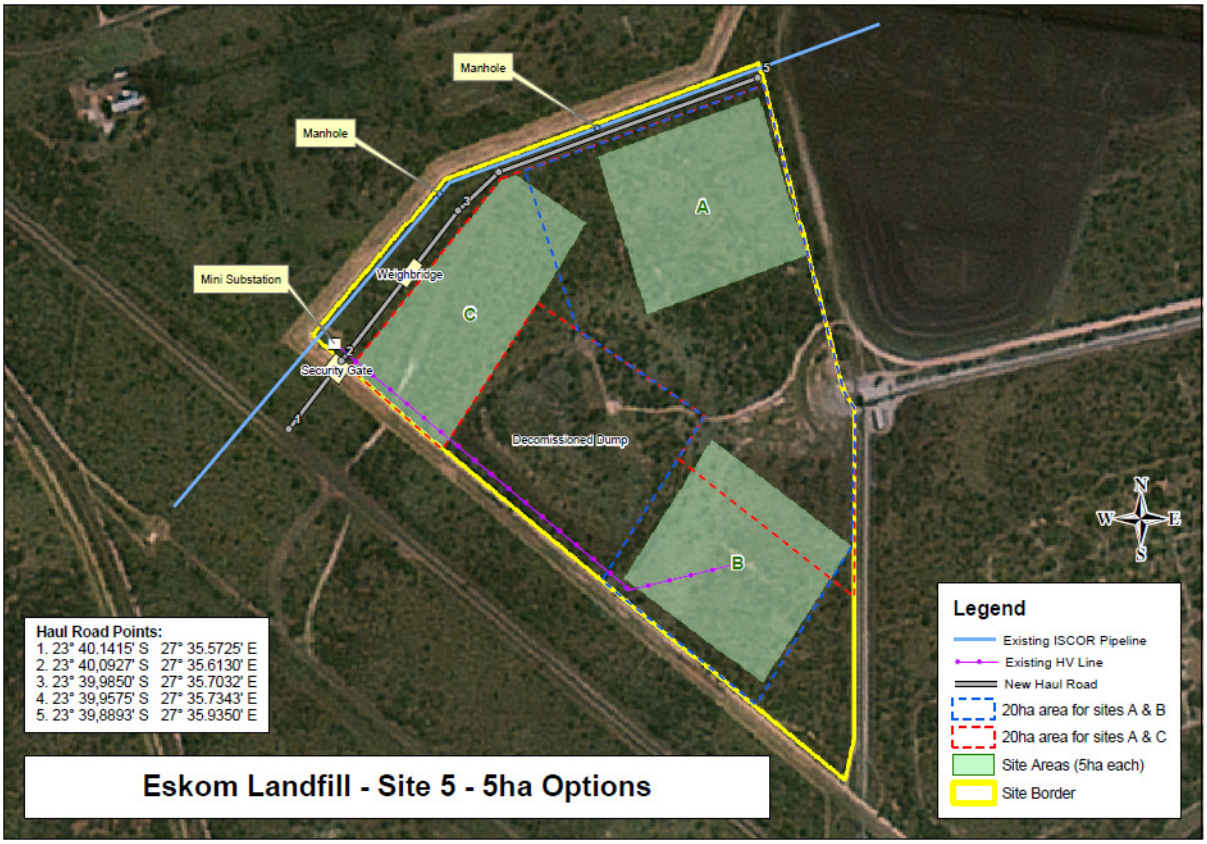

Figure 6.1: A map illustrating the spatial distribution of the three options (each approximately 5 ha in extent) evaluated during the EIA Phase

6.2.2 Site 5a

Site 5a is located in the north eastern corner of the site and is adjacent to Site 5c (western corner of the site). This site is located furthest from the decommissioned dump. It is located in close proximity to the access roads thereby has positive implications in terms of transportation cost savings. Unlike sites 5c and 5b, where an underground powerline was noted to be intersecting the sites and will require relocating before any potential construction, no existing infrastructures were observed to exist on site 5a.

Although the study sites are relatively homogenous, the ecological study has identified site 5a as the most preferred of the three sites, the remaining two sites are however still regarded as suitable. The transport, heritage and social studies regard all the sites to be equally suitable and did not highlight any specific site preferences. The geotechnical and visual specialists rated this site as 2nd (second) in order of preference and recommended site 5b and 5c. The specialist geohydrology input did not make any preferences pertaining to site 5a. The basis for this is that the proposed landfill be located in an area that has already been affected by water contamination rather than in an area where no water contamination has been identified. Locating the proposed development in the southern and eastern portions of site 5 will minimise the possibilities of increasing the area potentially exposed to groundwater pollution.

6.2.3 Site 5b

This site is located on the southern corner of the site and also south of site 5a and 5c. Immediately north west Site 5b is the decommissioned dump site. The presence of the existing dump does not pose a concern as Eskom is already in the process of rehabilitating the dump. Of minor concern is the existence of an underground high voltage transmission line that would need to be relocated before construction commences. In order to avoid impact on the underground transmission line, it is proposed that Eskom also consider locating the site away from the line by moving the site southwards.

Although the site is equally suitable from ecological, social, heritage and noise points of view, the specialist geohydrological, geotechnical and visual have identified the site as the most suitable. The suitability as per the key and influential specialist studies (geohydrology and geotechnical) was based on its capacity for future extension, availability of cover material, direction of flow by ground water and the potential of ground water contamination. In terms of visual aspects it is the most preferred as its location is such that observers on the D2816 road will have little view of the site, as the decommissioned dump acts as a visual barrier. Comparatively, it is the least preferred from a transport point of view as there are no existing roads in close proximity to the site.

6.2.4 Site 5c

Site 5c is located in the north western corner of the site in close proximity to access roads, the security gate, weighbridge and a mini substation. Immediately south of this site is the old waste dump. East of this side is vacant land and Site 5a. An underground high voltage transmission line runs along the southern boundary of the site and would require to be relocated before construction should this site be considered. It is also possible to move /shift the boundaries of Site 5c the site to the east to avoid impacting on the high voltage underground transmission line.

Of the three site alternatives, this alternative emerged as the least favourable from specialist investigations. It is regarded as equally suitable from an ecological, social, heritage and noise point of view whereas the geohydrological, geotechnical and visual specialists regard the site as the least preferred. Site 5c according to the geotechnical assessment has very little land available for future expansion, is the least disturbed and soils are of poor quality. The geohydrological investigation indicates that the northern portion of Site 5 is unpolluted and thus recommends that existing areas of pollution be kept as small as possible. Hence, it is recommended Site 5c be eliminated for the location of the landfill. It was only identified as the most preferred by the transport engineer due to its location in close proximity to the access roads.

6.3 Site specific findings

Following the review of the specialist reports by Envirolution and Eskom, a specialist integration workshop was held to discuss the specialist findings and suggested mitigation measures with respect to each of the three sites. **Table 6.1** summarises the finding of the respective specialists.

Table 6.1: Summary of specialist finding for the three respective sites (**✓ depicting suitability of the site for the proposed development)**

Specialists	Site 5a	Site 5b	Site 5c	Most Preferred	Least preferred
Ecology	✓	✓	✓	Site 5a (more disturbed than other sites	None (Site 5b and 5c are less disturbed – but can be mitigated)
Visual impact	✓	✓	✓	Site 5b	Sites 5a (2nd) and 5c least preferred
Heritage	✓	✓	✓	All sites are equally suitable	
Geohydrology	✓	✓	✓ (least contaminated but can be mitigated with appropriate design measures)	Site 5a and b (already polluted)	None (as impacts can be mitigated)
Geotechnical suitability	✓ (source of cover material)	✓ (extensively disturbed)	✓ (source of cover material)	Equally suitable	None
Social impact	✓	✓	✓	Equally suitable	No sites are unsuitable
Agricultural potential	✓	✓	✓	Equally suitable, no sites are unsuitable	
Traffic	✓	✓	✓	Sites 5a & 5c	None (Site 5b is away from access roads
Air Quality	✓	✓	✓	All sites are equally suitable	None

It is apparent from **Table 6.1** that many of the specialists regard the sites as equally suitable since there were no fatal flaws and with appropriate mitigation, the identified impacts can be reduced to acceptable significance.

Due to the relative homogeneity of the study area and the fact that none of the sites were classified as being fatally flawed by the specialists, it was a challenge to categorise the sites and recommend the most preferred one since all the individual sites within site 5 could be proposed with appropriate mitigation measures and can be successfully managed with no significant detrimental effect to the environment. The proposed development is a footprint development and environmental impacts are localised with the exception of the geohydrological conditions. The geohydrological conditions associated with the landfill operation can also be successfully managed if mitigated accordingly. The following section is a summary of the specialist investigations for the sub-sites within Site 5.

6.3.1 Geohydrology and geotechnical conditions

According to the geotechnical specialist, all the sites are suitable and can be considered for the location of the proposed development. The specific choice of the site is, however, dependent on Eskom decision regarding the source of cover material. Should Eskom consider using Sites 5a and Site 5b for cover material, site 5c can also be considered. The geohydrological specialist mostly prefers Site 5a & b as these sites are already contaminated. Site 5c can be considered, but if the site is chosen proper design and management during construction and operation is emphasized.

6.3.2 Ecology (flora, fauna and avifauna)

The area proposed for the landfill site has not been identified as an area of significant sensitivity. No threatened, near threatened or any rare and declining species as identified in the Threatened Plant Species Programme (TSP) are expected to occur on the study site. There are no sensitive bird species that would occur in the vicinity of each of the site although certain bird species e.g. pied crows may increase due to the establishment of the landfill. Most of the immediate habitat surrounding the proposed development would be vacated until construction is completed. The relocation of the faunal habitat during construction is therefore acceptable and is not deemed significant.

6.3.3 Surface Water Resources and Wetland Ecosystems

No drainage lines transverses Site 5. The site falls outside the 500m buffer zones of any watercourses and does not pose any significant risk in terms of potential impacts during construction and operational phases.

6.3.4 Visual impact

The site is fairly disturbed as it is located amongst man-made infrastructures such as roads, railway lines, power lines, conveyor belts and the Matimba Power Station. Its location is such that observers on the D2816 road will have little view of the site as the existing landfill acts as a visual barrier. The only affected observers will be the motorists and commuters on the Stockpoort Road. Visual impacts will mainly occur during the operational phase of the project and can be successfully managed by choosing a landfill design that will have less visual impact.

6.3.5 Cultural and Heritage impacts

The heritage survey indicated that the proposed development will not have impacts on the cultural heritage resources as none are known to exist in the area. .

6.3.6 Social impact

From a social perspective, all the sites are equally suitable for the proposed landfill. None of the sites are seen as posing a fatal flaw to the project. The social impacts described in the report will occur irrespective of which site will be utilised. As long as the mitigation measures suggested in the report are adhered to, any of the sites can be used for the proposed development.

6.4 Design Alternatives

6.4.1 Co-disposal options

Eskom has considered the option of co-disposal of waste (without discarding the hazardous waste storage facility). In other words, Eskom wants to have a separate designated cell for low grade hazardous waste (e.g. oils, oily rags, cans etc.) and other cells for disposal of general waste. The options were considered solely for the reasons that Eskom wants to save costs by avoiding unnecessary transportation of waste to Gauteng. Obvious benefits of a co-disposal option are that environmental and health risks associated with the long distance transportation of hazardous waste are reduced and that disposal of hazardous wastes that will be generated from the anticipated power stations is catered for.

6.4.2 Other design considerations

It cannot be determined at this stage what the final site footprint, shape, and design will be and what the final shape of the landfill will be. It is not anticipated, given the waste volumes that the landfill height may be higher than 10m above natural ground level. In the event that the landfill site does exceed this height, benches will be built at 10 m intervals and will incorporate stormwater management considerations in the design. The landfill design will be specified for slopes of 1 in 3 and will take into consideration the applicable DWAF Minimum Requirements during the design.

Land filling is done in cells which are built to last about four to five years. The landfill design will specify the final number of cells to be constructed. Landfill site design and operation will insofar as possible be optimised to start on the uphill side of the valley with the cells and working face as small as possible so as to minimise run-off and odour. It is preferable as far as possible that rehabilitation of waste cells be carried out immediately after completion of filling of a particular cell. This is not always possible because the final cell shape might not be exactly what is envisaged in the final shape of the landfill. If this is the case, then intermediate cover will be applied. The costs of capping are very high and therefore as far as is possible capping is preferable during the life span of the landfill rather than at the end so that the economic burden of capping is spread out during the life of the facility. If capping is not possible on cell completion, it is recommended that the permit holder set aside funds during the lifespan of the landfill to ensure that funds are available for final capping during closure stages. All landfill operations will be screened from the public by screening berms.

6.4.3 Visual/Aesthetic considerations

The trees/vegetation on the site will be cleared (only if they interfere with the construction of the proposed development) to allow for construction of and daily operations at the facility. The only vegetation and trees that may remain will be those that do not impact on the construction or operational activities. Typically at the approach to the site, indigenous trees and grass might be planted so that the site appears aesthetically pleasing and some might even be planted around the site for screening. Whilst all waste handling activities have as a first requirement protection of the environment, engineering design considerations do, as far as possible, consider public perceptions and the impact such facilities might have on the surrounding communities. Additionally flytraps will be placed around the site.

6.5 Recommended Alternative

Based on Table 6.1, site 5a is most preferred by the Geohydrologist (already polluted), Ecologist (already disturbed) and Traffic Engineer (access to services) and equally acceptable by the rest of the specialists. The Visual expert prefers site 5b but indicated that the mitigation can render site 5a and 5c suitable as well. Therefore site 5a (including the 20 hectare portion around it) is a viable option it terms of selection as the impacts will be minimal and is considered the most preferred alternative.

However given the findings of the EIA investigations which indicate there are no significant differences associated with the potential environmental impacts of all three sites and that there are no fatal flaws related to the proposed development at all three sites, all three identified alternatives can thus be considered with application of effective mitigation measures. Therefore based on the specialist findings for the 3 sites (Site 5a, b and c), it is a recommendation of this EIR that **Site 5b** (including the 20 hectare portion around it) be authorised for the location of the proposed development. Please refer to **Figure 6.2** below.

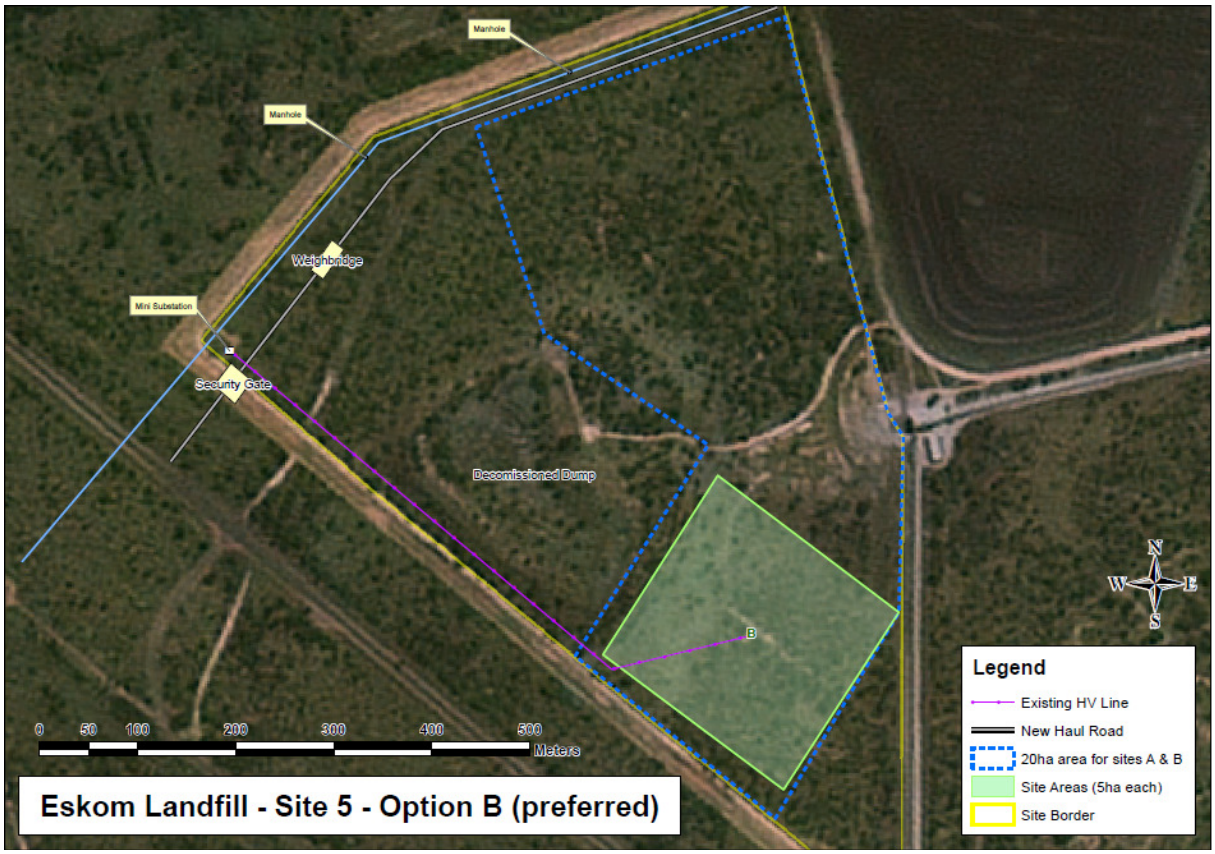

Figure 6.2. Preferred alternative (Site 5b) and its 20 hectare portion

The majority of the impacts have a *low* significance, which implies that they will not influence the decision to proceed with the proposed development, provided they can be effectively mitigated. Mitigating measures to address these impacts were already described in this

Section. The proposed mitigating measures are considered to be sufficient to effectively mitigate the l*ow* and *moderate* significance impacts and thus the decision can be made to proceed with the construction of the landfill and the temporary hazardous waste storage facility.

7 CHAPTER 7 CONCLUSIONS AND RECOMMENDATIONS

This EIR has provided a comprehensive assessment of the potential environmental impacts associated with the proposed construction of the landfill site at Matimba Power Station. These impacts have been identified by the EIA team (including specialists) and I&APs. The significance of the potential environmental (biophysical and social) impacts are summarised in **Tables 5.1** and **5.2**. Alternatives that were identified during the scoping phase were evaluated in detail during the EIA phase and recommendations made thereto. The key findings of the EIA are discussed in Chapters 4 and 5. In general, the proposed development will have an impact of *low* significance provided that there is effective application of the mitigation measures proposed in this EIR. The majority of these impacts are easily mitigated and can be reduced to *lower* significance through appropriate design and mitigation measures. No unacceptably impacts of unacceptably high significance are foreseen once proper mitigation measures have been implemented.

Generally, the key issues and concerns identified during the Impact assessment associated with the landfill site include:

- Potential impact on the groundwater resources and surface water should any leachate and contaminated stormwater be discharged into the natural environment; and
- Impact on the surrounding landowners in the form of aesthetics, dust, odours and noise from activities on site.

The following key conclusions are drawn from the impact assessment phase:

- The proposed development is a strategic response to address current waste management challenges facing Eskom in the Lephalale area as the existing landfill site in Lephalale is not permitted and cannot be utilised for disposal of the waste that is currently generated during the construction of the Medupi Power Station, as well as waste that will be generated during its operation;
- The proposed development is a response by Eskom to adhere to its Safety, Health and Environmental policy and legal requirements, as well as combating current operating costs;
- The project will benefit the local community through increased job creation both during the construction and operational phases;
- I&APs raised no objections to the proposed development during the Scoping or Environmental Impact Assessment phases;
- The specialist studies undertaken during the Impact Assessment phase have concluded that the proposed location of the landfill in Site 5 (Matimba Power Station)

is not in an environmentally sensitive area from a biophysical or socio-economic perspective. The development will occur in an already disturbed area located in close proximity to an area that was previously used as a landfill site;

» Based on the specialist studies, no environmental fatal flaws have been identified for the individual sites that were evaluated and recommended for the proposed development. However, a number of potentially significant environmental impacts have been identified and recommendations from each of the specialists' studies must be considered during the pre-construction, construction, operational and decommissioning phases of the proposed development; and

» Implementation of adequate mitigation measures would reduce all potential impacts to a *low* significance.

7.1 Recommendations

It is recommended that the environmental authorities authorise the development subject to the following conditions:

» Given the findings of the EIA investigations, which indicate there are no significant differences associated with the potential environmental impacts of all three sites and that there are no fatal flaws related to the proposed development at any of the three sites, all three identified alternatives can thus be considered with application of effective mitigation measures. Therefore based on the specialist findings for the three sites (Site 5a, b and c), it is a recommendation of this EIR that **site 5b** (including the 20 hectare portion around it) be authorised for the location of the proposed development.

» The majority of the impacts have a low significance, which implies that they will not influence the decision to proceed with the proposed development, provided they can be effectively mitigated. Mitigating measures to address these impacts have been described in this report. The proposed mitigating measures are considered to be sufficient to effectively mitigate the low and moderate significance impacts and thus the decision can be made to proceed with the construction of the landfill and the temporary hazardous waste storage facility.

» Eskom must ensure that all the requirements of Section 20 (1) the Environment Conservation Act, 1989 (Act 73 of 1989) as amended, are timeously submitted to DEAT.

» The proposed landfill and the temporary waste storage facility must be carefully designed to avoid significant ground water and visual impacts.

» It is therefore recommended that leachate management systems and a water management plan must be implemented to minimise impacts. The monitoring

programmes and other conditions and requirements to ensure that risks associated with the project are kept to minimum levels are discussed in detail in the Draft Environmental Management plan (Appendix E) and the operational plan (**Appendix E1**) attached as appendices to this document.

- » Eskom must ensure that they comply with the applicable legislation, regulatory and permit requirements from the Local and District Municipality, Limpopo Department of Economic Development Environment and Tourism, Department of Water Affairs and Forestry, Department of Labour and Department of Health during the construction and operational phases. It is essential that all applicable regulatory requirements are adhered to ensure that Eskom meets all the necessary legal requirements for the construction and operation of such a facility. Eskom against litigation issues as a result of potential environmental health and safety risks that may arise. Waste disposal sites are generally regarded as nuisances and are considered hazardous; the onus will therefore rest on Eskom in terms of strictly adhering to the legal requirements.
- » Construction activities should in no way impact on the surrounding water resources.
- » Public health and safety must be considered during planning and construction site layout.
- » A complaints procedure must be put in place to ensure that all complaints about nuisances from bad odours are handled fast and efficiently;
- » Mitigatory actions included in this report, specifications detailed in the EMP and the operational plan, and the authorisations conditions must be adhered. Monitoring must be undertaken during constructing and operational phases.

7.2 Way forward

This report serves as the Final Environmental Impact Report for the proposed construction of the landfill, a temporary hazardous storage facility and a low hazardous waste cell.

Comments received during the review of the Draft Environmental Impact Report have been incorporated into this report. This report has been prepared for submission to DEAT for their review and consideration. I&APs will be informed of the outcome of DEAT considerations in due course. Once a decision is made, DEAT will release a Decision (an authorisation or a refusal to authorise) which details the final outcome of the application. A feedback letter will be sent to all registered I&APs detailing the DEAT decision.

I&APs have 10 days, after the issue of the DEAT decision, to inform DEAT and the applicant of their intent to appeal the decision made by the authorities, and a further 30 days thereafter to submit their appeal.

8 CHAPTER 8 REFERENCES

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