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REPORT ON

Environmental Impact Assessment for the Kusile 60 year Ash Disposal Facility at the Kusile Power Station, Mpumalanga

FINAL ENVIRONMENTAL IMPACT REPORT

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ABBREVIATION	PHRASE
ADF	Ash Disposal Facility
BID	Background Information Document
CA	Competent Authority
CBA	Cost-Benefit Analysis
CRR	Comments and Responses Report
DEA	Department of Environmental Affairs
DEIR	Draft Environmental Impact Report
DMR	Department of Mineral Resources
DSR	Draft Scoping Report
DWS	Department of Water and Sanitation
DWEA	Department of Water and Environmental Affairs (Ministry)
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECA	Environment Conservation Act
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
FEIR	Final Environmental Impact report
FSR	Final Scoping Report
GCL	Geo-Synthetic Clay Liner
GIS	Geographic Information System
GNR	Government Notice Regulation
HDPE	High Density Polyethylene
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
IEP	Integrated Energy Plan
KPS	Kusile Power Station
kV	Kilo Volts
LCS	Leachate Collection System
LCT	Leach Concentration Thresholds
LED	Local Economic Development
MCA	Multi-criteria analysis
MVA	Mega Volt Ampere
NEMA	National Environmental Management Act

ABBREVIATION	PHRASE
NEM:AQA	National Environmental Management: Air Quality Act
NEM:WA	National Environmental Management: Waste Act
NERSA	National Energy Regulator of South Africa
NIRP	National Integrated Resource Plan
NWA	National Water Act
PCD	Pollution Control Dam
PoS	Plan of Study
PPP	Public participation Process
QDGC	Quarter-Degree Grid Cell
SDF	Spatial Development Framework
SIA	Social Impact Assessment
SIP	Strategic Infrastructure Project
SR	Scoping Report
ToR	Terms of Reference
WMA	Water Management Area
WMCO	Waste Management Control Officer
WML	Waste Management License
WMLA	Waste Management License Application
WUL	Water Use License
WULA	Water Use License Application

EXECUTIVE SUMMARY

The Executive Summary is intended to provide the reader with a concise overview of the key outcomes of the Environmental Impact Assessment Phase carried out for the proposed Kusile Power Station 60 year Ash Disposal Facility (ADF) Project (hereafter referred to as "*the project*"). Furthermore this Executive Summary has also been structured to provide a brief account of the project activities which falls within the ambit of the NEMA (1998) as well as their associated environmental consequences throughout the project lifecycle. The reader's attention is drawn to fact that the overarching purpose of the EIA Phase as well as the entire Scoping and Environmental Impact Reporting Process is to:

- Provide the Competent Authority (CA) with sufficient information to determine whether the anticipated environmental consequence of the project falls within acceptable levels, and in doing so facilitate decision making by the CA.

The proposed Kusile Power Station 60 year ADF project essentially entails the construction and operation of an ADF, which will be in addition to the authorised co-disposal ADF at the Kusile Power Station. A detailed account of all elements forming part of the planned project has been provided in **Chapter 9** (Project Description) of this report. As the proposed project is concerned primarily with constructing a suitable facility for the disposal of ash generated by the Kusile Power Station, the planned project activities fall within the ambit of the National Environmental Waste Act (59 of 2008) (NEMWA) as well as the National Environmental Management Act (107 of 1998) (NEMA).

As a means of ensuring that the reader is provided with the context of the project as a whole, the project description provided in **Chapter 9** includes all project activities, regardless of whether or not they trigger activities listed in Government Notice R544, R545 and R546, and Government Notice 921 (2013) in terms of the NEMA (1998) and NEMWA (2008) respectively. The project description provided in **Chapter 9** of this document provides a detailed description for each of the project components including the ADF infrastructure. The approach that will be adopted for the separation of clean and dirty water is provided in **Chapter 9**. A description of the project activities (e.g. relocation of existing services during the Construction Phase) that will be undertaken throughout the project lifecycle is provided in **Chapter 10** of this Final Environmental Impact Report (FEIR).

Coal fired power stations such as Kusile Power Station utilises large volumes of pulverised coal to generate electricity. The pulverised coal is burned in large boilers. The heat which is generated by the burning coal essentially drives the electricity generation process, which generates ash particles that are removed by using air quality abatement technologies, before releasing the gas through a smoke stack. The interest of the project however relates to providing an adequate facility for the disposal of the residual material (i.e. ash) that is generated by the coal combustion processes. The estimated volume of coal ash that will be produced by the electricity generation process for the remaining operating life of the Kusile Power Station, exceeds the capacity that can be accommodated in the footprint of the currently authorised ADF.

As the Kusile Power Station will operate for a period of no less than 60 years, the footprint of the authorised ADF will not have sufficient capacity for the disposal of ash during the full operational life of the power station. As a means of preventing a shortfall of a suitable area at which to dispose of the ash, it is proposed to construct an additional ADF for the disposal of ash over a 60 year period. The operation of the ADF will require supporting infrastructure that is necessary for the safe and efficient operation of the ADF.

In order to determine the anticipated consequences of the proposed project as well as the resultant change in the receiving environment, the existing environmental conditions of the project area must be determined. The findings of various specialist studies that were carried out for the proposed project, each focussing on a particular evironmental feature, were used to determine the baseline environmental conditions of the development area. It must be noted that by determining the baseline environmental conditions, the various pollution pathways (e.g transportation of contaminated runoff from the ADF (*source*) by stormwater runoff (*pathway*) into a watercourse (*receptor*)) associated with each of the project activities and in particular the proposed ADF can also be determined. The key findings of each of the Specialist Studies have been integrated with the Description of the Receiving Environment that is provided in **Chapter 6** of this FEIR. A description of all assumptions, uncertainties and gaps in knowledge that were taken into account in the preparation of this FEIR are detailed in **Chapter 6.1** of this document.

The findings of the Specialist Studies as well as the anticipated environmental impacts which were rated as being of high significance (refer to **Part 11**), show that the environmental features which are most vulnerable to anticipated project activities include groundwater and surface water resources, soil and air. The Environmental Impact Statement provided in **Part 11** of this document provides a detailed breakdown of the following:

1. The contribution of existing conditions to the status quo;
2. The environmental consequences (i.e. impact) that may result from the project activities (in the absence of mitigation measures);
3. Proposed mitigation against the environmental consequences of the development;
4. Significance of the collective impact of existing land uses and proposed project activities; and
5. The significance of environmental consequences that will remain after and regardless of the implementation of mitigation measures (i.e. residual impacts).

Apart from the Very High Significance impacts that will transpire as a result of the diversion of the Klipfonteinspruit wetland to accommodate the footprint of ADF, the permanent nature of the construction phase impacts on the geology, soil and land use was allocated to the Moderate – High significance assigned to these impacts. The risk posed to the aquatic habitat by potentially overflowing or structurally ineffective pollution control dams during the operational phase is considered as a Very High negative impact risk. Contaminated surface water runoff or water seeping out of the ADF or the PCDs is expected to result in water quality deterioration in receiving water resources. The anticipated impacts on groundwater during the Operational Phase of the proposed project are considered to be of a Moderate to Low significance. The significance of the Operational Phase groundwater impacts is largely due to the fact that the impact risk related to seepage, leachate infiltration (leak of liner) from ADF, contaminated water trenches and pollution control dams are Moderately-Low for Site A.

During the Operational Phase, concurrent construction and operational activities may continue to take place. Concurrent rehabilitation, which includes shaping of the ADF sides, will be done. Profiling of the terrain will be permanent, and will affect surface water drainage patterns beyond the life of the facility. The combined weighted project impact to topography (prior to mitigation) will probably be of a Moderate-Low negative significance, affecting the development site.

In order to best manage the anticipated environmental impacts as described in **Part 11**, the mitigation measures which have been formulated for each of the impacts have been taken forward to the Environmental Management Programme (EMPr) (refer to **Appendix J**).

During the preceding Scoping Phase and current Environmental Impact Assessment (EIA) Phase for the proposed project, all provisions relating to Public Participation included in Regulation 54 of the NEMA EIA Regulations R.543 (2010) were adhered to. The Public Participation Process (PPP) was also guided by the Environmental Management Principles which relate to the involvement of Interested and Affected Parties (I&APs) as well as various Public Participation Guidelines. A detailed account of the various steps that were taken as part of the PPP is provided in **Part 3.3** of this final EIR. Comments that were received from I&APs during the EIA Phase of the proposed project related primarily to the selection of site alternatives for the ADF, socio-economic concerns as well as the impact of the project activities on water resources. All issues, comments and questions that were received from I&AP's (during the both the Scoping Phase and EIA Phase) are provided in the Comments and Responses Report (CRR) included in **Appendix C4** of the FEIR. The responses provided by the various project team members to the comments received from I&APs are also included in the CRR.

The various alternatives that were considered for all aspects of the proposed project are described in **Part 5** of this final EIR. Two ash disposal methods, namely in-pit ash disposal or the construction of separate waste disposal facility were considered. A number of constraints posed by disposing of the ash at the New Largo Mine, deemed the possibility of employing in-pit ash disposal as unfeasible (refer to **Part 5.2.4**). The separate disposal of the waste stream (ash) is thus considered as the only viable ash disposal method. The feasibility of all identified site alternatives were evaluated based on the following criteria:

6. Identification of potential sites against a set of technical criteria;
7. Fatal flaw analysis of potential site alternatives; and
8. Screening and ranking of sites against economic, environmental and social criteria.

Site A was identified as the alternative which would result in the lowest overall inferred ecosystem cost as well as the lowest cost alternative to Eskom and electricity users. Furthermore the construction of the ADF on Site A will reduce the number of required dirty water dam controls (one only on the Klipfonteinspruit, more than 6.5 km from the Wilge River) thereby reducing the risk of water pollution and optimising the ability to mitigate impacts before reaching the Wilge River. The comparative alternative assessment provided in **Part 8** of this document explains the implications of each of the potential site alternatives, as well as the rationale for selecting Site A as the preferred Site Alternative.

Based on the results of the EIA Phase in particular the significance of the anticipated impacts as well as the extent to which these impacts can be mitigated to fall within an "*acceptable level*" formed the basis of the Environmental Assessment Practitioner (EAP) Opinion provided in **Part 12** of the final EIR. It is the opinion of the EAP that Environmental Authorisation (EA) be granted for the implementation of the proposed Kusile Power Station 60 year ADF Project. It is however also the recommendation of the EAP that the EA be subjected to adhere with the mitigation measures which have been stipulated in the EMPr.

1 INTRODUCTION

1.1 KUSILE POWER STATION ASH DISPOSAL FACILITY PROJECT

Kusile Power Station, located approximately 20 km from Bronkhorstspruit in the Mpumalanga Province (Figure 1-1), is a coal fired power station currently under construction. The power station will employ dry ashing facilities for the disposal of its ash. Studies have shown that the current ash dump, authorised with the power station in March 2008, is too small to accommodate all the ash for the life of the station. The current ash disposal facility has been determined to have a carrying capacity of less than 10 years, for ash and gypsum disposal.

An additional facility is therefore required to accommodate ash disposal for the life of the station. Alternatives have been considered (and are discussed in detail in Chapter 5). It is envisaged that the Kusile Ash Disposal Facility (also referred to in this report as "The Project") will include the following components (discussed in more detail in Chapter 8 and 9):

- A dry ash disposal facility;
- A conveyor belt system for the transportation of ash from the power station to the ash disposal site/facility;
- A single waste stream comprised of combined bottom ash and fly-ash;
- Services including electricity and water supply in the form of overhead power line and pipelines;
- The construction of new storm water management and infrastructure, and drainage system; and
- Linear infrastructure such as roads to and from the site, culverts and channels.

Zitholele has been appointed to undertake the Environmental Impact Assessment (EIA) and Waste Management License (WML) Application as required by the National Environmental Management Act ([NEMA] Act No 107 of 1998, as amended 2010) and the National Environmental Management: Waste Act ([NEM:WA] Act No 59 of 2008) for the proposed construction, operation and decommissioning of the project.

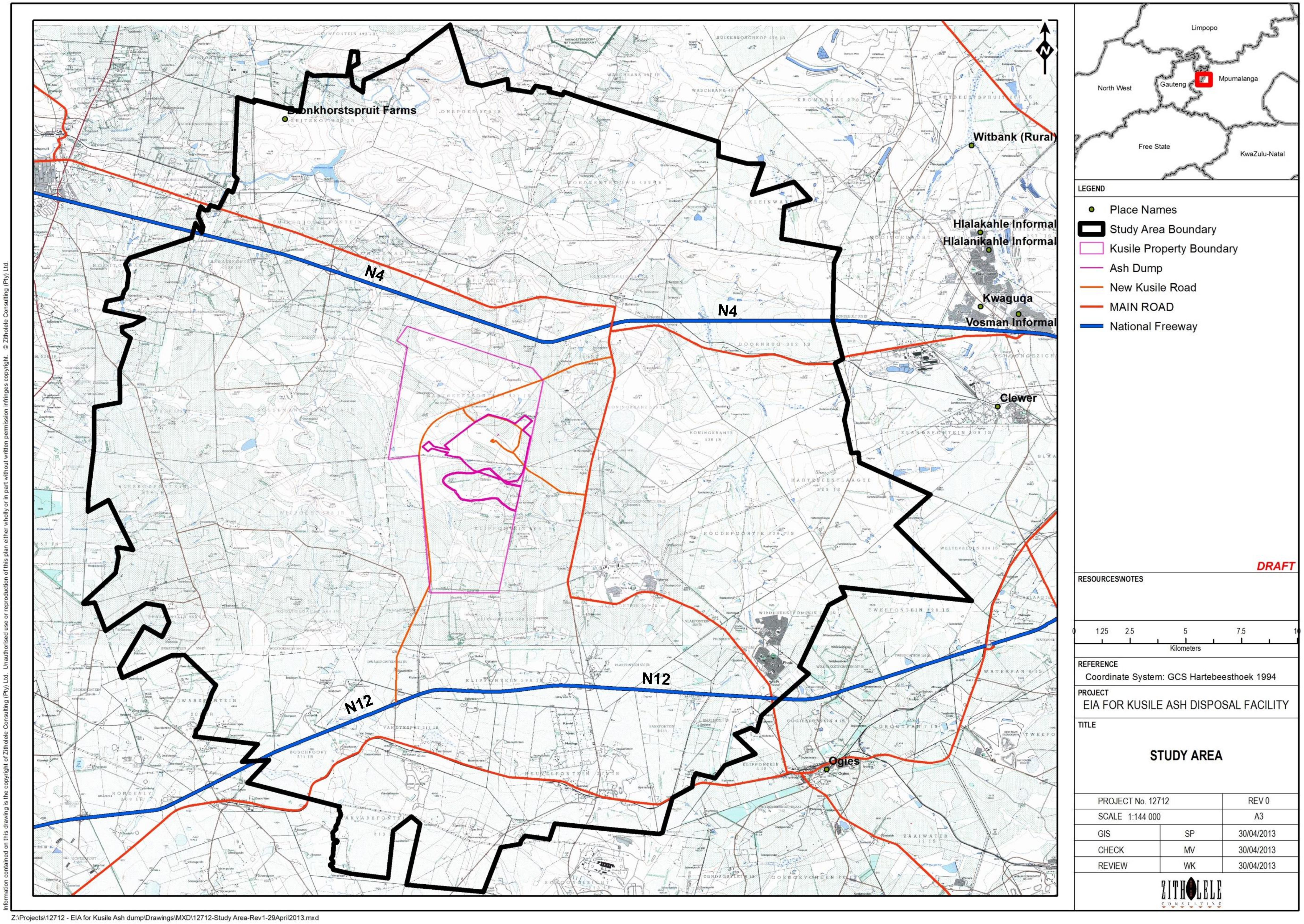

Figure 1-1: Overview of the study area located within a 15 km radius of the Kusile Power Station

1.2 ENVIRONMENTAL IMPACT ASSESSMENT PRACTITIONER (EAP) DETAILS

In terms of the NEMA and associated Environmental Impact Assessment (EIA) Regulations (2010), the proponent must appoint an Environmental Assessment Practitioner (EAP) to undertake the environmental assessment of an activity regulated in terms of the aforementioned Act.

In this regard, Eskom appointed Zitholele Consulting to undertake the EIA for the proposed ash disposal facility, in accordance with the EIA Regulations promulgated and amended in June 2010 in terms of the NEMA. This process also complies with the NEM:WA requirements for licensing of waste disposal facilities as the proposed activity is listed in the waste regulations (GN921 Category B).

Zitholele Consulting is an empowerment company formed to provide specialist consulting services primarily to the public sector in the fields of Water Engineering, Integrated Water Resource Management, Environmental and Waste Services, Communication (public participation and awareness creation), and Livelihoods and Economic Development.

Zitholele Consulting has no vested interest in the proposed project and hereby declares its independence as required by the EIA Regulations. The details of the EAP is listed below, refer to Appendix A for a copy of his *curricula vitae*.

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Dr Mathys Vosloo graduated from the Nelson Mandela Metropolitan University with a PhD in Zoology in 2012. Over the past few years Mathys has been involved in a variety of projects and has undertaken environmental authorisations ranging from the construction of roads, rehabilitation of dam wall infrastructure, development of low cost housing, and to electricity generation and transmission projects. Mathys has also been involved in the development of strategic environmental assessments and state of the environment reporting, and has developed numerous environmental management programmes during the course of his career. With more than 10 years of environmental and scientific experience and more than 7 years in environmental consulting Mathys has gained an advanced and holistic understanding of environmental management in the built environment.

1.3 WHO IS THE PROPONENT?

Eskom Holdings SOC (Ltd) is the South African utility that generates, transmits and distributes electricity. Eskom supplies ~ 95 % of the country's electricity, and ~ 60 % of the total electricity consumed on the African continent. Eskom plays a major role in accelerating growth in the South African economy by providing a high-quality and reliable supply of electricity.

1.4 CONTEXT OF THIS REPORT

This report represents the final Environmental Impact Report (DEIR), a key component of the integrated Waste Management Licence (WML) and Environmental Authorisation (EA) process for the proposed establishment of a new ash disposal facility at Kusile Power Station.

This report addresses the requirements for the Impact Assessment Phase for the EIA as outlined in the NEMA regulations. The aim of this DEIR is to:

- Provide information to the authorities as well as Interested and Affected Parties (I&APs) on the proposed project; including details on the:
    - Proposed development project;
    - Alternatives that have been considered;
    - Receiving environment;
    - Impacts and environmental risks identified and
    - Assessing and ranking methodology.
- Indicate how I&APs have, and are still, being afforded the opportunity to contribute to the project, verify that the issues they raised to date have been considered, and comment on the findings of the impact assessments;
- Provide proposed mitigation measures in order to minimise negative impacts and enhance positive impacts; and,
- Present the findings of the Impact Assessment Phase in a manner that facilitates decision-making by the relevant authorities.

2 LEGAL REQUIREMENTS

Environmental legislation in South Africa was promulgated with the aim of, at the very least, minimising and, at the most, preventing environmental degradation. The Acts and Regulations applicable to the Kusile Power Station Ash Disposal Facility Project are summarised in Table 2-1.

Table 2-1: Summary of relevant legislation

Legislation	Sections	Relates to
The Constitution Act (No 108 of 1996)	Chapter 2	Bill of Rights
	Section 24	Environmental rights
	Section 25	Rights in property
	Section 27	Health care, food, water and social security
	Section 32	Administrative justice
	Section 33	Access to information
National Environmental Management Act (No 107 of 1998), as amended	Section 2	Defines the strategic environmental management goals, principles and objectives of the government. Applies throughout the Republic to the actions of all organs of state that may significantly affect the environment.
	Section 24	Provides for the prohibition, restriction and control of activities which are likely to have a detrimental effect on the environment.
	Section 28	The developer has a general duty to care for the environment and to institute such measures as may be needed to demonstrate such care.
National Environmental Management: Waste Act (No 59 of 2008)	Chapter 2, Part 2	National and provincial norms and standards, and waste service standards
	Chapter 4	Priority waste and waste management activities. Reduction, re-use, recycling and recovery of waste. Waste management activities and contaminated land.
	Chapter 5	Licensing of waste management activities.
National Water Act (No 36 of 1998) and regulations	Section 19	Prevention and remedying the effects of pollution.
	Section 20	Control of emergency incidents.
	Chapter 4	Use of Water and licensing.
National Environmental Management: Air Quality Act (No 39 of 2004)	Chapter 4	Air Quality Management Measures
	Chapter 5	Licencing of listed activities
	R. 827 of 1 November 2013, i.t.o section 32	National Dust Control Regulations, to prescribe general measures for the control of dust in all areas
	Section 34	Control of Noise
	Section 35	Control of offensive odours
NEM: Protected Areas Act (No 57 of 2003)	The Act came into operation on 01 November 2004. The aim of the Act is to provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity, natural landscapes and seascapes. In 2004, the National Environmental Management: Protected Areas Amendment Act 31 of 2004 was promulgated to amend Act 57 of 2003 with regard to the application of that Act to national parks and marine protected areas. The NEM: Protected Areas Amendment Act was published for public information on 11 February 2005 and came into operation on 01 November 2005. The NEM: Protected Areas Act, as amended by the NEM: Protected Areas Act 31 of 2004 repeals sections 16, 17 & 18 of the ECA as well as the National Parks Act with the exception of section 2(1) and Schedule 1.	

Legislation	Sections	Relates to
The Conservation of Agricultural Resources Act (No 43 of 1983) and regulations	Section 6	Implementation of control measures for alien and invasive plant species
National Heritage Resources Act (No 25 of 1999)	Section 34	No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority.
	Section 35	No person may, without a permit issued by the responsible heritage resources authority destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or paleontological site.
	Section 36	No person may, without a permit issued by the South African Heritage Resource Agency (SAHRA) or a provincial heritage resources authority destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority. "Grave" is widely defined in the Act to include the contents, headstone or other marker of such a place, and any other structure on or associated with such place.
	Section 38	This section provides for Heritage Impact Assessments (HIAs), which are already covered under the ECA. Where they are covered under the ECA the provincial heritage resources authorities must be notified of a proposed project and must be consulted during the HIA process. The Heritage Impact Assessment (HIA) will be approved by the authorising body of the provincial directorate of environmental affairs, which is required to take the provincial heritage resources authorities' comments into account prior to making a decision on the HIA.
Atmospheric Pollution Prevention Act (No 45 of 1964) and regulations	Sections 27 – 35	Dust control
	Section 36 - 40	Air pollution by fumes emitted by vehicles
Occupational Health and Safety Act (No 85 of 1993) and regulations	Section 8	General duties of employers to their employees.
	Section 9	General duties of employers and self-employed persons to persons other than their employees.
National Environmental Management: Biodiversity Act, 2004 (No 10 of 2004) (NEMBA)	Strategy for achieving the objectives of the United Nation's Convention on Biological Diversity, to which South Africa is a signatory.	
	Sections 65 - 69	These sections deal with restricted activities involving alien species; restricted activities involving certain alien species totally prohibited; and duty of care relating to alien species.
	Sections 71 and 73	These sections deal with restricted activities involving listed invasive species and duty of care relating to listed invasive species.
Mpumalanga Nature Conservation Act (No 10 of 1998)	Chapters 2, 5, 6, 7	This act deals with the protection and management of wild animals, game, fish, indigenous plant species and endangered and rare fauna and flora species.

Legislation	Sections	Relates to
National Forests Act (No 84 of 1998) and regulations	Section 7	No person may cut, disturb, damage or destroy any indigenous, living tree in a natural forest, except in terms of a licence issued under section 7(4) or section 23; or an exemption from the provisions of this subsection published by the Minister in the Gazette.
	Sections 12 - 16	These sections deal with protected trees, with the Minister having the power to declare a particular tree, a particular group of trees, a particular woodland, or trees belonging to a particular species, to be a protected tree, group of trees, woodland or species. In terms of section 15, no person may cut, disturb, damage, destroy or remove any protected tree; or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister.
Fencing Act (No 31 of 1963)	Section 17	Any person erecting a boundary fence may clean any bush along the line of the fence up to 1.5 metres on each side thereof and remove any tree standing in the immediate line of the fence. However, this provision must be read in conjunction with the environmental legal provisions relevant to protection of flora.
Hazardous Substances Act (No 15 of 1973) and regulations	Regulates the classification, use, operation, modification, disposal or dumping of hazardous substances.	
Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act (No 36 of 1947) and Regulations	Sections 3 to 10	Control of the use of registered pesticides, herbicides (weed killers) and fertilisers. Special precautions must be taken to prevent workers from being exposed to chemical substances in this regard.
eMalahleni Local Municipality Integrated Development Plan Final Draft 2014/2015	-	The Integrated Development Planning is regarded as a tool for municipal planning and budgeting to enable municipalities to deliberate on developmental issues identified by communities.
eMalahleni Local Municipality By-laws	By-laws	One of the Key Performance Indicators included in the Integrated Development Plan (2014/2015), includes the compilation and review of the following relevant by-laws by June 2014: • Street trading. • Management & Control of Informal Settlements & Land invasion. • Waste Management. • Recreational Resort. • Outdoor Advertising. • Nature Conservation. • Air Quality Management.
Mpumalanga Biodiversity Conservation Plan (MBCP)	2005 - 2006	The Mpumalanga Biodiversity Conservation Plan is used as a land-use planning tool for the Mpumalanga Province. The Systematic Conservation Planning process uses more than 340 Biodiversity features and targets in the fine-scale analysis.

Legislation	Sections	Relates to
Gauteng Conservation Plan Version 3.3	2012	The main purposes of C-Plan 3.3 are: • to serve as the primary decision support tool for the biodiversity component of the Environmental Impact Assessment (EIA) process; • to inform protected area expansion and biodiversity stewardship programmes in the province; • to serve as a basis for development of Bioregional Plans in municipalities within the province. C-Plan 3.3 is a valuable tool to ensure adequate, timely and fair service delivery to clients of GDARD, and is critical in ensuring adequate protection of biodiversity and the environment in Gauteng Province.

A discussion of the most relevant legislation is given in the sections that follow.

2.1 THE CONSTITUTION OF THE REPUBLIC OF SOUTH AFRICA (ACT 108 OF 1996)

The Constitution of the Republic of South Africa, 1996 (hereafter referred to as "the Constitution") is the supreme Law in South Africa. The Bill of Rights is included in Chapter 2 of the Constitution. The Environmental Right is set out Section 24 of the Constitution and states that – Everyone has the right -

a) to an environment that is not harmful to their health or well-being; and
b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –
   i. prevent pollution and ecological degradation;
   ii. promote conservation; and
   iii. secure ecologically sustainable development and use of natural resources,
   iv. while promoting justifiable economic and social development.

The National Environmental Management Act, 1998 (Act No. 107 of 1998) is the primary statute which gives effect to Section 24 of the Constitution. The Environmental Right contained in Section 24 of the Constitution also places responsibility on the Environmental Assessment Practitioner (EAP), Applicant and Competent Authority to ensure that this right is not infringed upon. The Sector Guidelines for Environmental Impact Assessment (2010) (Government Notice 654) describe a number of responsibilities which are placed on the EAP, Applicant and Competent Authority to ensure conformance with the statutory Environmental Right. These responsibilities include:

- All parties to the EIA Process have a duty not to infringe other persons' rights in terms of Section 24 of the Constitution.

- The Applicant must ensure that while the development incorporates measures that prevent or control environmental pollution or degradation, it also maximises the positive environmental impacts.
- There must be an equitable balance between the rights of the applicant and the broader public. In this regard, the consideration of need and desirability is critical as it requires the strategic context of the development to be considered with the broader societal needs and public interest.
- The provisions of the Bill of Rights are binding on decision-makers.
- Decision-makers must ensure that their decisions are in keeping with the environmental right and promote an environment that is not harmful to health or well-being.

2.2 NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT 107 OF 1998)

The EIA for this proposed project is being conducted in accordance with the EIA Regulations that were promulgated in terms of Section 24 (5) of the NEMA, as amended. The NEMA can be regarded as the most important piece of general environmental legislation. It provides a framework for environmental law reform and covers three areas, namely:

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

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

- The procedures for state decision-making on the environment; and
- The institutions of state which make those decisions.
- The NEMA principles serve as:
  - A general framework for environmental planning;
  - Guidelines according to which the state must exercise its environmental functions; and
  - A guide to the interpretation of NEMA itself and of any other law relating to the environment.

2.2.1 What are the NEMA Principles?

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

- Environmental management must put people and their needs first;
- Development must be socially, environmentally and economically sustainable;
- There should be equal access to environmental resources, benefits and services to meet basic human needs;

- Government should promote public participation when making decisions about the environment;
- Communities must be given environmental education;
- Workers have the right to refuse to do work that is harmful to their health or to the environment;
- Decisions must be taken in an open and transparent manner and there must be access to information;
- The role of youth and women in environmental management must be recognised;
- The person or company who pollutes the environment must pay for the rehabilitation;
- The environment is held in trust by the state for the benefit of all South Africans; and
- The utmost caution should be used when permission for new developments is granted.

The National Department Environmental Affairs (DEA) is the Competent Authority (CA) responsible for issuing environmental authorisation for the proposed project. The Mpumalanga Department of Economic Development, Environment and Tourism (MDEDET) and the Department of Water and Sanitation (DWS) are key commenting authorities.

2.2.2 Environmental Impact Assessment Regulations: GN 543-546 of 18 June 2010

In June 2010, an amended set of NEMA Environmental Impact Assessment Regulations was promulgated, GNR.543 – 546. These regulations govern the listing of activities that require Environmental Authorisation (EA), the authorisation procedures themselves, and the public participation process for authorisation procedures. It should be noted that although the main activity of the project triggers the need for a waste management license in terms of NEM:WA, certain activities that will be undertaken as part of the project are also listed activities in terms of NEMA, and therefore also require an EIA process prior to proceeding with the project. All listed activities that are triggered as a result of this project are described in Table 2-2 below.

Table 2-2: Relevant NEMA Listed Activities

NOTICE NUMBER AND DATE	ACTIVITY NUMBER	DESCRIPTION OF THE LISTED ACTIVITY	DESCRIPTION
Construction of the waste disposal facility and associated infrastructure will impact on an area larger than ~1 500 ha.			
GN R. 545 of 2010	Activity 15	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, industrial or institutional use where the total area to be transformed is 20 hectares or more.	The direct footprint of the ADF and Ash Water Return Reservoir will be significantly greater than 20 ha.
GN R. 544 of 2010	Activity 24	The transformation of land bigger than 1000 m^2 in size, to residential, retail commercial, industrial or institutional use, where at the time of coming into effect of this Schedule such land was zoned as open space, conservation or has en equivalent zoning.	It is submitted that the wetlands and watercourses, and natural grasslands on site can be considered an equivalent zoning to open space as the area covered by site A does support natural populations of fauna and flora.
GN R. 544 of 2010	Activity 28	The expansion of or changes to existing facilities for any process or activity where such expansion or changes to will result in the need for a permit or license in terms of national or provincial legislation	The proposed activities will likely result in an amendment of the existing Waste Management Licence for the Kusile Power Station.

NOTICE NUMBER AND DATE	ACTIVITY NUMBER	DESCRIPTION OF THE LISTED ACTIVITY	DESCRIPTION
		governing the release of emissions or pollution, excluding where the facility, process or activity is included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case that Act will apply.	
Construction of a conveyor belt for the transportation of waste classified as low hazardous to the proposed disposal facility.			
GN R. 545 of 2010	Activity 6	The construction of facilities or infrastructure for the bulk transportation of dangerous goods – iii) in solid form, outside an industrial complex, using funiculars or conveyors with a throughput capacity of more than 50 tons per day.	The ash has been classified as low hazardous waste (Type 3 waste, but a hazardous waste nonetheless. The conveyor is expected to deliver approximately 800 tons of ash per day to the ADF once all units are operational.
Relocation of power line infrastructure.			
GN R. 544 of 2010	Activity 10	The construction of facilities or infrastructure for the transmission and distribution of electricity (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts.	~~An~~ Two 88 kV power line running across the site, and a 22 kV and 11 kV line in the north-eastern corner of the site will be relocated and constructed adjacent to the ADF site.
Construction of a return water dam and pollution control dams for the management of clean and dirty storm water.			
GN R. 544 of 2010	Activity 12	The construction of facilities for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50 000 cubic metres or more, unless such storage falls within the ambit of Activity 19 of GNR 545.	A number of clean and dirty water dams will be constructed to manage pollution and storm water around the ADF. The combined capacity of these dams will be in the order of 1 100 000 m^3.
Construction of a storm water infrastructure such as pipelines / cut off drains or channels and/or the alteration of existing storm water infrastructure.			
GN R. 544 of 2010	Activity 9	The construction of facilities or infrastructure exceeding 1000 metres in length for the bulk transportation of water, sewage or storm water – i) With an internal diameter of 0.36 metres or more; or ii) With a peak throughput of 120 litres per second or more.	Pipes with an internal diameter of 360 mm or infrastructure that allows a peak throughput of 120 litres per second may be used during the construction and operation of the ADF.
The construction of access roads for the development and or long term servicing of all planned infrastructure for the project and/or the realignment and expansion of existing roads.			
GN R. 544 of 2010	Activity 22	The construction of a road outside urban areas: i) With a reserve wider than 13,5 metres; ii) Where no reserve exists where the road is wider than 8 metres, or iii) For which an EA was obtained for the route determination in terms of Activity 5 of GN 387 of 2006 or Activity 18 of GN 545 of 2010.	Access and maintenance roads will need to be constructed around the developing ADF and along the conveyor route that can allow two trucks to pass one another comfortably. The road surface is thus very likely to be wider than 8 metres.
GN R. 544 of 2010	Activity 47	The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre: i) With a reserve wider than 13,5 metres; ii) Where no reserve exists where the road is wider than 8 metres, excluding widening or lengthening inside urban areas.	Some of the existing access and farm roads will probably be used for hauling construction material and plant etc. It may become necessary to upgrade these roads through widening in order to maintain these roads in a good condition during construction and operation of the ADF.
GN R. 546 of 2010	Activity 4	The construction of a road wider than 4 metres with a reserve less than 13.5 meters (a) in Mpumalanga (ii) outside urban areas in (ee) Critical Biodiversity Areas as identified systematic biodiversity plans adopted by the competent authority or in bioregional plans.	Access and maintenance roads may have to be constructed through critical biodiversity areas as identified in the Gauteng Conservation Plan ver 3.3 and the Mpumalanga Biodiversity Conservation Plan (2007)
The crossing of rivers by road, conveyor or storm water structures, potential storm water outlets.			

NOTICE NUMBER AND DATE	ACTIVITY NUMBER	DESCRIPTION OF THE LISTED ACTIVITY	DESCRIPTION
GN R. 544 of 2010	Activity 11	The construction of: i) Canals; ii) Channels; iii) Bridges; iv) Dams; v) Weirs; vi) Bulk storm water outlet structures; xi) Infrastructure or structures > $50m^2$, where such construction occurs within a watercourse or 32 metres of a watercourse, measured from the edge of the watercourse.	Canals, channels, bridges, dams and other associated infrastructure will be constructed within 32 m or in a watercourse within the ADF footprint. A bridge containing the conveyance system, roads, and electrical infrastructure will be constructed over tributaries of the Wilge River.
GN R. 544 of 2010	Activity 18	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock from: (i) a watercourse;	The site preparation and construction phase of the ADF will result in the depositing of material within watercourses and wetlands within the development footprint.
GN R. 544 of 2010	Activity 26	Any process or activity identified in terms of section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).	Construction of the ADF may necessitate the need to undertake a search and rescue of plant species protected in terms of the NEM:BA.
The installation of tanks for the storage of fuel and diesel within the contractors camp			
GN R. 544 of 2010	Activity 13	The construction of facilities or infrastructure for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 cubic metres.	The establishment of the contractor's camp is likely to include the erection of fuel tank/s for the storage of fuel and diesel exceeding $80m^3$ but less than 500 m^3

Since the activities of the proposed project trigger Listing Notice GN 545, a Scoping and EIA had to be undertaken. NEMA provides for a single integrated process for all the listed activities on site. Since the project comprises activities that require both a Basic Assessment and EIA levels of investigation, all activities were assessed to the detail required for the Scoping and EIA process.

2.3 NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT (NEM:WA) (ACT 59 OF 2008)

All Waste Management Activities are regulated by the National Environmental Management Waste Act, 2008 (Act No. 59 of 2008) (NEM:WA) and the regulations thereunder. A number of the project activities associated with the proposed Kusile Power Station Ash Disposal Facility project are regarded as Waste Management Activities. As such these activities are governed by the NEM:WA (2008) and must conform to the provisions of the Act.

In order to regulate waste management activities and to ensure that these activities do not adversely impact on human health and the environment, the NEM:WA (2008) introduced the licensing of waste management activities. All waste management activities which are listed in Government Notice 921 (2013) in terms of the NEM:WA (2008) requires licensing from the Competent Authority before these activities may proceed. Prior to the implementation of any waste management activity listed in Category A, of Government Notice 921 (2013), a Basic

Assessment Process as set out in the Environmental Impact Assessment Regulation made under Section 24(5) of the NEMA (1998) must be carried out as part of the Waste Management License Application Process. However prior to the implementation of any Waste Management Activities listed in Category B of Government Notice 921 (2013), a Scoping and Environmental Impact Reporting Process must be carried out as part of the Waste Management License Application Process. Each of the project activities, as well as the corresponding waste management activity, is provided in Table 2-3.

Table 2-3: Description of applicable Waste Management Activities listed in Government Notice 921 (2013)

No.	Category	Waste Management Activity		Project Activity	Description
1.	Category B	7	The disposal of any quantity of hazardous waste to land.	Ash Disposal Facility	The dry ash generated by the combustion of coal in the electricity generation process will be disposed of at the Kusile 60 year Ash Disposal Facility. Owing to the nature and composition of the ash that is generated by the combustion of coal, it is considered to be low hazardous waste.
2.	Category B	10	The construction of a facility for a waste management activity listed in Category B of this Schedule (not in isolation to associated waste management activity).	Ash Disposal Facility	The development of the dry ash disposal facility is required to provide sufficient capacity for the life of the newly constructed Kusile Power Station.

With the identified listed activities it is inferred that the proposed infrastructure requires the submission of a WML Application as well as a full Scoping and EIA to the National Department of Environmental Affairs.

The following regulations were taken into consideration during conceptual design:

- Government Notice 704. 1999. National Water Act, Act 36 of 1998
- RSA (Republic of South Africa) (2013a) National Environmental Management: Waste Act (59/2008): Waste Classification and Management Regulations. Government Gazette 36784 No. R. 634 of 23 August 2013.
- RSA (Republic of South Africa) (2013b) National Environmental Management: Waste Act (59/2008): National norms and standards for the assessment of waste for landfill disposal.

2.4 THE NATIONAL WATER ACT (NO. 36 OF 1998)

It should be noted upfront that water uses that may require licensing in terms of the National Water Act ([NWA] No 36 of 1998) are being addressed separately as part of the overall Integrated Water Use Licensing Process for the Kusile Power Station. This report has, however, included for the sake of completeness the potential water uses that may be triggered by this project.

The list of potential water uses that will require licensing is given in Table 2-4.

Table 2-4: Potential applicable Section 21 Water Use Licenses

Water Use	Section 21 Water Uses	General description
Section 21 (b)	Storing of water.	Storing of water in return water dams, pollution control dams, and or storm water control dams.
Section 21 (c)	Impeding or diverting the flow of water in a water course.	Activities within or near wetlands and watercourses.
Section 21 (g)	Disposing of waste in a manner which may impact on a water resource.	Construction of the waste disposal facility; Disposal of ash onto the ash disposal facility; and Storage of contaminated water in a pollution control dam / balancing dam / evaporation dam.
Section 21 (i)	Altering the bed, banks, course, or characteristics of a watercourse. This includes altering the course of a watercourse (previously referred to as a river diversion).	Activities within or near wetlands, or activities affecting wetlands.

2.5 ADDITIONAL ACTS AND FRAMEWORKS

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

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

The proposed construction of the waste disposal facility comprises certain activities (e.g. changing the nature of a site exceeding 5 000m^2; construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length; and the construction of a bridge or similar structure exceeding 50m in length) that require authorisation in terms of Section 38 (1) of the Act.

Section 38 (8) of the Act states that, if heritage considerations are taken into account as part of an application process undertaken in terms of the ECA or any other legislation, there is no need to undertake a separate application in terms of the National Heritage Resources Act. The requirements of the National Heritage Resources Act have thus been addressed as an element of the EIA process, specifically by the inclusion of a Heritage Impact Assessment.

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

The Department of Environmental Affairs (DEA) Information Series of 2002 and 2006 comprise 23 information documents. The documents were drafted as sources of information about concepts and approaches to Integrated Environmental Management (IEM). The IEM is a key instrument of the NEMA and provides the overarching framework for the integration of environmental assessment and management principles into environmental decision-making. The aim of the information series is to provide general guidance on techniques, tools and processes for environmental assessment and management.

3 EIA AND PPP PROCESS

3.1 SCOPING PHASE

3.1.1 Study approach

The EIA Process being followed complies with the EIA Regulations as amended and administered by the DEA and promulgated in July 2010 in terms of the Section 24 (5) of the NEMA. The technical and public participation process undertaken for this EIA is summarised below and schematically represented in Figure 3-1.

3.1.2 Pre-application consultation

On notification and receipt of the appointment letter from Eskom, a project inception meeting was held on 7 July 2011 between Eskom and the Zitholele Consulting Project Team. During this project kick-off meeting the following was discussed:

- Project Motivation, Scope and Requirements;
- Project Schedule;
- Relevant studies undertaken;
- Roles and responsibilities of Zitholele and Eskom team members
- Identification of key stakeholders and role players; and
- Analysis of the ash disposal site alternatives.

3.1.3 Submission of an application for authorisation

The DEA integrated EIA and WML application form (Appendix B) for the proposed project was submitted to the DEA on 1 September 2011. Copies of the application form and notification of this application form were forwarded to the MDEDET as a key commenting authority.

3.1.4 Site visit

A site visit was conducted on the 29 July 2011 with the objective of familiarising the project team (Eskom, Zitholele Consulting and design engineers, Jones & Wagener Engineering and Environmental Consultants) with the area, undertaking the site selection and to distribute Background Information Documents (BID)'s to landowners.

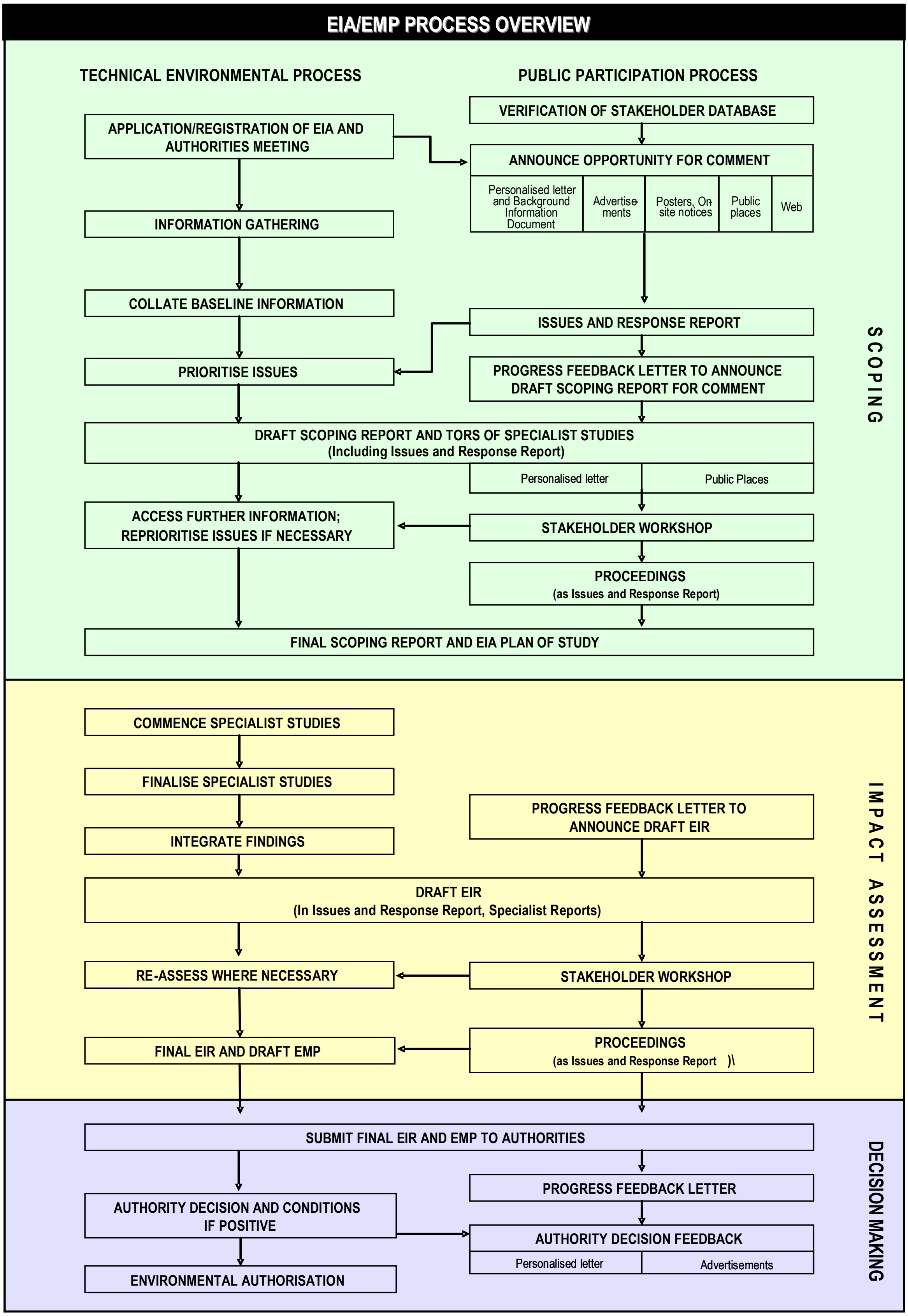

Figure 3-1: Technical and public participation process and activities for this project

3.1.5 Draft Scoping Report and Plan of Study for EIA

The Draft Scoping Report (DSR) was prepared with information and issues identified during the Scoping Phase activities. The Plan of Study (PoS) for EIA and the Terms of Reference (ToR) for the envisaged specialist studies were included in Chapter 9 of the DSR. The DSR and PoS for EIA were then updated with the comments received from key commenting authorities, public review and comments obtained from I&APs.

3.1.6 Final Scoping Report and Plan of Study for EIA

The comments from the review of the DSR and PoS for EIA were used to compile a Final Scoping Report (FSR). The FSR was submitted to the CA for consideration and approval. An acceptance letter from the CA was received and is attached in Appendix C.

3.1.7 Specialist studies

In the PoS for EIA several specialist studies were suggested and accepted by the DEA. These studies have been used to inform the compilation of this report, and include:

- Ash Classification;
- Ash Disposal Facility Concept Design / Geotechnical Investigations (Phase 1);
- Topographical Survey;
- Soils and Land Capability Assessment;
- Terrestrial Ecology (Fauna and Flora);
- Avifauna Assessment;
- Surface Water and Wetland Delineation and Assessment;
- Groundwater Assessment;
- Traffic Impact Opinion;
- Air Quality Impact Opinion;
- Noise Impact Opinion;
- Social Assessment;
- Heritage and Paleontological Assessment; and
- Visual Assessment.

During consideration of the PoS the DEA further suggested undertaking the following studies to investigate the potential impact of the Ash Disposal Facility (ADF) on these aspects:

- Bat Assessment
- Sustainability and Economic Assessment

All specialist studies are attached as Appendix F.

A detailed account of the PPP undertaken during the Scoping Phase is included in the Final Scoping Report, available on the Zitholele Website (*http://www.zitholele.co.za/kusile-ash*).

3.2 IMPACT ASSESSMENT PHASE

3.2.1 Approach to the impact assessment phase

Potential impacts were assessed throughout the impact assessment phase of the EIA process. The identified impacts were assessed using the standard impact assessment methodology. The Environmental Impact Statement and EAP's recommendation is provided in Chapters 10 and 0 in this DEIR.

3.2.2 Impact Assessment Methodology

In order to ensure uniformity, a standard impact assessment methodology has been utilised so that a wide range of impacts can be compared. Impacts are assessed separately for the construction, operational, closure, and post-closure phases of the project.

Furthermore, impacts are described according to the Status Quo, Project Impact, Cumulative Impact, Mitigation Measures and Residual Impact as follows:

- The Status Quo assesses the existing impact on the receiving environment. The existing impact may be from a similar activity, e.g. an existing ash disposal facility, or other activities e.g. mining or agriculture.
- The project impact assesses the potential impact of the proposed development on an environmental element;
- The cumulative impact on an environmental element is the description of the project impact combined with the initial status quo impacts that occur;
- Appropriate mitigation measures that could reduce the impact risk are then prescribed; and
- The residual impact describes the cumulative impact after the implementation of mitigation measures.

The impact assessment methodology makes provision for the assessment of impacts against the following criteria:

- Direction of Impact (Positive / Negative);
- Magnitude;
- Spatial scale;
- Duration / Temporal scale;
- Probability of Impact Occurring; and
- Degree of certainty.

More detailed description of each of the assessment criteria and any abbreviations used in the rating matrix is given in the following sections.

3.2.2.1 Magnitude Assessment

Magnitude rating (importance) of the associated impacts embraces the notion of extent and magnitude, but does not always clearly define these since their importance in the rating scale is very relative. For example, the magnitude (i.e. the size) of area affected by atmospheric pollution may be extremely large (1000 km^2) but the significance of this effect is dependent on the concentration or level of pollution. If the concentration is great, the significance of the impact would be HIGH or VERY HIGH, but if it is diluted it would be VERY LOW or LOW. Similarly, if 60 ha of a grassland type are destroyed the impact would be VERY HIGH if only 100 ha of that grassland type were known. The impact would be VERY LOW if the grassland type was common. A more detailed description of the impact significance rating scale is given in Table 3-1below.

Table 3-1: Description of the significance rating scale.

Rating			Description
Score	Code	Category	
7	SEV	SEVERE	Impact most substantive, no mitigation possible
6	VHIGH	VERY HIGH	Impact substantive, mitigation difficult/expensive
5	HIGH	HIGH	Impact substantive, mitigation possible and easier to implement
4	MODH	MODERATE-HIGH	Impact real, mitigation difficult/expensive
3	MODL	MODERATE-LOW	Impact real, mitigation easy, cost-effective and/or quick to implement
2	LOW	LOW	Impact negligible, with mitigation
1	VLOW	VERY LOW	Impact negligible, no mitigation required
0	NO	NO IMPACT	There is no impact at all - not even a very low impact on a party or system.

3.2.2.2 Spatial Scale

The spatial scale refers to the extent of the impact i.e. will the impact be felt at the local, regional, or global scale. The spatial assessment scale is described in more detail in Table 3-2.

Table 3-2: Description of the spatial rating scale.

Rating			Description
Score	Code	Category	
7	NAT	*National*	The maximum extent of any impact.
6	PRO	*Provincial*	The spatial scale is moderate within the bounds of impacts possible, and will be felt at a provincial scale
5	DIS	*District*	The spatial scale is moderate within the bounds of impacts possible, and will be felt at a district scale
4	LOC	*Local*	The impact will affect an area up to 5 km from the proposed route corridor.
3	ADJ	*Adjacent*	The impact will affect the development footprint and 500 m buffer around development footprint
2	DEV	*Development footprint*	Impact occurring within the development footprint
1	ISO	*Isolated Sites*	The impact will affect an area no bigger than the servitude.

3.2.2.3 Duration / Temporal Scale

In order to accurately describe the impact it is necessary to understand the duration and persistence of an impact in the environment. The temporal scale is rated according to criteria set out in Table 3-3.

Table 3-3: Description of the temporal rating scale.

Rating			Description
Score	**Code**	**Category**	
5	PERM	Permanent	The environmental impact will be permanent.
4	LONG	Long term	The environmental impact identified will operate beyond the life of operation.
3	MED	Medium term	The environmental impact identified will operate for the duration of life of the line.
2	SHORT	Short-term	The environmental impact identified will operate for the duration of the construction phase or a period of less than 5 years, whichever is the greater.
1	INCID	Incidental	The impact will be limited to isolated incidences that are expected to occur very sporadically.

3.2.2.4 Degree of Probability

The probability or likelihood of an impact occurring is described as shown in Table 3-4 below.

Table 3-4: Description of the degree of probability of an impact accruing

Score	Code	Category
5	OCCUR	*It's going to happen / has occurred*
4	VLIKE	*Very Likely*
3	LIKE	*Could happen*
2	UNLIKE	*Unlikely*
1	IMPOS	*Practically impossible*

3.2.2.5 Degree of Certainty

As with all studies dealing with long term impact, it is not possible to be 100% certain of all facts, and for this reason a standard "degree of certainty" scale is used as discussed in Table 3-5 below. The level of detail for specialist studies is determined according to the degree of certainty required for decision-making. The impacts are discussed in terms of affected parties or environmental components.

Table 3-5: Description of the degree of certainty rating scale

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

3.2.2.6 Impact Risk Calculation

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

$$Impact\ Risk = \frac{\text{Significance} + \text{Spatial} + \text{Temporal}}{2.714} \times \frac{\text{Probability}}{5}$$

An example of how this rating scale is applied is shown below in Table 3-6:

Table 3-6: Example of rating scale

Impact	Magnitude	Spatial scale	Temporal scale	Probability	Rating
Greenhouse gas emissions	2	*3*	3	3	1.8
	LOW	*Local*	Medium Term	*Could Happen*	**LOW**

***Note:** The significance, spatial and temporal scales are added to give a total of 8, that is divided by 2.714 to give a criteria rating of 2,95. The probability (3) is divided by 5 to give a probability rating of 0,6. The criteria rating of 2,95 is then multiplied by the probability rating (0,6) to give the final rating of 1,8, which is rounded to the first decimal.*

The impact risk is classified according to 5 classes as described in Table 3-7 below.

Table 3-7: Impact Risk Classes

Rating	Impact class	Description
6.1 - 7.0	**7**	**SEVERE**
5.1 - 6.0	**6**	**VERY HIGH**
4.1 - 5.0	**5**	**HIGH**
3.1 - 4.0	**4**	**MODERATE-HIGH**
2.1 - 3.0	**3**	**MODERATE-LOW**
1.1 - 2.0	**2**	**LOW**
0.1 - 1.0	**1**	**VERY LOW**

Therefore with reference to the example used for greenhouse gas emissions above, an impact rating of 1.8 will fall in the Impact Class 2, which will be considered to be a Low impact.

3.2.3 Mitigation and management measures

Mitigation and management measures have been identified throughout the course of the EIA process, from the assessment of the first alternative to the selection of the preferred design. Best practice standards were considered when identifying mitigation and management measures for the potential impacts.

3.2.4 Draft Environmental Impact Report

Upon completion of the specialist studies and impact assessments the results of the studies were documented in the DEIR and made available for stakeholder review prior to finalisation and submission to authorities, in the FEIR (this Report). The contents of the EIR are determined by the NEMA EIA Regulations and at a minimum include the following:

- Introduction (details of the EAP who prepared the report and his/her expertise);
- Motivation for the proposed project based on economic and environmental considerations;
- A detailed description of the proposed development;
- A detailed description of the proposed development site;
- A description of the environment that may be affected by the activity and the manner in which physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed development;
- A description of the need and desirability of the proposed development and the identified potential alternatives to the proposed activity;
- A summary of the methodology used in determining the significance of potential impacts;
- A description and comparative assessment of all alternatives identified during the environmental impact assessment process;
- A summary of the findings of the specialist studies;
- A detailed assessment of all identified potential impacts;
- A list of the assumptions, uncertainties and gaps in knowledge;
- An opinion by the EAP as to whether the development is suitable for approval within the proposed site;
- An environmental management plan that complies with Regulation 34 of Act 107 of 1998;
- Copies of all specialist reports appended to the EIA report;
- An environmental awareness plan; and
- Any further information that will assist in decision making by the authorities.

In addition, as required by the EIA Regulations, the PPP report was attached to the DEIR as an appendix and included:

- Details of the public participation process conducted, inter alia –
  - A list of all the potential interested and affected parties that were notified;
  - The steps that were taken to notify potentially interested and affected parties;

- Proof that notice boards, advertisements and notices notifying potentially interested and affected parties, and (if applicable) the owner or person in control of the land, of the application have been displayed, placed or given;
- A list of all persons, organisations and organs of state that were registered as interested and affected parties in relation to the application;
- Comments and Response Reports containing summaries of the issues raised by interested and affected parties, the date of receipt of and the response of the EAP to those issues (or the reason for not addressing an issue); and
- Copies of all the comments received from interested and affected parties.

3.2.5 Environmental Management Programme (EMPr)

An EMPr, in the context of the EIA Regulations, is a tool that takes a project from a high level consideration of issues, down to detailed workable mitigation measures that can be implemented in a cohesive and controlled manner.

The objectives of an EMPr are to minimise disturbance to the environment, present mitigation measures for identified impacts, maximise potential environmental benefits, assign responsibility for actions to ensure that the pre-determined aims are met, and to act as a “cradle to grave” document.

3.2.6 FEIR and EMPr compilation

The DEIR and EMPr ~~(this report) will be~~ were made available for review by stakeholders. The comments received from the review phase ~~will be~~ were used to finalise the report~~, i.e.~~ into the FEIR.

3.2.7 Submission and decision-making

Upon finalisation, the EIR and EMPr ~~will be~~ were submitted to the CA for decision-making and approval.

3.2.8 Public Participation Process (PPP)

Zitholele Consulting, on behalf of Eskom, would like to thank all Interested and/or Affected Parties (IA&Ps) for their valued contributions during the scoping phase of the EIA. The comments, concerns / issues / questions and recommendations that were raised have ensured that the environmental team could proceed with a clear understanding and approach for the impact phase.

Public participation is the cornerstone of any EIA process and is also an essential and legislative requirement for environmental authorisation. The principles that demand communication with society at large are best embodied in the principles of the NEMA. In addition, Section 24 (5), Regulation 54-57 of Government Notice Regulation (GNR) 543 under the NEMA, guides the public participation process that is required for an Environmental Impact Assessment (EIA) process. The public participation team also followed Guideline Series 7, dated 10 October 2012 and adhered to the IAP2 Code of Conduct.

The public participation process for the proposed Kusile ADF has been designed to satisfy the requirements laid down in the above legislation and guidelines. Figure 3-1 provides an overview of the EIA technical and public participation processes undertaken in the impact phase, and shows how issues and concerns raised by the public are used to inform the technical investigations of the EIA at various milestones during the process.

3.3 PPP PROCESS FOLLOWED (SCOPING AND IMPACT PHASES)

3.3.1 Objectives of public participation in an EIA

The objectives of public participation in an EIA are to provide I&APs' access to sufficient information in an objective manner so as to:

- During Scoping:
    - Assist I&APs to identify issues of concern, and providing suggestions for enhanced benefits and alternatives;
    - Contribute their local knowledge and experience; and
    - Verify that their issues have been considered and to help define the scope of the technical studies to be undertaken during the Impact Assessment.
- During Impact Assessment:
    - Verify that their issues have been considered either by the EAP and EIA Specialist Studies; and
    - Comment on the findings of the EIA, including the measures that have been proposed to enhance positive impacts and reduce or avoid negative ones.

The key objective of public participation is to ensure transparency throughout the process and to promote informed decision making.

3.3.2 Identification of Interested and Affected Parties (I&APs)

The identification of key stakeholders was done in collaboration with Eskom, the local municipalities and other organisations in the study area. Having undertaken work previously in the area, Zitholele already had a stakeholder database that could be used as a departure point for this project. The identification of stakeholders took place throughout the EIA process.

The stakeholders' details were captured in an electronic database management software programme (Maximizer) that automatically categorises every mailing to stakeholders, thus providing an on-going record of communications - an important requirement by the authorities for public participation. In addition, comments and contributions received from stakeholders were recorded, linking each comment to the name of the person who made it.

According to the NEMA EIA Regulations, a register of I&APs (Regulation 55 of GNR 543) must be kept by the public participation practitioner. Such a register was compiled and updated with the details of involved I&APs throughout the EIA process (Appendix C).

3.3.3 Announcement of opportunity to become involved

The opportunity to participate in the EIA was announced between 29 September and 7 October 2011 as follows:

- Registered mail and emails were sent to all potentially affected stakeholders – the landowners of the alternative sites and some of the potentially affected landowners where linear infrastructure could be developed. The mail consisted of a notification letter, a map of the study area, a list with a description of the proposed alternatives sites, a list of farms which were included as potential alternative sites, a list of the landowners and a comment sheet. Proof of the process of notification was submitted to the DEA with the application forms (see Appendix C for proof of notification).
- A Background Information Document (BID) containing details of the proposed project, a map of the project area, a registration / comment sheet and a letter of invitation to stakeholders to become involved was distributed via mail and email to all interested and potentially affected stakeholders (Appendix C). Stakeholders were also invited to visit the Zitholele/Eskom websites where all documents for public review were made available: http://www.zitholele.co.za/kusile-ash and http://www.eskom.co.za/ c/44/environmental-impact-assessments/[i].
- Advertisements were placed in the following newspapers as seen in Table 3-8 (Appendix C).

Table 3-8 : Advertisements placed during the announcement phase

NEWSPAPER	DATE
Streeknuus	12 October 2011
Corridor Gazette	13 October 2011
Ekasi News	14 October 2011
Witbank News	13 October 2011
Mpumalanga News	13 October 2011
Middelburg Herald	14 October 2011
Middelburg Observer	14 October 2011
Ridge Times	12 October 2011
The Echo	13 October 2011
Springs Advertiser	12 October 2011
Citizen	11 October 2011
Beeld	12 October 2011

- Site notice boards were positioned at prominent, public locations on 7 October 2011, and on all roads leading to the study area. See Appendix C which provides a detailed register of where the site notices were placed and a map indicating the placement of the notices in the study area.

3.3.4 Comments and Response Report

The issues raised in the announcement phase of the project were captured in a Comments and Responses Report (CRR) Version 1 and appended to the DSR. The report was updated to include additional I&AP contributions received throughout the Scoping Phase. The issues and comments raised during the public review period of the DSR were added to the FSR as Version 2 of the CRR. Version 3 of the CRR is attached to ~~this~~ the DEIR and Version 4 ~~will be~~ is attached to the FEIR.

3.3.5 Obtaining Comment and Contributions

The DSR was made available for public review from 18 January to 27 February 2012. The availability of the DSR for public review was announced as follows:

- Letters were sent to all stakeholders on the database announcing the availability of the DSR for public review and included the date for a public meeting and the public locations where the documents could be viewed; and
- Advertisements to announce the public review of the DSR as well as the public meetings were placed between 18 and 20 January 2012 in the same newspapers used for the project announcement.

The DSR's availability and public meeting date was advertised in ~~the following~~ a number of newspapers, which are listed in Table 3-9.

Table 3-9 : Advertisements announcing the availability of the DAR and invitation to attend the public meeting

NEWSPAPER	DATE
Streeknuus	20 January 2012
Corridor Gazette	19 January 2012
Ekasi News	20 January 2012
Witbank News	20 January 2012
Mpumalanga News	19 January 2012
Middelburg Herald	27 January 2012
Middelburg Observer	20 January 2012
Ridge Times	20 January 2012
The Echo News	20 January 2012
Springs Advertiser	18 January 2012
Citizen	18 January 2012
Beeld	19 January 2012

The following opportunities to comment were available to I&APs during the Scoping Phase:

- Completing and returning the registration / comment sheets on which space was provided for comment;
- Providing comments telephonically or by email to the public participation office; and
- Attending the public meeting that was advertised widely.

Issues relevant to the project were considered and where necessary were carried forward into the Impact Assessment phase. The minutes of the public meeting were attached to the FSR in the form of a Comments and Responses Report (Version 2). The DSR was updated based on comments received from all stakeholders (i.e. authorities, land owners, community organisations, and I&APs.

The DSR, including CRR Version 1, was further distributed for comment as follows:

- Left in public venues within the vicinity of the project area;
- Published on the Eskom and Zitholele websites;
- Mailed to I&APs who requested a copy of the report; and
- Electronic copies were made available at the stakeholder meeting.

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

The public meeting, to present the environmental studies and their preliminary findings and providing I&APs another opportunity to raise comments / concerns / recommendations, was held at the El Toro Conference facility, Kendal, on Wednesday 15 February 2012.

Issues / comments / concerns raised at these meetings were captured in the CRR (Version 1) and included as Appendix E.

Focus group meetings were also held on 20 July 2012, 26 July 2012 and 3 August 2012 in the Eskom conference room at Wilge Village to present information regarding the proposed site alternatives and EIA process.

3.3.6 Final Scoping Report

The FSR was updated with additional issues raised by I&APs. The FSR was submitted to the Competent Authority (CA) DEA in August 2012 and to those I&APs who specifically requested a copy.

3.3.7 Public participation during the impact assessment

The purpose of the public participation process during the Impact Assessment Phase is to ensure that the DEIR and Draft Environmental Management Programme (DEMPr) are made available to the public for review and comments. I&APs ~~will be~~ were requested to comment on the findings of the EIA, including the measures that have been proposed to enhance positive impacts and reduce or avoid negative ones.

The DEIR ~~(this report)~~ includes the CRR (Version 3), which lists every issue raised with an indication of where the issue is dealt with in the technical evaluations, and the relevant findings. Stakeholders ~~will be~~ were notified of the availability of the DEIR and DEMPr for review and comments and afforded an opportunity to engage with the project team at the public meetings ~~to be~~ held during the review period of the DEIR.

3.3.7.1 EIA Newsletter

An EIA Newsletter was distributed to I&APs registered on the proposed project's database during December 2013. The purpose of this newsletter was to provide I&APs with an update regarding the EIA process, including environmental and engineering tasks and public consultation still to be undertaken. It also provided a brief overview of the background to the project, project description and way forward.

A comment sheet was included with the distribution of the EIA Newsletter, providing I&APs an opportunity to comment on the content of the EIA Newsletter and to submit comments / queries / concerns as at that stage.

Subsequently, a follow-up email, dated 23 May 2014, was circulated to all registered I&APs to keep them informed of the EIA progress and possible timeframes for release of the DEIR for public and authority review.

3.3.7.2 Mining Right Information Process

The public participation team undertook an extensive investigation into Mining & Prospecting Right Application process to determine which properties located within the various site alternatives under environmental investigation has any Mining and/or Prospecting Rights registered against their property. It is important to note that the DMR has also been approached for this information, however, the project team wanted to cross reference information. The investigation process included the following:

- An e-mail was sent to all identified landowners within the study area informing them of the reason for the request;
- Attached to the e-mail was a data form which the landowners were requested to complete e.g. property name, portion number and whether such rights is registered against the property;
- A map indicating the various site alternatives under investigation; and
- A list of properties within the various site alternatives.

All data forms submitted were acknowledged.

A follow-up e-mail was sent to landowners thanking those again for responding and urging those who had not yet submitted their forms to please do so. In some instances where landowners did not have e-mail addresses, faxes were sent and if no fax number was available, SMSes were sent, trying to obtain as much information as possible regarding this matter. The results from this enquiry are presented in Appendix C.

3.3.7.3 Availability of the DEIR and DEMPr

All I&APs registered on the proposed project's database were notified of the availability of the DEIR and DEMPr and the DEIR and DEMPr was made available at the following public places and ~~is~~ was also freely available in electronic format, including Zitholele's website.

Table 3-10 : Advertisements placed during the announcement phase

Location	Address	Contact
Printed Copies		
Phola Public Library	Qwabe Street, Phola Location	Agnes Mabena; Tel: 013 645 0094
Ogies Public Library,	61 Main Street, Ogies	Ntombi Jela Tel: 013 643 1150 or 643 1027
Delmas Public Library	C/o Sarell Cilliers Street & Van Riebeeck Avenue, Delmas	Lydia Mehlape; Tel: 013 932 6305
Kusile Project Office	Kusile Power Station Office, Wilge Village	Hardus Kotze / Leon Stapelberg Tel.: 013 639 4836
Electronic Copies		
http://www.zitholele.co.za/kusile-ash		
Available on CD on request via email from Zitholele Consulting.		Nicolene Venter or Patiswa Mnqokoyi Phone 011 207 2060 E-mail: publicprocess@zitholele.co.za

3.3.7.4 Invitation to Meetings

3.3.7.4.1 Focus Group Meeting

During the DEIR and DEMPr review period a Focus Group Meeting (FGM) ~~will be~~ was held with possibly affected landowners on the proposed site alternatives and those adjacent to the proposed site alternatives to obtain comments on the environmental findings as per the DEIR and the recommended mitigation measures. It ~~will~~ also provided them a further opportunity to raise comments / concerns not yet raised to date. The purpose of a FGM is to hold a smaller meeting with a specific group or organisation who have similar interest in or concerns about the proposed project. ~~It is envisaged that~~ The FGM mentioned above ~~will be~~ was held as ~~follows~~ as presented in Table 3-11.

Table 3-11 : Focus Group Meeting with possibly directly affected and adjacent landowners

Date & Time of Meeting	Venue
Date: Wednesday 20 August 2014 Time: 10h00 – 12h00	Kopanong Hall, Kendal Power Station

3.3.7.4.2 Key Stakeholder Workshop

During the DEIR and DEMPr review period a Key Stakeholder Workshop (KSW) ~~will be~~ was held with stakeholders representatives such as the Provincial, District and Local Authorities, chairpersons of Organisations, etc. A KSW is valuable to a proposed project as it allows stakeholders the opportunity to hear each other's views and issues in context to their own, thus allowing for a more integrated EIA approach. ~~It is envisaged that t~~ The KSW mentioned above ~~will be~~ was held as ~~follows~~ presented in Table 3-12 below.

Table 3-12 : Key Stakeholder Workshop

Date & Time of Meeting	Venue
Date: Wednesday 20 August 2014 Time: 14h00 to 16h00	Kopanong Hall, Kendal Power Station

3.3.7.4.3 Public Meeting

During the DEIR and DEMPr review period a Public Meeting (PM) ~~will be~~ was held with the broader public and community members interested in the proposed project. The PM will allow I&APs the opportunity to be informed of the environmental findings as per the DEIR, the mitigation measures proposed and allowing them the opportunity to raise any issues / concern not yet raised to date. ~~It is envisaged that t~~ The PM mentioned above ~~will be~~ was held as ~~follows~~ presented in Table 3-13 below.

Table 3-13 : Public Meeting

Date & Time of Meeting	Venue
Date: Wednesday 20 August 2014 Time: 18h00 to 20h00	El Toro Conference Venue

3.3.8 Notification to I&APs of the submission of the FEIR

Once the FEIR and EMPr reports are submitted to the CA, a letter will be sent to I&APs registered on the proposed project's database indicating that the reports have been submitted and are available for review and should they want to receive an electronic copy, they can submit their request in writing to the Public Participation Office (for attention: Nicolene Venter, 011 207 2060, publicprocess@zitholele.co.za). The letter will also outline the next steps in the EIA process. Comments on the FEIR can be submitted directly to the DEA Case Officer (Ms Masina Litsoane, 012 395 1778, mlitsoane@environment.gov.za), with a copy of the correspondence sent to the EAP.

3.3.9 Announcement of Authority Decision

Once the DEA issues a decision, Eskom must, in writing and within 12 days of the date of the decision (i.e. within 12 days after the date that the decision was made by the DEA and not within 12 days of having been notified of the decision), or as the Environmental Authorisation will instruct notification of the registered I&APs of the decision. The DEA's reasoning, as contained in the copies of the DEA's decision, will be attached to the notice.

In addition to the notification to the registered I&APs, Eskom may also within 12 days of the date of the decision, be instructed to place a notice in the same newspaper(s) used in the PP Process. The notices should inform I&APs of the DEA's decision and describe where copies of the DEA's decision can be accessed. It must be made public knowledge that appeals may be lodged against the DEA's decision, and the process to do so should be explained.

4 NEED AND DESIRABILITY OF THE PROJECT

In accordance with the Regulation 31(2)(f) of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended, Environmental Impact Assessment Regulations published in Government Notice No. R.543, this part of the Environmental Impact Report provides a detailed account of the Need and Desirability of the proposed Kusile 60 Year Ash Disposal Facility project. In considering the need and desirability of the proposed project the strategic concept of the project along with the broader societal needs and public interest has been taken into account. In the Guideline on Need and Desirability (DEA[1], 2010) a number of questions formulated to guide the identification of the Need and Desirability of a proposed development is provided. The information provided in Table 4-1 and Table 4-2 provides answers specific to the project at hand for each of the guiding questions contained in Section 5 of the Guideline on Need and Desirability (DEA, 2010).

The completion and full commissioning of the Kusile Power Station and associated infrastructure is essential to contribute to the electricity supply to the country and therefore also the affected municipal areas. The employment opportunities associated with the proposed project will in turn also contribute to reducing the high unemployment rate of the surrounding communities. As such the timing of the proposed development is aligned with the immediate needs of the receiving social environment and national priority infrastructure developments.

Due to nature of the proposed project it anticipated that a number of environmental impacts on the receiving environment will transpire throughout the project life-cycle. Furthermore a number of the anticipated impacts will / may transpire regardless of the location of the proposed project. The placing / selecting of the development area have been guided by numerous factors such as the input provided by specialists and comparative analysis which have been carried out. The preferred location of the proposed Kusile 60 Year Ash Disposal Facility confines the footprint of Eskom's Power Stations and associated infrastructure to one District Municipality within the Mpumalanga Province. The distance of the proposed ash disposal facility to residential areas also places sensitive receptors further away from the ash disposal facility. The consideration of additional documents such as municipal Integrated Development Plans and Spatial Development Framework served to also further confirm the benefits which the proposed development holds for the surrounding communities.

Based on the answers that have been provided in Table 4-1 and Table 4-2 it is evident that ample consideration has been given to the need and desirability of the proposed project. The determination of the need and desirability project also served as further confirmation that all reasonable measures have been taken to determine the best practicable environmental option.

[1] Department of Environmental Affairs (2010), Companion to the EIA Regulations 2010, Integrated Environmental Management Guideline Series 9, Department of Environmental Affairs, Pretoria

Table 4-1: Assessment of the Need of the proposed Kusile 60 Year Ash Disposal Facility Project

No.	Question	Description	Answer
1.	Is the land use (associated with the activity being applied for) considered within the timeframe intended by the existing approved Spatial Development Framework (SDF) agreed to by the relevant authority?	The greater study area of the proposed Kusile 60 Year Ash Disposal Facility project falls within both Gauteng Province[2] as well as the Mpumalanga Province. As such the SDF and Integrated Development Plans (IDP) for both the municipalities associated with the development area were consulted to determine whether the proposed land use is aligned with the planned developments in the municipal area. The proposed Kusile 60 Year Ash Disposal Facility forms part of the infrastructure associated with the Kusile Power Station. A number of key Local Economic Development (LED) anchor projects have been identified in the Nkangala District Municipality Integrated Spatial Development Plan. The Kusile Power Station is one of the identified key LED anchor projects and is linked to the economic pillars of the Nkangala District Municipality. As shown in the SDF of the Nkangala District Municipality the footprint of the Kusile Power Station is located within an area that has been allocated to mining and agricultural activities. The location of the Power Station is however to a certain degree determined by the location of the surrounding coal mines as a constant coal supply is required. Based on the aforesaid the proposed Ash Disposal Facility forming part of the Kusile Power Station infrastructure is therefore aligned with the planned land use for the area and the timeframes associated with these land uses.	Yes
2.	Should the development, or if applicable, expansion of the town / area concerned in terms of this land use (associated with the activity being applied for) occur here at this point in time.	With the planned commissioning of the last unit of the Kusile Power station in 2017, it is anticipated that the Power Station and associated infrastructure will be fully operational by 2018[3]. As the operation of all units of the Kusile Power Station will generate substantial volumes of ash, it is crucial to ensure that adequate ash disposal facilitates are in place for the disposal thereof as will be required.	Yes
3.	Does the community / area need the activity and the associated land use concerned (is it a societal priority)?	The proposed Kusile Power Station and associated operations is expected to generate an estimated 8000 jobs for the surrounding local communities during construction. The proposed project will also provide the opportunity for skills development. The number of employment opportunities that will however be created by only the operation of the proposed Kusile 60 year Ash Disposal Facility is still unknown at this stage. Twelve outcomes specific to achieving the optimisation of the implementation of public-service delivery priorities have been set by the Cabinet. These outcomes have since	Yes

[2] No IDP or Spatial Development Framework for the Metsweding District Municipality (Gauteng Province) could be found. However during engagement with the Commenting Authorities during the EIA Phase the location of the proposed development in relation to the planned land use for the area will be discussed.
[3] Information taken from the Eskom COP17 Fact Sheet Kusile and Medupi

No.	Question	Description	Answer
		been translated into action items which have been assigned across all spheres of government. As indicated in the Nkangala District Municipality IDP (2013:14) all municipalities are expected to consider the twelve outcomes when reviewing their IDPs. One of these defined outcomes includes the provision of decent employment through inclusive economic growth. The role of local government (i.e. Nkangala District Municipality) includes ensuring the proper implementation of the EPWP[4] at municipal level. The provision of and ensuring the supply of electricity can be regarded as of national importance. Within the context of the Nkangala District Municipality the supply of electricity to households within the various local municipalities forming part of the District Municipality still remains a challenge. An overview of the status of electricity supply provided in the Victor Khanye Local Municipality IDP indicates that an estimated 35% of households in the local municipal areas still remain without electricity. Furthermore proposed industrial developments (e.g. Sephaku Cement Factory) in the local municipal areas will add further pressure on the Local Municipality to ensure the supply of electricity. As a result of the construction activities associated with the Kusile Power Station infrastructure the Gross Domestic Product of the Nkangala District Municipality is expected to increase by approximately 25% annually. Based on the above it can be said that the proposed Kusile Power Station is fundamental for ensuring adequate electricity supply to South Africa's growing economy. The employment opportunities that will be created by the operation of the power station and associated infrastructure will contribute to the development of skills on a local level. The provision of basic services such as electricity and facilitating employment opportunities remains priority areas for the Nkangala District Municipality as well as for the Victor Khanye Local Municipality.	
4.	Are the necessary services with adequate capacity currently available or must additional capacity be created to cater for the development?	The proposed Ash Disposal Facility will require an area of approximately 1500 hectares. The infrastructure required for the proposed Ash Disposal Facility will be constructed by the proponent. Although the Kusile Power Station is located within the Olifants Catchment, the water that will be required for the operation of the Power Station and therefore also by the extension of the ash disposal facility will be taken from the Vaal River System. In addition the dry-ashing method as well as the dry-cooling process that will be employed for the operation of the power station and associated infrastructure will require less water as opposed to the wet-ashing method and wet-cooling process.	The necessary services with adequate capacity are currently available for the proposed development.

[4] EPWP: Expanded Public Works Programme

No.	Question	Description	Answer
		According the DWS (2011:24) the water requirements of the six operational power stations located within the Olifants River catchment will increase until approximately 2016 but all of this water will be sourced from outside the Olifants Catchment. In order the meet the water demands of the power stations which are located within the Olifants River Catchment and to ensure that the water balance of the catchment is not affected, water transfers from the Upper Komati and Vaal Systems will be increased. Based on the aforementioned, the necessary services required for the construction and operation of the Kusile Power Station and associated infrastructure can be accommodated for.	
5.	Is this development provided for in the infrastructure planning of the municipality, and if not what will the implication be on the infrastructure planning of the municipality (priority and placement of services and opportunity costs)?	The Kusile Power Station (and therefore also the required infrastructure for the operation thereof) is identified as a key LED anchor project within the Nkangala District Municipality Integrated SDP. Therefore the proposed project has been taken into account for the infrastructure planning and developments within the boundaries of the Nkangala District Municipality.	Yes
6.	Is this project part of a national programme to address an issue of national concern of importance?	As maintained in the Electricity Regulations on the Integrated Resource Plan 2010 – 2030 the South African electricity supply / demand balance will remain under pressure until such time as both the Medupi and Kusile Power Stations become fully operational. Any delays in bringing the Medupi or Kusile generating units into operation will prolong and further worsen the shortfall in supply over the required economic demand. Therefore the construction of the proposed Ash Disposal Facility Project as an infrastructure component of the Kusile Power Station is of national importance to ensure that Eskom maintains the Energy Availability Factor.	Yes

Table 4-2: Assessment of the Desirability of the proposed Kusile 60 Year Ash Disposal Facility Project

No.	Question	Answer	
1.	Is this development the best practicable environmental option for this land / site?	Various alternatives were considered for the location of the Kusile 60 year Ash Disposal Facility and the associated infrastructure (e.g. conveyor belt system). Based on various determining factors including the distance of the facility to sensitive environmental features, social factors as well as engineering considerations a number of potential site alternatives were identified and assessed. Based on these consideration Site A was identified as the preferred alternative. The construction of the proposed ash disposal facility and associated infrastructure at Site A would result in the least adverse impacts on the receiving environment as opposed to impacts associated with the alternative locations.	Yes
2.	Would the approval of this application compromise the integrity of this existing approved and credible municipal IDP and SDF as agreed by the relevant authorities?	As was explained in Table 4-1 (Question 1) the proposed 60 Year Ash Disposal Facility forming part of the Kusile Power Station infrastructure is aligned with the planned land use for the area shown in the Nkangala District Municipal SDF and the timeframes associated with these land uses.	No
3.	Would the approval of this application compromise the integrity of the existing environmental management priorities for the area (e.g. as defined in EMFs), and if so, can it be justified in terms of sustainability considerations?	The Nkangala District Municipality IDP (2013) places significant emphasis on Air Quality Management Issues as well the implementation of the Atmospheric Emission Licensing Function Project. This is indicative of the high priority which is placed on Air Quality Management. The proposed ash disposal facility, although it may contribute to deterioration of the ambient air quality it is not foreseen that the proposed development will compromise the District Municipality's efforts towards the management of air quality issues. Additional Environmental Management Initiatives included in the Nkangala District Municipality IDP (2013) include improving the monitoring of environmental compliance as well as actively participating in EIA Processes that are carried out within the District Municipality through providing comments on the proposed development. The proposed Ash Disposal Facility is subjected to an S&EIR Process as well as a Public Participation Process which is currently underway. As such Commenting Authorities will be provided the opportunity to provide comments on the proposed project. Therefore the S&EIR Process is aligned with the Nkangala District Municipality's efforts towards monitoring and ensuring compliance with all applicable Environmental Management Legislation.	Yes
4.	Do location factors favour the land use associated with the activity applied for at this place?	Various alternatives were considered for the location of the Kusile 60 Year Ash Disposal Facility and the associated infrastructure (e.g. conveyor belt system). Based on various determining factors including the distance of the facility to sensitive environmental features, social factors as well as engineering considerations a number of potential site alternatives were identified and assessed. Based on these consideration Site A was	Yes

No.	Question	Answer	
		identified as the preferred alternative. The construction of the proposed ash disposal facility and associated infrastructure at Site A would result in the least adverse impacts on the receiving environment as opposed to impacts associated with the alternative locations. Site A is also the closest alternative to the Kusile Power Station (KPS) which means that the impacts are confined to a sub-catchment that is already impacted by the KPS and New Largo mine, thus they would be easier to manage than if they were spread in various catchments.	
5.	How will the activity, and associated activities, applied for impact on sensitive natural or cultural areas (built and rural / natural environment)?	It is anticipated that the proposed ADF may impact on the riparian area associated with the development footprint. These impacts may include the loss of wetland habitat, alteration of stream flow and increased sediment transport into the wetlands. Most of these impacts can be successfully mitigated. A detailed account of the impact assessment including the methodology as well as the significance assigned to each of the assessed impacts is provided in Chapter 10 of this Environmental Impact Report. As seen in Chapter 10 the significance for most of the assessed impacts is reduced by the implementation of mitigation measures.	Refer to Chapter 10 of this Environmental Impact Report.
6.	How will the development impact on people's health and wellbeing?	A number of sensitive receptors in terms of the air quality impacts associated with the proposed development were identified. The identified sensitive receptor includes schools and residential areas which are located in close proximity to proposed ash disposal facility alternative sites. According to the World Health Organisation (cited by Airshed Planning Professionals (Pty) Ltd, 2013), the evidence on airborne particulates and public health consistently shows adverse health effects at exposures experienced by urban populations throughout the world. The range of effects is broad, affecting the respiratory and cardiovascular systems and extending from children to adults including a number of large, susceptible groups within the general population. Although sensitive receptors have been identified for the proposed ADF, fugitive dust and particulate emission will be managed through the implementation of mitigation measures. Furthermore regardless of the location of the ash disposal facility the mitigation of dust emissions is critical to maintain Particulate Matter concentrations within the South African National Ambient Air Quality Standards.	Refer to Chapter 10 of this Environmental Impact Report for a detailed account of the impact assessment including the methodology as well as the significance assigned to each of the assessed impacts. Also refer to the Air Quality Study included in Appendix F of this report.
7.	Will the proposed activity or the land use associated with the activity applied for, result in unacceptable opportunity costs?	Opportunity costs can be defined as the net benefit that would have been yielded by the next best alternative (for example, if farming is the next best alternative for a piece of land, then the foregone benefit of losing the farming option will be the opportunity cost of any other land use, or if not proceeding with the activity, then the foregone benefits of	No

No.	Question	Answer	
		the proposed activity is the opportunity cost of not proceeding). Opportunity costs also relate to the use of limited resources, for example water. If a limited volume of water is available in an area the most desirable use of the water considering the needs in the area must be determined in order to consider the opportunity costs associated with the different uses of the water. The concept of opportunity costs is applicable to project alternatives as well as policy selection. A key part of considering opportunity costs is commonly to comparatively consider and assess the different alternatives in terms of the benefits and/or disadvantages associated with each alternative. A comparative analysis of all identified site alternatives as well as the technology to be used is provided in Chapter 7 of this report. The option of not implementing the project activities (i.e. no-go option) has also been included in the comparative analysis. The comparative analysis provides an indication of the risks, disadvantages, advantages and opportunities that are associated with each of the alternatives.	
8.	Will the proposed land use result in unacceptable cumulative impacts?	A cumulative impact is defined in the National Environmental Management Act, 1998 (Act No. 107 of 1998) Environmental Impact Assessment Regulations (2010) published in Government Notice No. R 543 as meaning “the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area”. It is anticipated that the most significant Cumulative Impact associated with the proposed ADF will include its contribution to the current poor air quality of the region. The poor regional air quality can be attributed to the particulate emissions emanating from the surrounding mining activities, agricultural activities and power stations. Furthermore the footprint of the Kusile Power Station and associated infrastructure falls within the Highveld Priority Area which is associated with poor air quality, and elevated concentrations of criteria pollutants occur due to the concentration of industrial and non-industrial sources. The implementation of adequate mitigation measures aimed at managing the release of particulate emission will reduce the significance of the anticipated air quality impacts thereby reducing the impact of the ADF on the surrounding ambient air quality. It is therefore the opinion of the EAP that the proposed ADF will not result in unacceptable cumulative impacts	No

5 ALTERNATIVES IDENTIFIED

A process to determine the most feasible alternatives was undertaken during the scoping phase and was documented in a site selection report, which has been included in Appendix D for perusal of the detailed information. This Chapter only presents a summary of the methodology, key findings and recommendations provided by the report.

Alternatives considered for the proposed Kusile Ash Disposal Facility project can be divided into the following categories:

- Waste disposal alternatives;
- Site alternatives;
- Design alternatives; and
- The No-Go (no development) alternative.

These are discussed in the sections below.

5.1 WASTE DISPOSAL ALTERNATIVES

The optimal goal in building an ash disposal facility and associated infrastructure (such as conveyors, canals, pipelines and return water dams) is to effectively minimise the negative environmental and social impacts whilst ensuring safety, reliability, and cost savings for the utility.

To ensure that defensible alternatives are identified and considered, a structured approach is utilised. Initially, the project team determined the need and motivation for the proposed project (NEMA, 1998). The discussion then identified all the potential solutions that can result in the need being met; at this point no alternatives had been excluded. When dealing with waste related projects, this discussion typically is structured around the waste hierarchy (National Management Waste Strategy (NMWS), 2010) as illustrated in Figure 5-1 below.

The essence of the approach is to group waste management measures in a series of steps, which are applied in descending order of priority. The foundation of the hierarchy, and the first choice of measures in the management of waste, is waste avoidance and reduction. Where waste cannot be avoided, it should be recovered, reused, recycled and treated (NMWS, 2010). Waste should only be disposed of as a last resort.

In working through these systematic hierarchical steps alternative solutions are generated. Waste management could be a single solution best suited to the type of waste, or a combination of several solutions. In each of these steps alternatives can be evaluated and excluded as being not feasible. Technical scientific information is utilised to exclude alternatives in each of these steps. Once feasible alternative solutions are identified a process of evaluation can commence to evaluate the environmental, social, and technical acceptability of these solutions, within each solution alternatives may be considered to improve the positive aspects or reduce the negative aspects of each solution.

Figure 5-1: Waste Management Hierarchy

5.2 IDENTIFICATION OF WASTE MANAGEMENT SOLUTIONS

5.2.1 Waste avoidance and minimisation:

Ash avoidance could only be achieved through changing the power generating technology (i.e. to wind or solar). This is unfeasible as it would result in a loss of invested project capital to date, in addition, alternative energy generating technology costs are high in South Africa and in some instances would be impractical with regards to the project area.

An option for waste minimisation by using a coal source containing low ash content was proposed. This was considered unfeasible as it would result in exponentially higher project costs and the spoiling or loss of the currently identified coal source.

5.2.2 Recovery, re-use and recycle:

Eskom is currently sourcing contractors who could re-use the ash, for example in construction materials such as in bricks and cement, for soil amendment and stabilisation and/or other applications such as cosmetics, floor tiles etc. Demand for the ash is however marginal by comparison to the volume of waste produced. More than 95 % of the waste stream would remain and require disposal.

Another option would be to use the ash for backfilling mining operations at the New Largo Colliery. However, the mining operation has not yet been approved and so this option is currently not available. In addition, there is not enough information available to determine the extent and risks of environmental impacts that may occur as a result of such a use. This option is therefore considered unfeasible at this stage.

5.2.3 Treatment:

Coal ash is typically not treated although it can be done using ion exchange or reverse osmosis. The process is very costly and would still require a disposal facility for the remaining, more concentrated waste residue.

5.2.4 Disposal:

Based on the above, it is evident that two disposal alternatives exist, these being in-pit ash disposal or a separate waste disposal facility. However, using a pit at the New Largo Mine to dispose of the ash presents the following issues:

- The mine has not been approved yet;
- The mine plan has not been finalised; and
- Currently, there is insufficient information to enable the identification of potential environmental impacts resulting from the in-pit ash facility.
- Recent changes in the National Environmental Management: Waste Act would require the in-pit facility to be lined with an appropriate liner system as per the promulgated National Norms and Standards for disposal of waste to Landfill. This is regarded as unfeasible as lining of vertical or inclined sides is not been fully investigated or proven to be effective.

The separate disposal of the waste stream (ash) is thus the only viable option remaining.

Optimisation of the proposed disposal of waste

The disposal of the ash stream can be optimised as an attempt to minimise the impacts associated with the ash disposal activity. These include:

Gypsum and ash separation: Eskom indicated that for the first five years the ash and gypsum waste stream would be combined, and that thereafter these waste streams would be separated. Gypsum would then be deposited on the existing approved co-disposal ash disposal facility south of the Kusile Power Station. Such a facility has already been authorised. It was agreed that the 60 year facility would therefore only receive ash waste.

Multi-stacking: Based on the known geology that occurs over 80 % of the study area it seems that multi-stacking with a 15 m front running bench would be feasible. An increase of the stack height could be achieved because of the additional stability and as such the ADF height could be increased from the typical 40 m to a height of nearly 100m, thereby reducing the estimated 1 500 ha footprint to 900 ha, a footprint reduction of 600 ha.

Mass transportation of the waste stream: Eskom indicated that one of the major factors to consider in the selection of the waste site is the alignment of the conveying system. Factors taken into account included the length and bends in the conveyor as they have implications on the project's cost and likelihood of ash spillages respectively.

Single versus multiple facility locations: It is desirable from an environmental perspective that the footprint of the facility be reduced from the outset to the smallest possible footprint. Therefore, the implementation of the multi-stacking option is preferred. It was agreed that for the purpose of the EIA a trade-off between a single stack and multi-stack facility be evaluated.

Location Alternatives: The site selection methodology consists of four major phases: delineation of the study area; delineation of developable area; rating of the developable area on the basis of design suitability, environmental and social sensitivity; and an overlay analysis and site selection.

5.2.5 Remediation:

The ash waste facility will be covered with topsoil and rehabilitated.

Due to the large volumes of ash that will be generated it was ~~been~~ concluded concluded that an ash ~~dump~~ disposal facility will be required, even with the implementation of all the other waste hierarchy alternatives.

5.3 SITE ALTERNATIVES

The identification and evaluation of site alternatives is a phased approach consisting primarily of the following:

- Identification of potential sites against a set of technical criteria;
- Fatal flaw analysis of potential site alternatives; and
- Screening and ranking of sites against economic, environmental and public criteria.

5.3.1 Initial Site Identification

Negative mapping was used to exclude all sites within the project area that conflicted with the proposed ash dump. This was done through a list of "limiting factors" and No-Go areas to which appropriate buffers was assigned. The No-Go areas included the N4 and N12 National Roads, the rail reserve in the study area, the Wilge River, high density residential areas such as the Wilge and Phola settlements and the Kusile Power Station footprint.

This phase identified 11 potentially developable areas for further investigation during the site selection process. These areas are shown in Figure 5-2.

5.3.2 Site Screening

The 11 potentially developable areas were then evaluated according to their environmental and social suitability. According to the environmental and social criteria, the best rated area was site A, the second best sites were C, G and small A+G, followed by B and F + G. Sites H 1-3 and I were excluded due to abundance of sensitive features within the proposed footprints.

In order to rank the sites for technical suitability certain design assumptions and information were required. These included:

Stacker philosophy: The initial ash stack will be a truck and haul operation. This is not feasible for the main 60 year stack due to the high placement rate required and excessive costs. Thus the 60 year stack must make use of mechanised stackers. Due to the underlying geology not offering sufficient strength to support a front stack of more than 15 m (Kusile 10 year Ash Dump Stability Report, 2009), it was assumed that a multi-level stacker setup, similar to the one at Majuba Power Station, would be used. This setup would allow the initial stacker to place an estimated 15 m front stack and 12 m back stack, which will consolidate the underlying clay layers, increasing their strength in time to support the second stacker's 21 m front stack and 12 m back stack. Stacker philosophy is discussed in more detail in Chapter 8.

Ash Classification and Liner Type: The type of liner system require for lining the ash disposal facility featured prominently in the technical assessment of the different potential sites. Ash Classification and Liner Type is discussed in more detail in Appendix H.

Ash Volumes and Densities: It was calculated that for a 60 year life of mine, the ash volume generated (532 Million m^3) would require a stack with a footprint of 1 300 ha and a dump height of 60 m. These specifications were subsequently refined and updated during the EIR phase. Ash volumes and densities are discussed in more detail in Chapter 8.

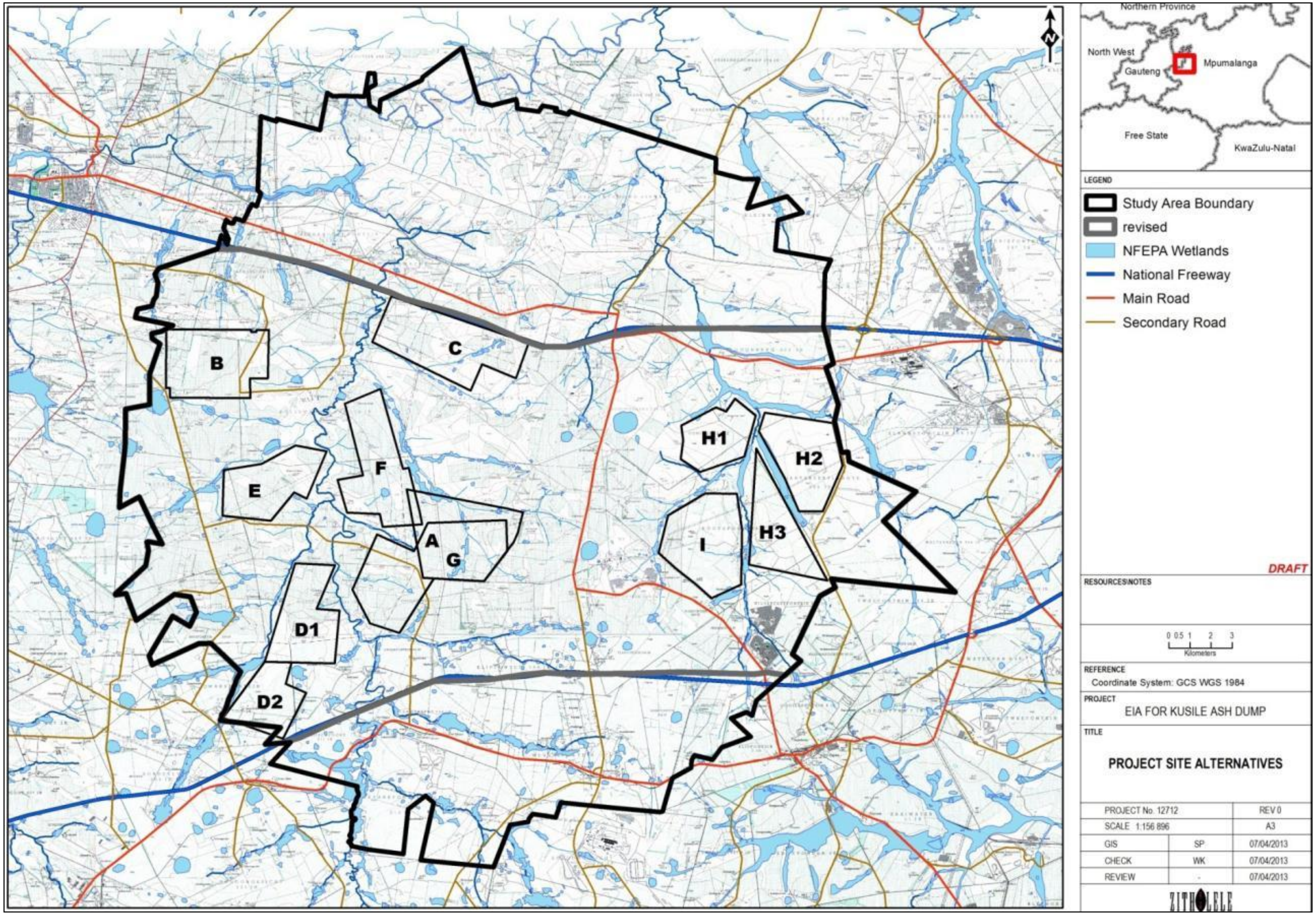

Figure 5-2: Potentially developable areas

5.3.3 Combined rating of Technical, Environmental, and Social criteria

The totals calculated for the Environmental and Social elements were added to the weighted Technical totals in order to get a combined rating of all elements used as part of the selection criteria (Table 5-1).

From the table it can be seen that that the best rated area (highest score) is Area A with a combined score of 261. Second best is Area B with as score of 246, third best Area is small A+G with a score of 235 followed by Area C with 218. Area F+G have a combined score of 190, followed by D1+2 and then E. Area H1 - 3 and I have been excluded due to too many sensitive features in the area.

Table 5-1: Top five combined environmental, social and technical ratings

Element	A	B	C	D1+2	E	F	A+G	H1-3	I	G	F+G
Technical (weighted)	234	221	192	160	149		209	99	155		167
Environmental	18	17	18	14	13	10	18	12	12	18	15
Social	9	8	8	8	8	8	8	8	8	8	8
Combined Rating	261	246	218	182	170	18	235	No-go	No-go	26	190

The top five sites based on site screening and design suitability assessment during the site selection phase of the project are summarised in Table 5-2 below.

Table 5-2: Top five sites based on the selection matrix

Ranking	Site	Notes
1	**A, small A**	Site A is the closest to the power station (~1km), therefore it is less costly in terms of capital costs and operations and is very accessible. Its terrain is very undulating and includes two valleys, therefore large earthworks are expected. The site has good drainage potential as one way drainage occurs. If the full area is used, large infrastructure and river diversion works are needed; however, a second smaller alternative, site small A, can be sited here within most of the existing constraints. Environmentally Site A is located in an area that is bisected by two streams. The placement of the ash facility in this area will result in the deviation of at least one of these streams. Socially the site is relatively uninhabited and no major relocations of people are expected.
2	**B**	Site B is one of the furthest from the station (~10 km). The terrain is less undulating than other sites and is the most suitable in terms of geology and slope stability. The shape of the ~~dump~~ ash disposal facility lends itself to easier operations and rehabilitation. Environmentally Site B is the most suitable site. There are no streams on site and the site also avoids all the desktop sensitivities. It should however be noted that in order to utilise Site B the conveyor and pipeline route will cross over various sensitivities including the Wilge River, it associated

Ranking	Site	Notes
		wetlands as well as areas of relatively sensitive biodiversity. Socially Site B has several small holdings on the periphery of the site and relocations will be expected. Also as above the conveyor and pipeline route traverses through a populated area that could require further relocations.
3	**small A** **+** **G**	A smaller Site A does not need the costly deviations and the largest river diversion is also not required. Site G is also relatively close (~4km) to the power station and is therefore quite accessible. The terrain is very undulating and the site G considered on its own is not large enough to receive the 60 years of ash produced. Site G is therefore only viable in combination with another site – in this case site small A. Environmentally the combination of Site small A and G will impact on at least two streams. The reshaped Site A does avoid the larger stream in that area, but these impacts cannot be avoided. Site G is located in an area of relatively low biodiversity sensitivity. Socially Site G has a couple of potential landowners that will have to be relocated as part of the project.
4	**C**	Site C is relatively close (~ 2km) to the power station and the terrain is suitable in terms of drainage. However, it is a poor site in terms of geotechnical conditions. Environmentally Site C is located in an area with relatively low biodiversity sensitivity, however a small stream bisects the site and some small but sensitive wetlands occur along the stream. It has also been earmarked for a biodiversity offset area in terms of an existing environmental authorisation granted in the area. Socially this site has recently been identified and used for the relocation of people previously displaced by the power station construction activities. Several relocations will have to take place, including people that have previously been relocated to this area.
5	**F** **+** **G**	Site F is relatively close to the power station and access is relatively easy. However, the geometrical shape of Site F may lead to operability difficulties. Site G is also relatively close to the power station and is therefore quite accessible, but the terrain is very undulating. Sites F and G considered on their own are not large enough to receive the 60 years of ash produced. These two sites are therefore only viable in combination with another site – in this case site the combination of site F and G. Environmentally the combination of Site F and G will impact on at least one stream. Site G is located in an area of relatively low environmental sensitivity. The environmental sensitivity within Site F ranges from low to high with a more or less even distribution. Further to this a small section of site F is located over a sensitive ridge area. Socially Site G has a couple of potential landowners that will have to be relocated as part of the project. Site F ranges from low to high from a social perspective.

The following feasible sites alternatives were identified through the site selection process:

- Site A, Site small A
- Site B
- Site C
- Site F
- Site G

5.4 NO-GO ALTERNATIVE

The NO-GO alternative proposes that the 60 year ash disposal facility is not constructed at any of the proposed locations. This alternative may seem to have a noticeable cost saving for Eskom, but would have a huge cost to the country, due to cost of unserved energy. The impact on the receiving environment will also be negated therefore there will be no direct loss and indirect impact on the wetlands and watercourses at any of the proposed locations. The potential pollution risk resulting from constructing and operating the ash disposal facility on the nearby Wilge River will therefore also not materialise. Other potential environmental impacts that will be prevented include potential risk of polluting ground water and impacts on air quality. This alternative will prevent these potential impacts from occurring on the local and regional scale.

The NO-GO alternative will however have considerable negative impacts on the national and possibly international scale. The Kusile Power Station that is currently being constructed at its current location will require an ash disposal facility to be able to operate. Ash that is generated at the power station through the coal-burning process must be disposed of in an environmentally responsible manner. If a facility that will allow environmentally responsible disposal of ash is not authorised and constructed the Kusile Power Station cannot operate to generate electricity.

The Kusile Power Station, together with the Medupi Power Station is strategically placed new power station developments specifically aimed at providing sufficient power to keep up with South Africa's electricity demand and stabilise the national grid. If the Kusile Power Station cannot produce electricity, a shortage of electricity will be the result. This could result in renewed forced load-shedding, and other demand-side management initiatives, in an attempt to try and stabilise the national electricity grid. These initiatives may impact large, medium and small businesses across South Africa impacting the economy on an economic and social level. The ability to export electricity to neighbouring countries may also be impacted thus resulting in socio-economic impacts across borders.

5.5 SITE SPECIFIC CONCEPT DESIGNS

5.5.1 Arrangement of sites

The sites are located mostly on the northern, western or southern side of the power station. The northern, southern and eastern directions have the following constraints:

- North: N4 highway;
- South: N12 highway and mineral rights/ reserves;
- East: New Largo Mine reserve which will supply coal to Kusile (shown partly on the south eastern corner of the layout).

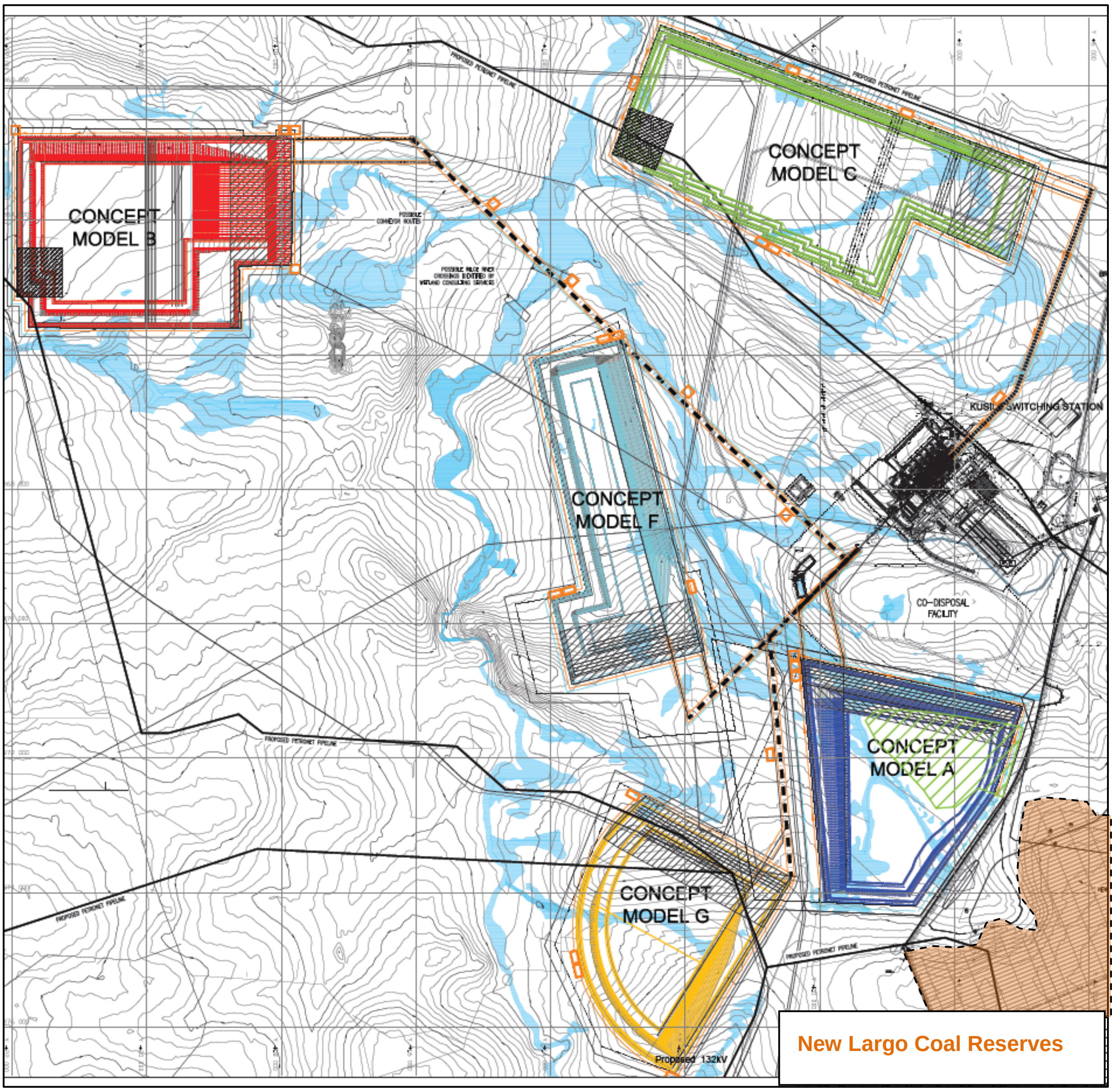

Figure 5-3: Arrangement of sites

5.5.2 Site A

Site A is positioned south of the power station. It is wedge shaped, starting wide in the north and becoming narrower as it develops southwards.

If the ash facility is restrained to the eastern side of the access road, the height of the ash stack increases to ensure that the required storage capacity is achieved. The highest point of the stack is 100m above ground level.

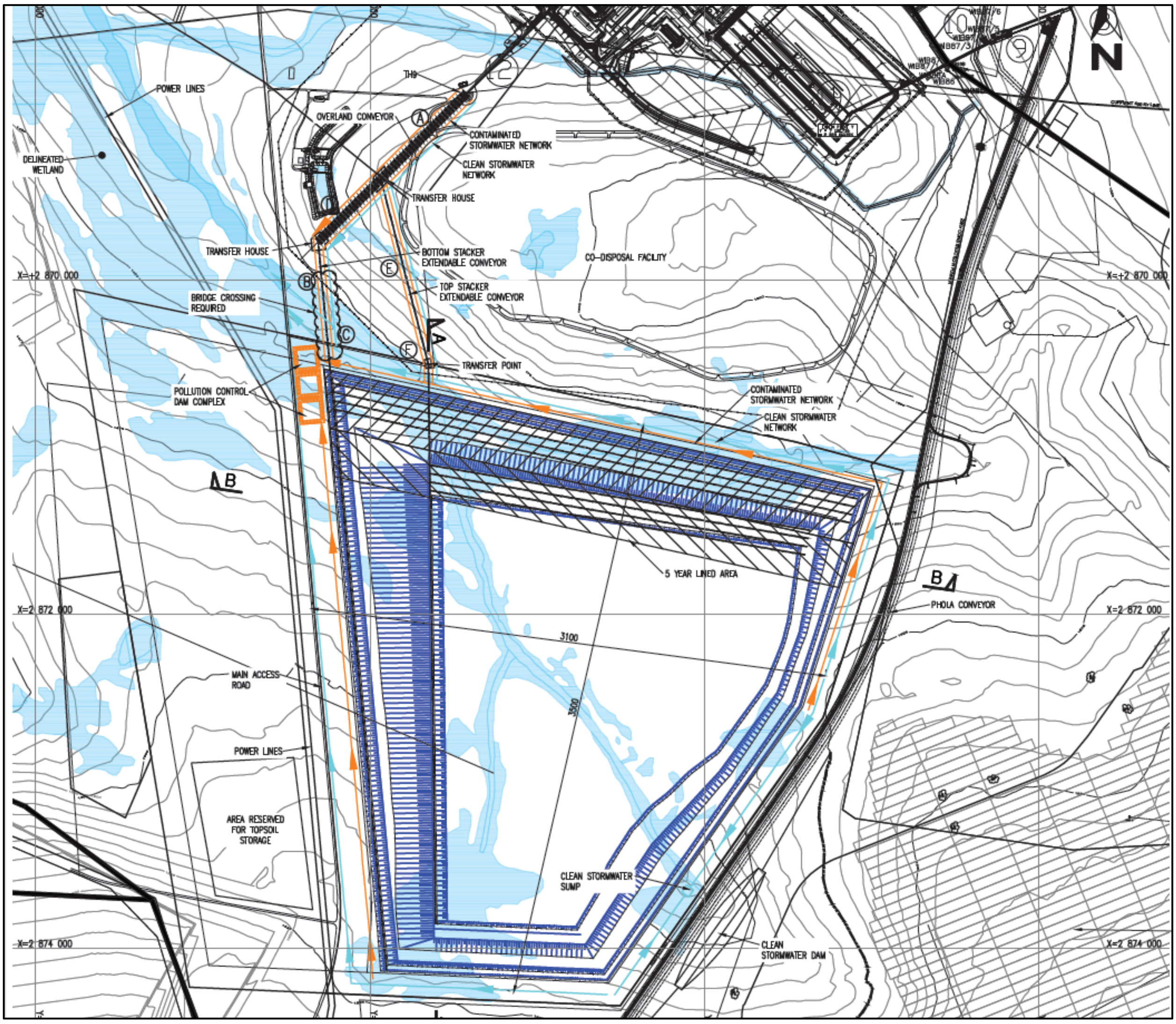

Figure 5-4: Site A Concept Model

The limited space also means that the ash stack needs to start near final height instead of typically starting near ground level and building an approach ramp at a slope of 1[v]:20[h] up to final height. Therefore a substantial starter platform will be required. The starter platform will likely be constructed from ash using a truck and haul operation. The platform will also need to be lined.

Site A is also characterised by a valley draining from the south-east to the north-west (forming the Holfonteinspruit). This valley will continue to lead clean storm water into the site for the duration of operations and therefore will require a combination of a river diversion and a clean storm water attenuation dam. Eventually, a dam and diversion canal system upstream of the New Largo Phola Conveyor will be required as shown in Figure 5-4. A river diversion will also be required for the Klipfonteinspruit which is located along the northern side of the site.

Site information for Site A is provided in the table below.

Table 5-3: Site A Information

Mechanical Information		**Ash Facility Characteristics**	
Description		**Description**	
Overland Conveyor		**Footprint Area (ha)**	822
Length (m)	1,250	**Facility Volume (Million m^3)**	530.4
Extendable Conveyor		**Volume Split**	
Top Stack		Top Stacker	75%
Initial Length (m)	1,750	Bottom Stacker	25%
Additional Length (m)	2,750	**Life Expectancy (years)**	60
Bottom Stack		**Total Height (m)**	100
Initial Length (m)	800	**Area of first 5 year lined area (ha)**	198.4
Additional Length (m)	3,410	**Civil Infrastructure Requirements**	
Shiftable Conveyor		**Description**	
Top Stack			
Length [Range] (m)	630 to 2,310	**No. of Dams required**	
Number of Shifts	54	Ash facility	2
Bottom Stack		Overland Conveyor	0
Length [Range] (m)	630 to 3,240	**Single Dam Size (m^3)**	40,000
Number of Shifts	65	**Storm Water Sump**	2
Transfer Points	3	**No. of bridges required**	1

5.5.3 Site small A

Site small A is an optimised version of the full size Site A model. The goal of this concept was to minimise the effect of the ash facility on the river tributary that runs along the north of the site (the Klipfonteinspruit). The original Site Model A almost completely covers this tributary, resulting in the river being diverted. Site small A is located off the wetland delineation around the tributary at the cost of a portion of the storage capacity of the ash facility. The result is that the facility will only have a 45 year life and will have to be used in conjunction with one of the other smaller sites (Site G or Site F) in order to service the 60 year life of the power station. The ash stack develops from the northern side in a southern direction. Site small A will have similar starter platform requirements to the full Site A.

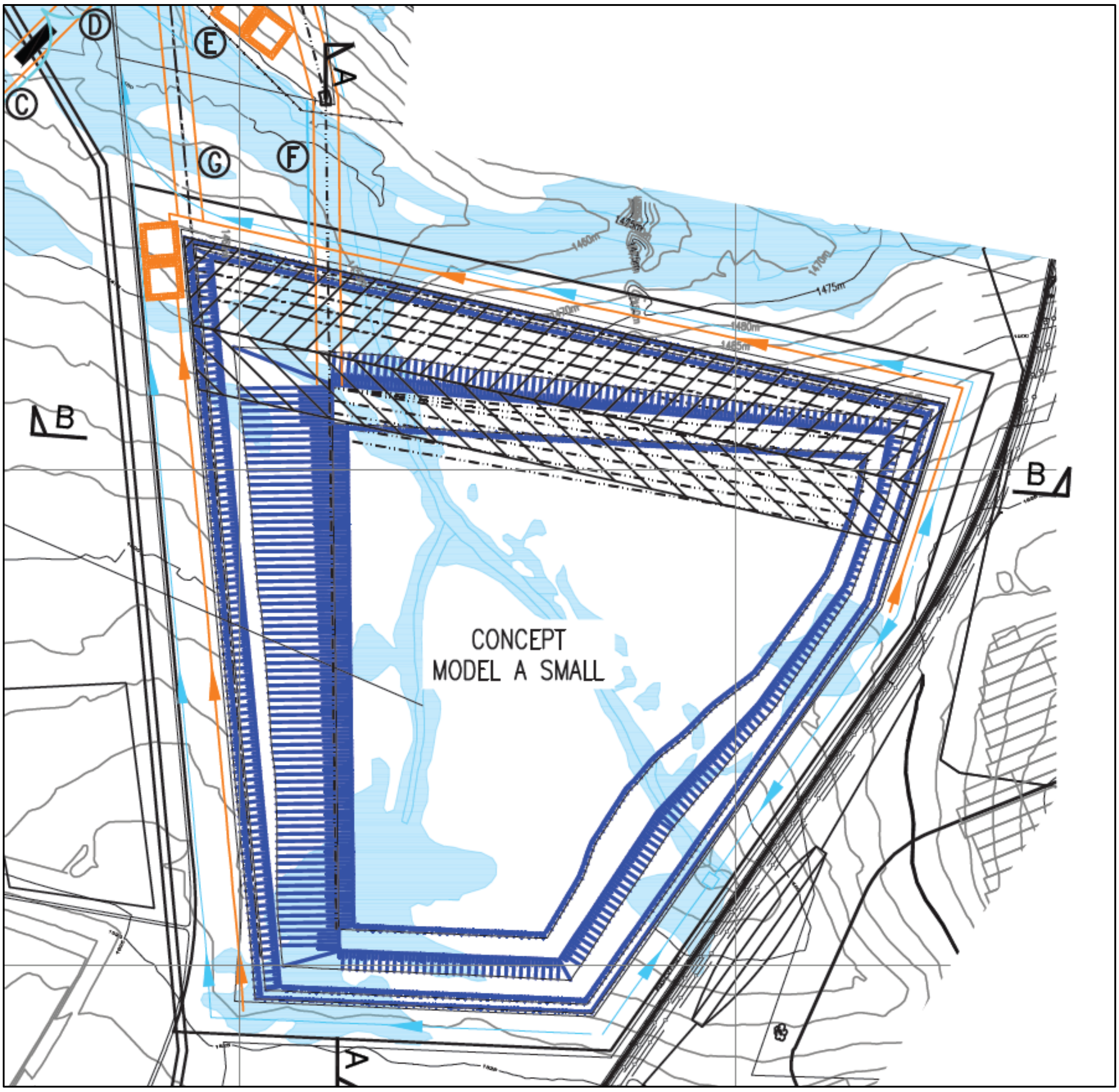

Figure 5-5: Site small A Concept Model

Site information for Site small A is provided in the table below.

Table 5-4: Site small A pertinent information

Mechanical Information		Ash Facility Characteristics	
Description		**Description**	
Overland Conveyor		**Footprint Area (ha)**	656
Length (m)	1,250	**Facility Volume (Million m^3)**	394
Extendable Conveyor		**Volume Split**	
Top Stack		Top Stacker	73.30%
Initial Length (m)	2,200	Bottom Stacker	26.70%
Additional Length (m)	2,310	**Life Expectancy (years)**	45
Bottom Stack		**Total Height (m)**	110
Initial Length (m)	1,055	**Area of first 5 year lined area (ha)**	178.4
Additional Length (m)	1,890	**Civil Infrastructure Requirements**	

Mechanical Information		Ash Facility Characteristics	
Shiftable Conveyor		**Description**	
Top Stack			
Length [Range] (m)	630 to 2,190	**No. of Dams required**	
Number of Shifts	45	Ash facility	2
Bottom Stack		Overland Conveyor	1
Length [Range] (m)	630 to 3,030	**Single Dam Size (m^3)**	40,000
Number of Shifts	56	**Storm Water Sump**	2
Transfer Points	3	**No. of bridges required**	2

5.5.4 Site B

Site B is located north west of the power station and is the furthest away (approximately 12 km). However, the geometric shape of the site allows for a rectangular ash facility with a low aspect ratio which will lead to easier operations. The size of the site allows for a typical approach ramp of 1[v]:20[h] to be used resulting in only a minor starting platform being required. The ash stack will start on the eastern side and develop in a western direction.

Site B is located on a water shed which leads to good drainage conditions and only minor clean water diversions will be required. However, the site is surrounded by delineated wetlands and drainage towards the east heads in the direction of the Wilge River.

The overland conveyor is approximately 9km long. This leads to high operational costs. Also, extensive storm water management infrastructure will be required including four Pollution Control Dams (PCDs) located along the conveyor.

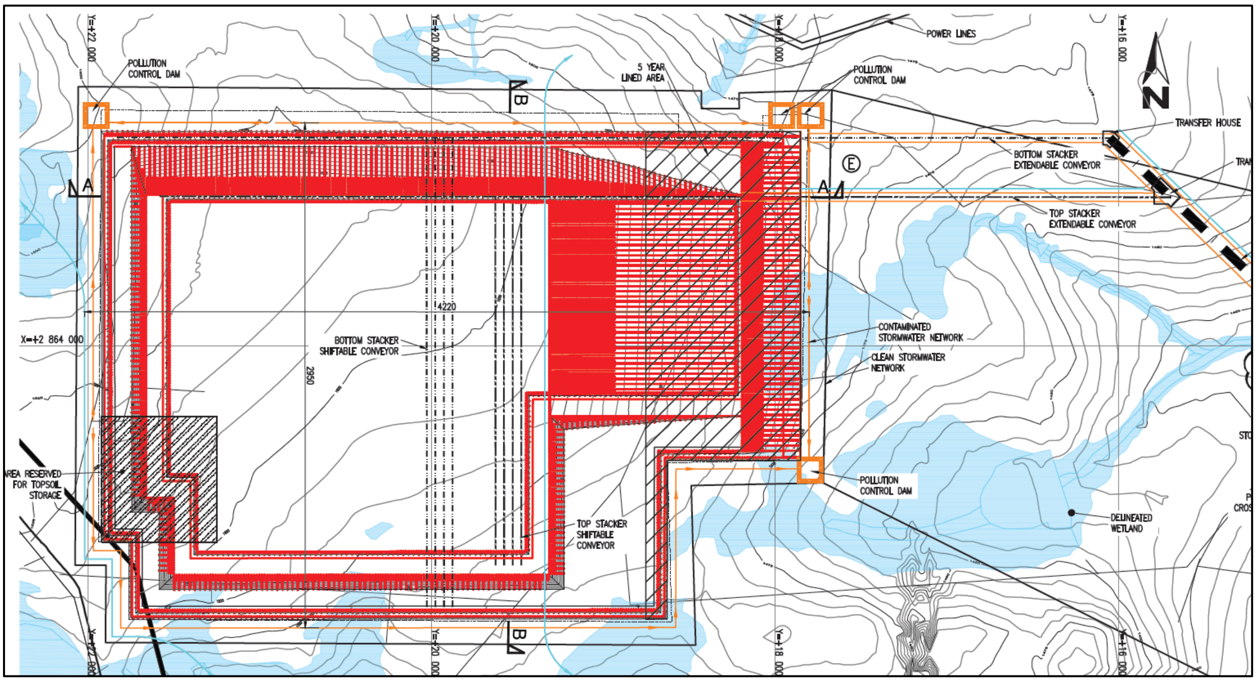

Figure 5-6: Site B Concept Model

Site information for Site B is provided in the table below.

Table 5-5: Site B pertinent information

Mechanical Information		Ash Facility Characteristics	
Description		**Description**	
Overland Conveyor		**Footprint Area (ha)**	1,077
Length (m)	9,100	**Facility Volume (Million m³)**	575.9
Extendable Conveyor		**Volume Split**	
Top Stack		Top Stacker	79%
Initial Length (m)	2,395	Bottom Stacker	21%
Additional Length (m)	3,385	**Life Expectancy**	65.2
Bottom Stack		**Total Height (m)**	89
Initial Length (m)	1,800	**Area of first 5 year lined area (ha)**	185.2
Additional Length (m)	3,850	**Civil Infrastructure Requirements**	
Shiftable Conveyor		**Description**	
Top Stack			
Length [Range] (m)	1,805 to 2,735	**No. of Dams required**	
Number of Shifts	66	Ash facility	3
Bottom Stack		Overland Conveyor	4
Length [Range] (m)	1,220 to 2,145	**Single Dam Size (m³)**	40,000
Number of Shifts	76	**Storm Water Sump**	0
Transfer Points	3	**No. of bridges required**	3
		Main Access Road Crossing	1

5.5.5 Site C

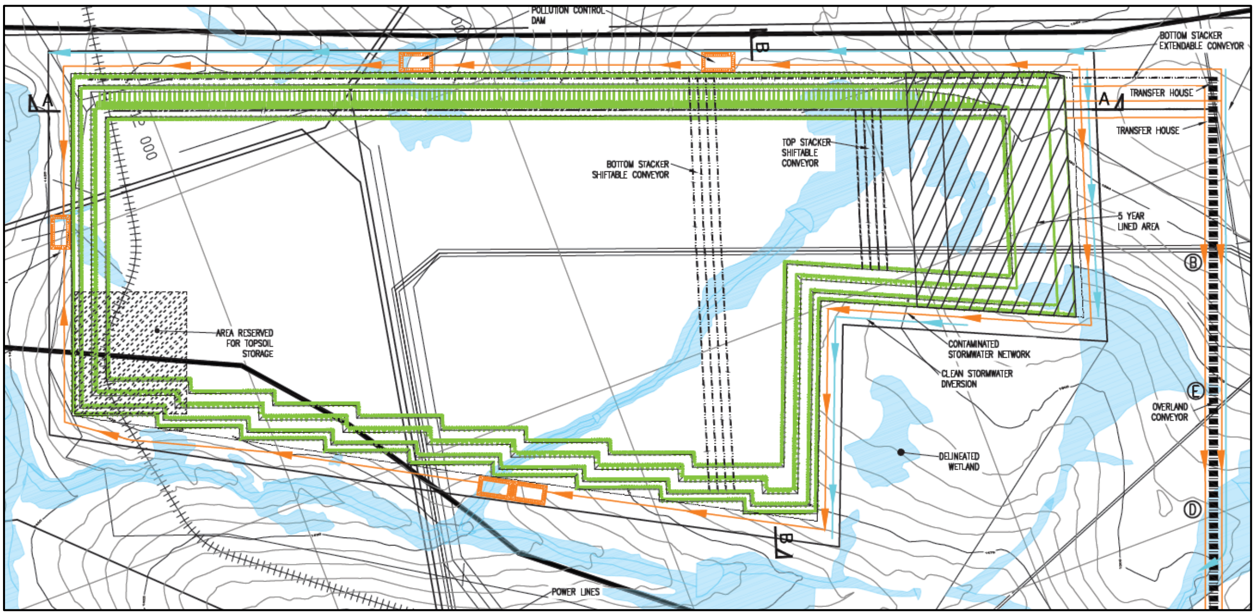

Figure 5-7: Site C Concept Model

Site C is located north of the power station. The geometric shape of the site leads to an ash facility with a high aspect ratio. The size of the site allows for a typical approach ramp of 1[v]:20[h] to be used resulting in only a minor starting platform being required. However, when the facility reaches the stage where it widens out, excessive dozing will be required to widen out the stack so that the shiftable conveyors can be extended. The site starts on the eastern side and develops in a western direction.

There is a tributary located in the footprint which heads from the north east to the south west. Storm water feeding this tributary from an upstream direction will be diverted around the ash facility into tributaries running along the northern and southern sides.

Site C extends over the new Kusile Railway on its western edge. Usually this would lead to a diversion being required. However, only the end section of the facility extends over the railway and this can likely be prevented during the optimisation stage during the detail design if Site C is selected as the preferred option. Site C also covers a large amount of 400KV power lines which will need to be diverted around the ash facility.

A borrow pit is required if Area C is chosen as the desired alternative due to poor material availability. The borrow pit was placed on Site A (Figure 5-8) in order to try reduce the total impact on the area around the power station.

The process to size the borrow pit was as follows:

- First, the total clay material required for Site C was calculated to be 3,750,000 m^3 based on using 300mm clay in the liner system as required in a Type C liner.
- Second, an available area in Site A was chosen so that little impact is made on the wetlands. The size of the area was measured to be 220 hectares.
- Lastly, the average depth of the borrow area was calculated to be 2.0 – 2.2m (including removal of topsoil 0.3 – 0.5m and 1.7m of clay).

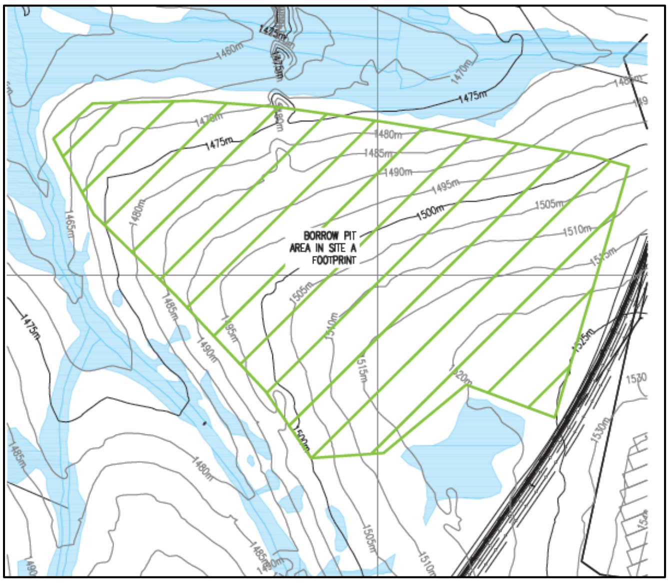

Figure 5-8: Borrow pit area for Site C located on Site A footprint

Site information for Site C is provided in the table below.

Table 5-6: Site C pertinent information

Mechanical Information		Ash Facility Characteristics	
Description		**Description**	
Overland Conveyor		**Footprint Area (ha)**	1,250
Length (m)	6,600	**Facility Volume (Million m^3)**	538.9
Extendable Conveyor		**Volume Split**	
Top Stack		Top Stacker	63%
Initial Length (m)	1,770	Bottom Stacker	37%
Additional Length (m)	5,355	**Life Expectancy (years)**	61
Bottom Stack		**Total Height (m)**	70
Initial Length (m)	1,465	**Area of first 5 year lined area (ha)**	137.5
Additional Length (m)	5,805	**Civil Infrastructure Requirements**	
Shiftable Conveyor		**Description**	
Top Stack			
Length [Range] (m)	1,355 to 2,540	**No. of Dams required**	
Number of Shifts	106	Ash facility	4
Bottom Stack		Overland Conveyor	1
Length [Range] (m)	1,010 to 2,145	**Single Dam Size (m^3)**	40,000
Number of Shifts	115	**Storm Water Sump**	0
Transfer Points	3	**No. of bridges required**	0
		Main Access Road Crossing	1
		Borrow pit required	1

5.5.6 Site F

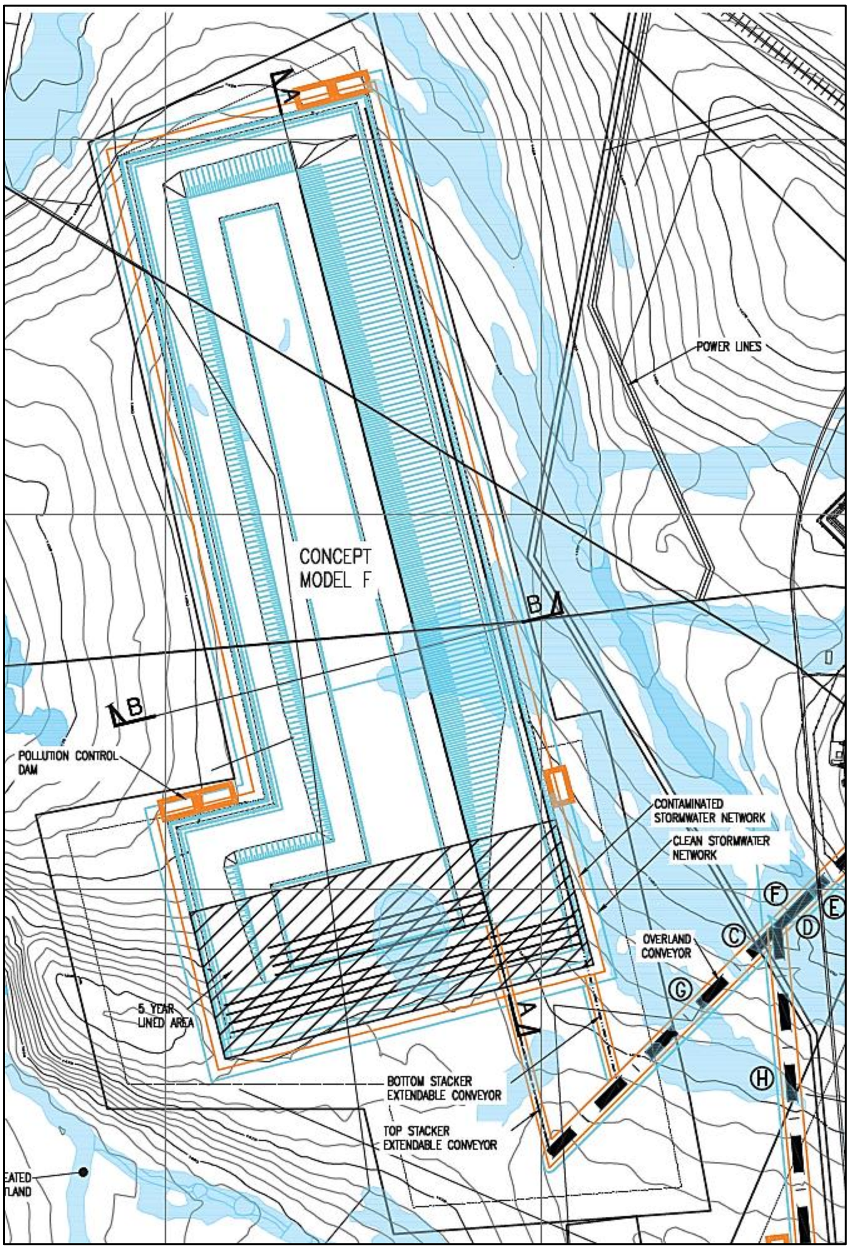

Figure 5-9: Site F Concept Model

Site F is located to the western side of the power station. It is located between the Wilge River and one of its large tributaries (the Klipfonteinspruit). The shape of the site leads to a long thin ash stack which will be more difficult to operate than a wider ash stack as conveyor shifts will happen more frequently. The ash stack will start on its southern side and develop northwards.

As the size of the site is limited, the ash facility is not large enough to store sufficient ash for a 60 year life. Therefore it will need to be used in conjunction with another of the small sites (Site G or Site small A).

Site F is located on a ridge between two valleys, therefore storm water will fall away from the site except along the southern side where there may be some drainage towards the site. As Site F is located on a ridge that falls in the same direction as the facility develops there is no need for a significant starter platform. There is sufficient space to reach final height as the approach ramp takes up less space.

There is a major power line that runs in an east-west direction which bisects the site. The power line will need to be diverted around the site.

Site information for Site F is provided in the table below.

Table 5-7: Site F pertinent information

Mechanical Information		Ash Facility Characteristics	
Description		**Description**	
Overland Conveyor		**Footprint Area (ha)**	758
Length (m)	3,570	**Facility Volume (Million m^3)**	375.7
Extendable Conveyor		**Volume Split**	
Top Stack		Top Stacker	70%
Initial Length (m)	1,290	Bottom Stacker	30%
Additional Length (m)	4,055	**Life Expectancy (years)**	42.5
Bottom Stack		**Total Height (m)**	100
Initial Length (m)	785	**Area of first 5 year lined area (ha)**	131.1
Additional Length (m)	4,600	**Civil Infrastructure Requirements**	
Shiftable Conveyor		**Description**	
Top Stack			
Length [Range] (m)	1,280 to 1,920	**No. of Dams required**	
Number of Shifts	80	Ash facility	3
Bottom Stack		Overland Conveyor	1
Length [Range] (m)	545 to 1,180	**Single Dam Size (m^3)**	40,000
Number of Shifts	91	**Storm Water Sump**	0
Transfer Points	2	**No. of bridges required**	0
		Main Access Road Crossing	1
		Borrow pit required	0

5.5.7 Site G

Site G is located south west of the power station. It is the only site that makes use of radial shifting procedures whereby the shiftable conveyor is rotated about a point instead of being shifted parallel each time. The radial shifting leads to an arc forming on the southern/western side of the facility. The ash stack will start on the northern side and develop around the north eastern corner towards the eastern side.

The site is constrained on the north, west and south sides by wetland features and on the eastern side by infrastructure such as a provincial road and 400KV power lines. The ash facility modelled is not large enough to store sufficient ash for a 60 year life. Therefore this site will need to be used in conjunction with another of the small sites (Site F or Site small A).

A conventional approach ramp of 1[v]:20[h] is used in this option therefore a significant starter platform will not be required. There is a tributary flowing in an east to west direction in a valley formed by a quartzite horseshoe shaped formation (see geology layout in Appendix B). The ash facility will cover the entire catchment that feeds the tributary, however, during operations there will be constant diversion of clean storm water running off the north facing slope. The valley also has steep side slopes which may complicate the design of the liner system and the operations of the ash stack.

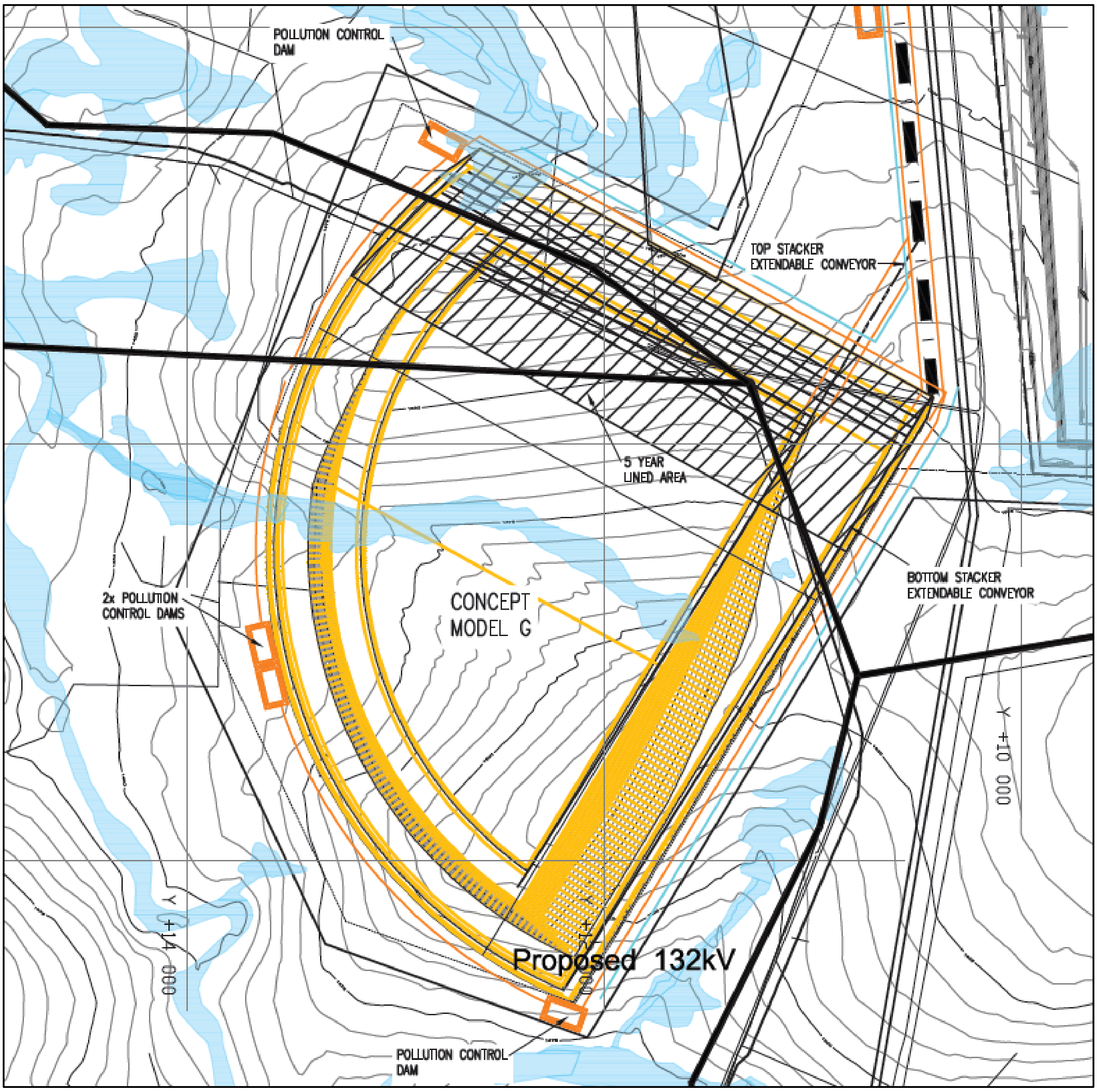

Figure 5-10: Site G Concept Model

Site information for Site G is provided in the table below.

Table 5-8: Site G pertinent information

Mechanical Information		Ash Facility Characteristics	
Description		**Description**	
Overland Conveyor		**Footprint Area (ha)**	772
Length (m)	5,280	**Facility Volume (Million m^3)**	402.2
Extendable Conveyor		**Volume Split**	
Top Stack		Top Stacker	70%
Initial Length (m)	1,140	Bottom Stacker	30%
Additional Length (m)	665	**Life Expectancy (years)**	45.5
Bottom Stack		**Total Height (m)**	100
Initial Length (m)	285	**Area of first 5 year lined area (ha)**	211.7
Additional Length (m)	1,055	**Civil Infrastructure Requirements**	
Shiftable Conveyor		**Description**	
Top Stack			
Length [Range] (m)	1,765 to 2,000	**No. of Dams required**	
Number of Shifts	14 Reg - 29 Radial	Ash facility	3
Bottom Stack		Overland Conveyor	2
Length [Range] (m)	2,150 to 2,460	**Single Dam Size (m^3)**	40,000
Number of Shifts	22 Reg - 37 Radial	**Storm Water Sump**	0
Transfer Points	3	**No. of bridges required**	0
		Main Access Road Crossing	1
		Borrow pit required	0

5.5.8 Construction and Operation Water Requirements

The following table shows a preliminary estimate of the water requirements for the construction and operation stages of the project.

Table 5-9: Construction and Operation Water Requirements

	Site A	Site small A	Site B	Site C	Site F	Site G
Construction Water Requirements						
Area (ha)	822	656	1077	1250	758	772
Depth (m)	0.45	0.45	0.45	0.45	0.45	0.45
Volume (m^3)	3,699,000	2,952,000	4,846,500	5,625,000	3,411,000	3,474,000
Mass of soil (t)	6,658,200	5,313,600	8,723,700	10,125,000	6,139,800	6,253,200
2% Moisture Content increase (m^3)	133,164	106,272	174,474	202,500	122,796	125,064
Operations Water Requirements						
No of days of operations (60 yr life)	21,900	21,900	21,900	21,900	21,900	21,900
Exposed Area (5%)	411,000	328,000	538,500	625,000	379,000	386,000
Rehabilitated Area (2%)	164,400	131,200	215,400	250,000	151,600	154,400
Dust Suppression (m^3/day)	1,315	1,050	1,723	2,000	1,213	1,235
Irrigation (m^3/day)	986	787	1,292	1,500	910	926
Total Dust Suppression (m^3)	28,802,880	22,986,240	37,738,080	43,800,000	26,560,320	27,050,880
Total Irrigation (m^3)	21,602,160	17,239,680	28,303,560	32,850,000	19,920,240	20,288,160

5.5.9 Disposal site scenarios

Environmental, social and technical constraints identified during the site selection process, limited some of the identified feasible sites (Site small A, Site F and Site G) to the extent that these sites would not be able to receive the entire 60 years of ash production from the Kusile Power Station in their individual capacity. A combination of these sites with others created feasible disposal scenarios where a combination of sites would be able to receive the total volume of ash produced over the power station life of 60 years. The following feasible disposal scenarios (indicated as sites) was identified:

- Site A
- Site B
- Site C
- Site AF (site small A + site F)
- Site AG (site small A + site G)
- Site FG (site F + site G)

These disposal scenarios were further investigated during the comparative and specialist impact assessments.

6 DESCRIPTION OF THE RECEIVING ENVIRONMENT

6.1 CLIMATE

6.1.1 Data Collection

Climate information was attained using the climate of South Africa database, as well as from the Air Quality Impact Assessment for the Kusile Ash Disposal Project (Airshed Planning Professionals, 2013).

6.1.2 Regional Description

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

The region experiences frequent frosts, occurring on average 41 days of the year. In addition to frost the area is prone to hail storms during the summer time. Winds are usually light to moderate, with the prevailing wind direction north-westerly during the summer and easterly during winter.

6.1.3 Precipitation

Rainfall data from the Middelburg and Bethal stations indicated a total annual rainfall range of 730 mm to 750 mm, which is slightly higher than the regional estimate (Table 6-1). Rainfall occurs predominantly in summer (October to April) with the highest rainfall experienced in January. Land owners reported that the study site experience flash flooding during certain times of the year.

Table 6-1: Long-term mean monthly rainfall figures (mm)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Middelburg (1904 – 1950)	132	103	88	42	19	7	9	8	22	63	124	118	735
Bethal (1904 – 1984)	134	94	78	46	19	7	8	10	25	78	128	120	747

6.1.4 Surface Temperature

The monthly temperature profile, based on data measured at Eskom's Kendal Power Station, indicates an annual average maximum of 26.5°C, an annual average minimum of 9.6°C and an annual average temperature of 16.2°C. The average daily maximum temperatures range from 31.5°C in December to 19.9°C in June, and the average daily minimum temperatures range from 14.5°C in December to 2.1°C in July (Figure 6-1).

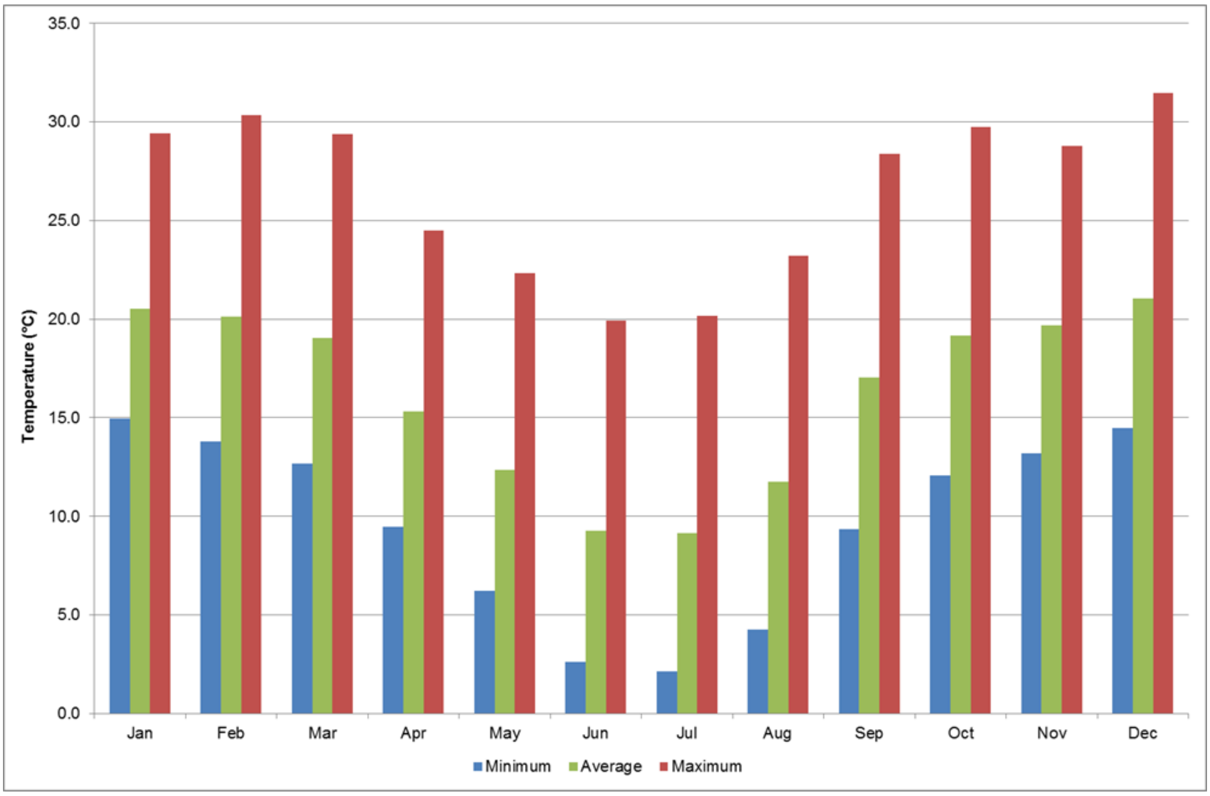

Figure 6-1: Minimum, maximum and average monthly temperatures for the period of January 2009-October 2012

6.1.5 Local Wind Field

The dominant wind direction as measured at Kendal (Figure 6-2) and Majuba Power Stations (Figure 6-3), from January 2009 to October 2012, was found to be west-north-west with a frequency of occurrence approaching 12%. Easterly sector winds were the next dominant with a frequency of 10%. Winds from the southern and south-western sectors occur relatively infrequently (<4% of the total period). Calm conditions (wind speeds <1m/s) occur 6.66% of the time.

A frequent north-westerly flow dominates day-time conditions with >12% frequency of occurrence. At night, an increase in easterly flow is observed (~11% frequency).

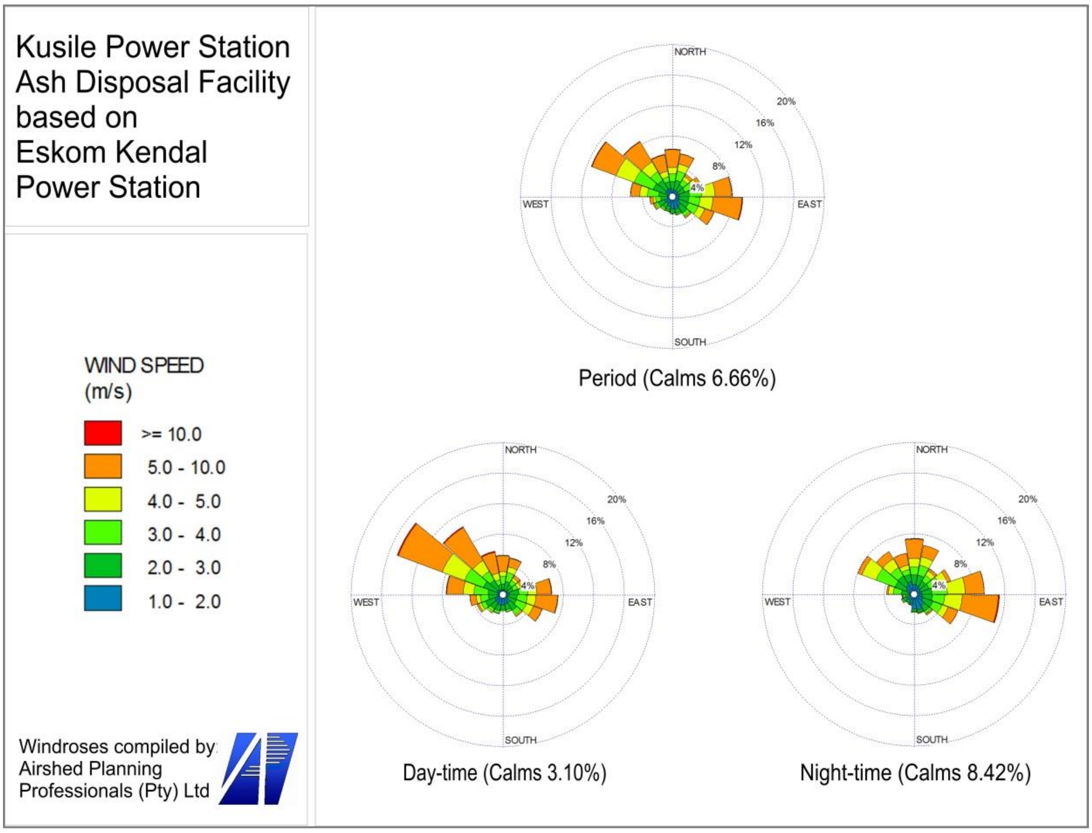

Figure 6-2: Wind roses for Kendal Power Station (January 2009-October 2012)

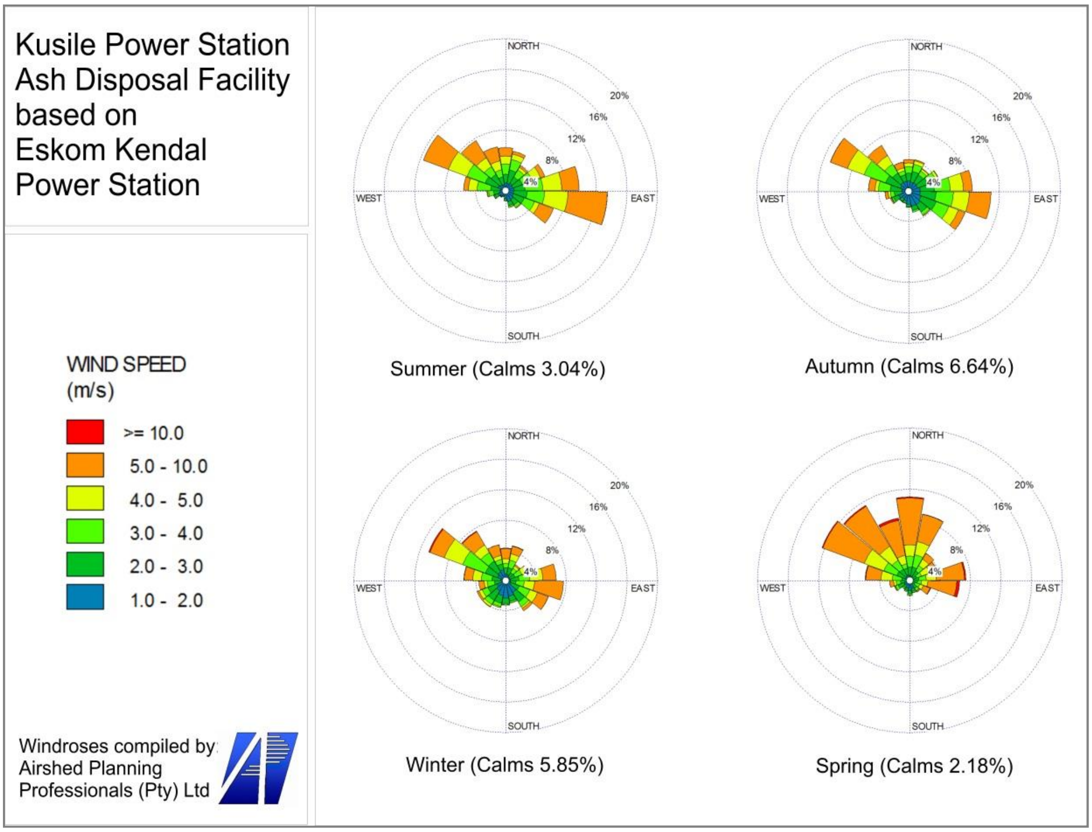

Figure 6-3: Seasonal wind roses for Majuba (January 2009- October 2012)

During summer months, winds from the east become slightly more frequent, due to the strengthened influence of the tropical easterlies and the increasing frequency of occurrence of ridging anticyclones off the east coast. There is an increase in the frequency of calm periods (i.e. wind speeds <1m/s) during the autumn (6.64%) and winter months (5.85%) with an increase in the westerly flow. During spring-time, winds from the north-westerly sector dominate, frequently in the range of 5.0 to 10.0m/s, with calm conditions occurring only 2.18% of the time.

6.2 AIR QUALITY

6.2.1 Data Collection

Eskom's ambient monitoring data from the monitoring site at Kendal Power Station, 20km south-east of the Kusile Power Station, provided an indication of the background air pollution in the region.

6.2.2 Ambient Air Quality

The Highveld Airshed Priority Area (HPA) was declared the second national air quality priority area (after the Vaal Triangle Airshed Priority Area) by the Minister of Environmental Affairs at the end of 2007. The Kusile Ash Disposal Facility alternative sites A and G fall within the HPA. The other alternatives either fall partially within (F, small A, and C) or completely outside (alternative B) the HPA. Given the proximities of the sites to the HPA, the particulate emissions are likely to contribute to the poor air quality.

The poor ambient air quality in the eMalahleni Hot Spot is a result of emissions from power generation, metallurgical manufacturing processes, open-cast coal mining and residential fuel burning; where industrial processes dominate the source contribution. Dispersion modelling projected exceedances of the daily PM10 limit for more than 12 days across the eMalahleni Hot Spot (HPA, 2011). Monitored daily PM10 concentrations within the Hot Spot, at Witbank and Greendale High School showed regular exceedances of the daily limit, between 2008 and 2012 (Figure 6-4). The HPA Air Quality Management Plan (2011) reported exceedances of the annual limit, for 2008/2009, at one of the two monitoring stations in Witbank with an annual average of ~83µg.m^{-3} for Witbank 2.

In addition, the New Largo Colliery, which is to be situated in proximity to the Kusile Power Station, is likely to result in local cumulative impacts when combined with alternatives A, G and F.

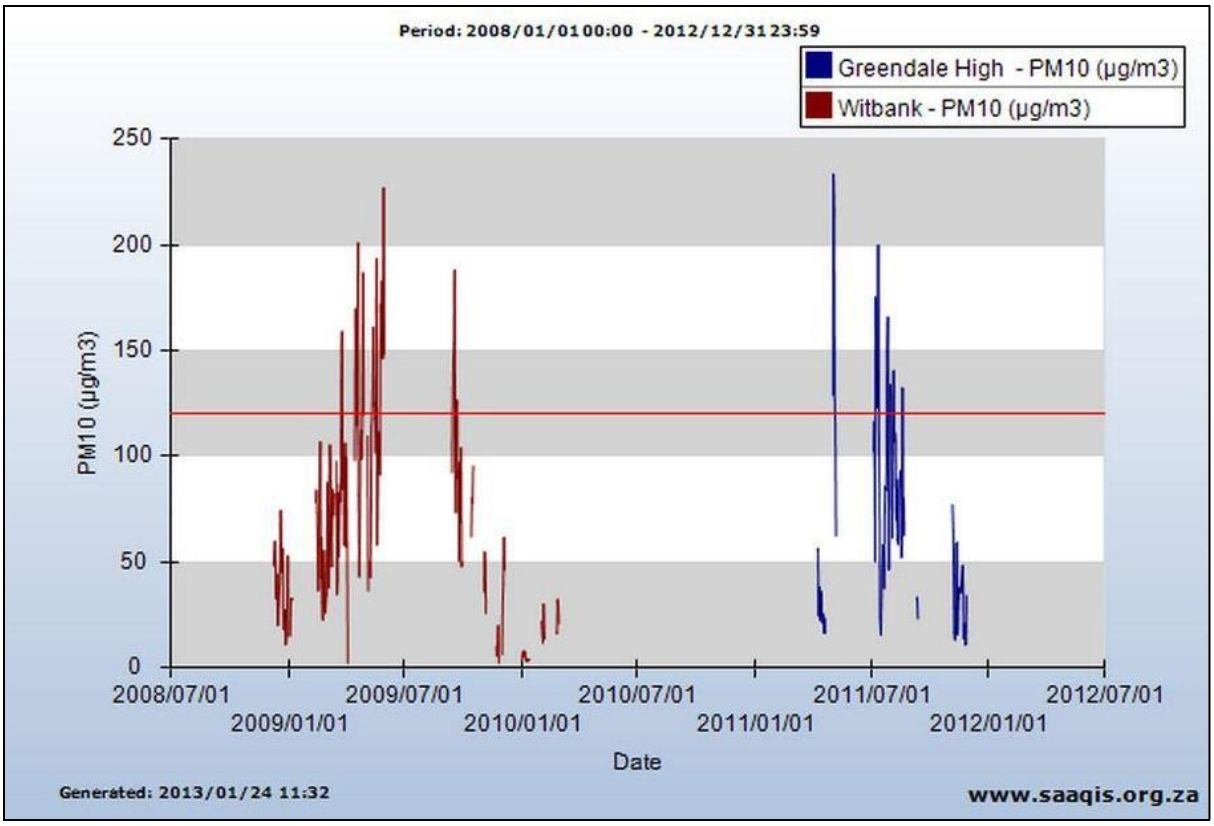

Figure 6-4: Daily PM10 concentrations, 2008-2012 (from www.saaqis.org.za). The horizontal red line indicates the current daily limit of 120 µg.m^{-3}

6.3 GEOLOGY

6.3.1 Methodology and Data Sources

The geological analysis was undertaken by desktop evaluation using a Geographic Information System (GIS) and data from DWS.

6.3.2 Regional Description

The geology in the area is fairly complex; none of the potential ash disposal sites are located on completely homogenous terrain. The main rock types found in the region are sandstone, dolerite, granite, norite, quartzite, tillite and shale. A simplified distribution of the aforementioned rock types is illustrated in Figure 6-5 below.

Granite and quartzite form the harder rocks in the region and hence mostly occupy the ridges found around the site. Sandstone, which covers the bulk of the Mpumalanga Highveld, in association with dolerite, generally weathers into sandy soils with relatively flat undulating plains.

6.3.3 Sensitivities

With regards to the construction of an ash disposal facility, the geological sensitivities to consider include:

- Areas of unstable geology, which in this instance refers to the areas of deep clay layers that underlie Site A and B. Clay deposits tend to shrink and swell, and so could slip under the foundation of the ash disposal facility. Special foundation designs will therefore need to be developed; and
- Areas of shallow soils or rock outcrops are also deemed to constitute sensitive geology. In such areas, 'cut to fill' operations may be required to create suitable ash storage areas, resulting in permanent damage to in-situ geology. Clay soils would also need to be imported to establish a suitable base, thus a borrow pit would be necessary in addition to the footprint of the ash disposal facility. Such conditions underlie Area C and parts of Area F and Area G.

6.4 TOPOGRAPHY

6.4.1 Data Collection

The topography data was obtained from the Surveyor General's 1:50 000 toposheet data for the region, namely 2528 and 2628. Contours were combined from the mapsheets. Using Arcview GIS software the contour information was used to develop a digital elevation model of the region (Figure 6-6).

6.4.2 Regional Description

The topography of the region is a gently to moderately undulating landscape of the Highveld plateau. A few small scattered wetlands and pans occur in the area. Rocky outcrops and ridges also form part of the landscape character. The altitude ranges between 1 260 – 1 620 metres above mean sea level (mamsl). Figure 6-6 provides an illustration of the topography of the region as well as the ridges.

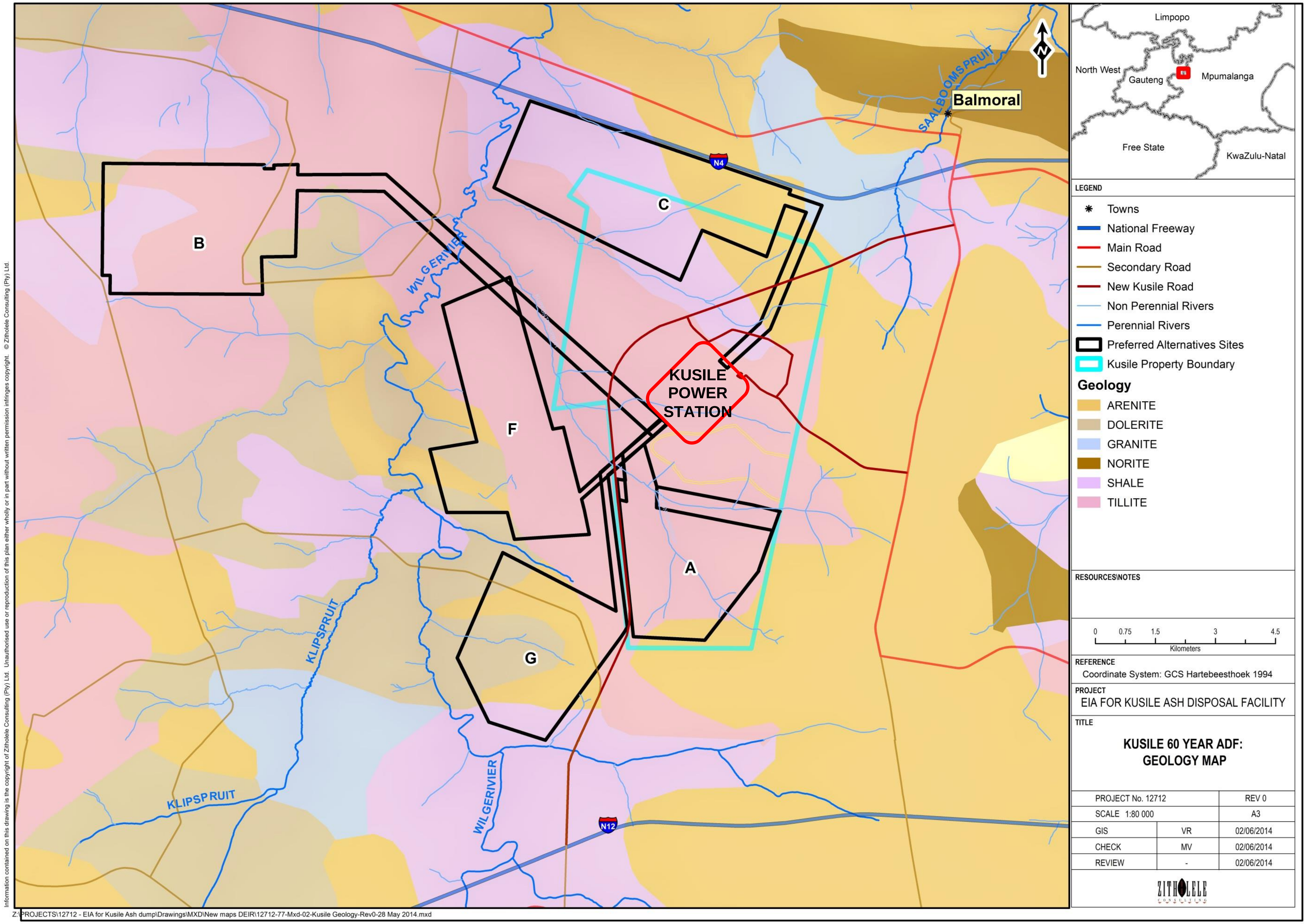

Figure 6-5: Regional geology of the area

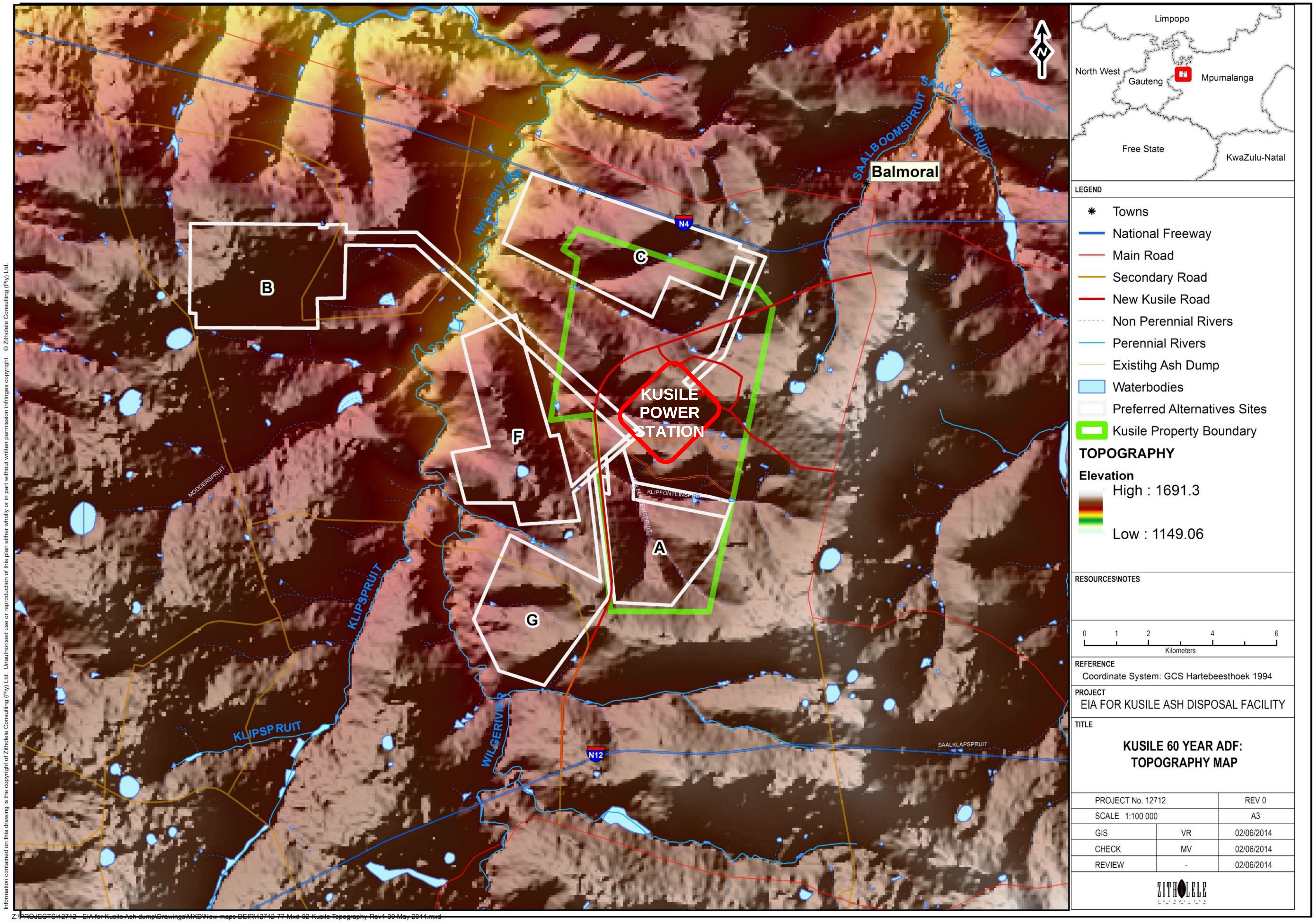

Figure 6-6: Topography of the area

6.5 SOILS

6.5.1 Data Collection

Information used to describe the baseline soil conditions for this study included:

- Studies completed for New Largo and the new Kusile Power Station;
- 1:250 000 and 1:50 000 scale topocadastral maps, Land Type Mapping and aerial imagery;
- Interaction with the Kusile SHEQ manager and his personnel, as well as local farmers and land owners; and
- A field inspection to determine pedological/soil patterns, geomorphological character, and the present land use.

6.5.2 Regional Description

The major soil types mapped within the study area reflect the host geology/lithologies of the parent materials, while the topography and climatic conditions that prevail have further influenced the paedogenesis and soil forms present. Noticeable to the sites investigated was the presence of Karoo sediments and quartzite, the structural impacts of intrusive dolerite dykes and sills, the associated fracturing and possible faulting of the country rock, and the subtle but important influence of the flat to undulating topography, with localised steep slopes and resultant shallow profiles.

These geomorphological characteristics are further influenced by the negative water balance and semi-arid environment, with the effects of evaporites and the development of laterites being highlighted as aspects of importance to the ecological status, and conditions that will influence the capability of the land.

The major attributes of the groupings of soil include (Figure 6-7):

- Deep (>750 mm) clay rich loams;
- Deep (>750 mm) sandy and silty loams;
- Moderately (500 mm to 750 mm) deep clay and sandy clay loams;
- Moderately (500 mm to 750 mm) deep sandy and silty loams;
- Shallow (<500 mm) clay rich sandy loams and sandy clay loams;
- Shallow (<500 mm) silty loams;
- Moderately deep (00 mm to 750 mm) but rocky sandy loams;
- Shallow (<500 mm) and rocky (>30 % stone and rock in profile);
- Areas of outcrop or sites with >80 % rock at surface, and
- Wet based soils with a variety of depths and clay composition.

In terms of the taxonomic classification used, the major or dominant soil forms mapped include those of the orthic phase Hutton, Clovelly, Glenrosa and Mispah forms with sub dominant soils of the Valsrivier and Shortlands Form, while the major hydromorphic forms mapped include the Glencoe, Dresden, Avalon, Pinedene, Bainsvlei and Westleigh, with significant area of glaycutanic structure associated with the bottom lands and flood plain environment.

In assessing the detail for soils occurring within and surrounding Site “B” the following dominant soils were mapped:

- Deep (>750 mm) sandy loams and sandy clay loams of the Hutton, Clovelly and Griffin Soil Form, with sub dominant Clovelly, Glencoe and Avalon soil Forms;
- Moderate to deep (500 mm to 750 mm) sandy clay loams and silty loams of the Hutton, Clovelly and Glencoe soil Forms;
- Minor areas of moderate to shallow (300 mm to 500 mm) sandy clay loams with minor gravel and stone lines;
- Areas of shallow wet based soils comprising clay loams and silty clay loams comprising for the most part Westleigh, shallow Avalon and Kroonstad form soils, and
- Minor areas of shallow (<300 mm) to outcropping lithologies that comprise Glenrosa and Mispah form soils.

The majority of site B comprises good grazing and moderate to good arable potential land capability ratings (>70 % of the area). The wet based soils and potential wetlands occur in the lower lying areas and are associated with a soft plinthic and/or hard plinthite layer at the “C” horizon.

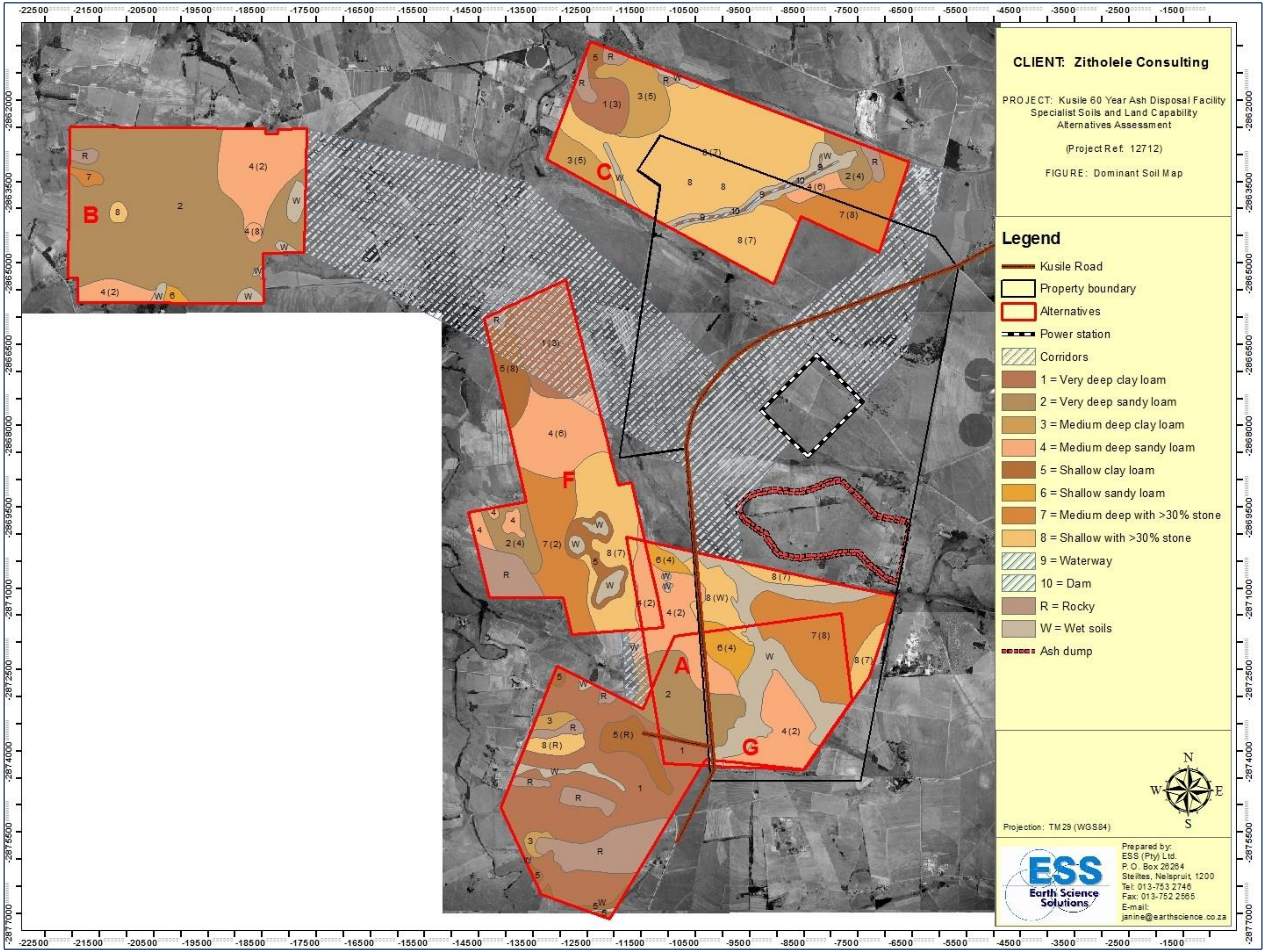

Figure 6-7: Dominant soils map: all sites

The semi-arid climate and negative water balance combined with the horizontal attitude of the sedimentary host lithologies that characterise the Karoo sediments have resulted in ferricrete or laterite (Ouklip) formation as a dominant feature of many of the soils, with varying degrees of formation and depth of occurrence. The presence of a hard pan ferricrete (Hard plinthic horizon) or soft plinthite is considered of importance to the soil moisture and in many cases is the reason for wet features within the soil profile (barrier layer). This moisture is important to the biodiversity, the presence of pans and water features within the landscape, and the success or failure of the wetland systems. These soils are thus classified as highly sensitive.

In addition to the geomorphological aspects mentioned above, soil texture and structure also played a role in the soil classification and the resultant sensitivity of the materials mapped. The fine (sediment) to medium (quartzite) grained nature of the topsoils, the relatively low clay content (<15 %) and the generally low organic carbon renders the majority of the soils highly sensitive to erosion. This is only tempered by the relative flatness of the topography, with a resultant moderate to low erosion index for most of the site. These ratings assume that the soils are well protected and the vegetative cover is not disturbed. Once the cover is disturbed or removed, the potential for erosion is increased.

Effective rooting depths on site vary from as shallow as 200 mm on the upper and midslopes to over 1500 mm on the colluvial derived materials in the lower and stream channel accumulations. The shallow rooting depths (200 mm to 400 mm), with an orthic topsoil on a lithocutanic subsoil (Glenrosa) are common place across the candidate site (site C), whilst the opposite is noted on site B where the soils are for the most part greater than 600 mm deep, and a significant proportion of the site is greater than 800 mm.

Hydromorphic soils, often associated with wetlands or the transition to wetlands, are generally found associated with either perched seep zones were the soils have been restricted within a concave land form, or on the lower moist grasslands and valley slopes where the major wet zones occur. In contrast to the transition zone soils described above, the wetland soils are by definition soils with more defined hydromorphic characteristics. These soils are for the most part saturated all year round to a depth of 500 mm below surface.

Depths of utilisable soil (to top of mottled horizon) vary from 300 mm to 600 mm for the majority of the sites assessed, while site B returned depths of between 600 mm and 1 200 mm on average.

6.5.3 Soil Erodibility

The erosion indices for the dominant soil forms on the study site are classified as having a moderate to high erodibility index. This is largely ascribed to the low, or at best moderate clay content of the “A” horizons, and the low organic carbon content. These factors are tempered somewhat by the relative flatness of the terrain for all but a few areas, and the generally well conserved vegetative cover (all but the shallow soils and over utilised valley bottoms).

It should be noted however, that the vulnerability of the subsoil's to erosion once the vegetative cover and topsoil layer have been disturbed is markedly higher than for undisturbed soils. Good management of these soils for erosion and compaction will be essential.

6.6 PRE-MINING LAND CAPABILITY

6.6.1 Data Collection

The land capability of the study area was classified according to the Chamber of Mines Guidelines (1991). The criteria for this classification are set out in Table 6-2 below. The criteria are based on dryland cropping, on an average cropping regime and average climatic conditions for the region.

Table 6-2 : Criteria for pre-mining land capability (Chamber of Mines, 1991)

Criteria for Wetland

- Land with organic soils or supporting hygrophilous vegetation where soil and vegetation processes are water dependant.

Criteria for Arable land

- Land, which does not qualify as a wetland.
- The soil is readily permeable to a depth of 750 mm.
- The soil has a pH value of between 4.0 and 8.4.
- The soil has a low salinity and SAR
- The soil has less than 10% (by volume) rocks or pedocrete fragments larger than 100 mm in the upper 750 mm.
- Has a slope (in %) and erodibility factor (K) such that their product is <2.0
- Occurs under a climate of crop yields that are at least equal to the current national average for these crops.

Criteria for Grazing land

- Land, which does not qualify as wetland or arable land.
- Has soil, or soil-like material, permeable to roots of native plants, that is more than 250 mm thick and contains less than 50 % by volume of rocks or pedocrete fragments larger than 100 mm.
- Supports, or is capable of supporting, a stand of native or introduced grass species, or other forage plants utilisable by domesticated livestock or game animals on a commercial basis.

Criteria for Wilderness land

- Land, which does not qualify as wetland, arable land or grazing land.

Based on the outcomes of the soil study and the geomorphological information gained during the site inspection, the various sites were rated in terms of their land capability. Site B has a significant proportion of area that rates as arable land potential. Site C, in contrast, is dominated primarily by soils that rate as wilderness or low intensity grazing land (Figure 6-7, Figure 6-8).

6.7 SURFACE WATER

6.7.1 Data Collection

Data for this study was obtained from the Department of Water Affairs and fieldwork sampling.

6.7.2 Catchment Area Description

The proposed project sites are located in the Wilge River Catchment in quaternary catchment B20F. The quaternary catchment B20E is located upstream of B20F (Figure 6-9). The Wilge River joins the Olifants River from the west upstream of Loskop Dam. The extensively mined Witbank Dam and Middelburg Dam catchments are located upstream of the confluence of the Wilge and Olifants Rivers. The Bronkhorstspruit is the major tributary of the Wilge River. The Bronkhorstspruit Dam is located on the Bronkhorstspruit upstream of the town of Bronkhorstspruit in quaternary catchment B20C. The dam supplies Bronkhorstspruit with water. Water is also transferred from the Bronkhorstspruit Dam into the Western Highveld Region in the upper Elands River Catchment to meet domestic and industrial water requirements. The proposed project sites are located in the adjacent catchment and therefore they do not impact on the water resources of this water supply system. A portion of the site B falls within B20D. For the purposes of this analysis, the footprint for the site B is taken as being in B20F.

The Wilge Dam (formerly Premier Mine Dam) is located downstream of the Bronkhorstspruit Dam at the confluence of the Bronkhorstspruit and Wilge Rivers. Water is abstracted from this dam to supply the town of Cullinan and the Cullinan diamond mine. Water is released from Bronkhorstspruit Dam to support the abstraction from the Wilge Dam. The proposed project sites are located upstream of the Wilge Dam. The Wilge River flows through the Ezemvelo Nature Reserve which is located immediately below the confluence of the Wilge and Bronkhorstspruit Rivers. This section of the Wilge River is regarded as Ecologically Important and Sensitive and hence has been given an ecological sensitivity category of “B”.

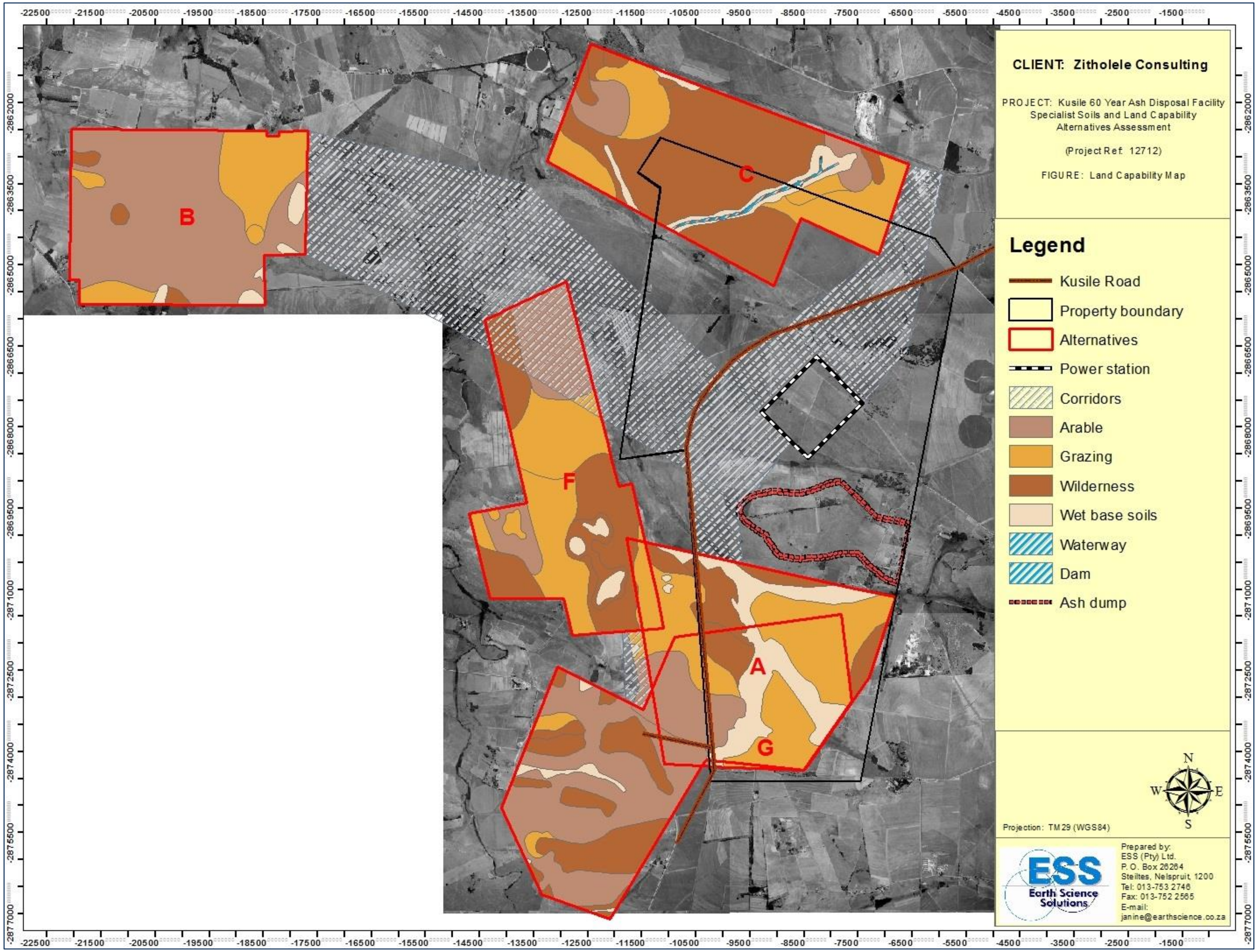

Figure 6-8: Land capability plan: all sites

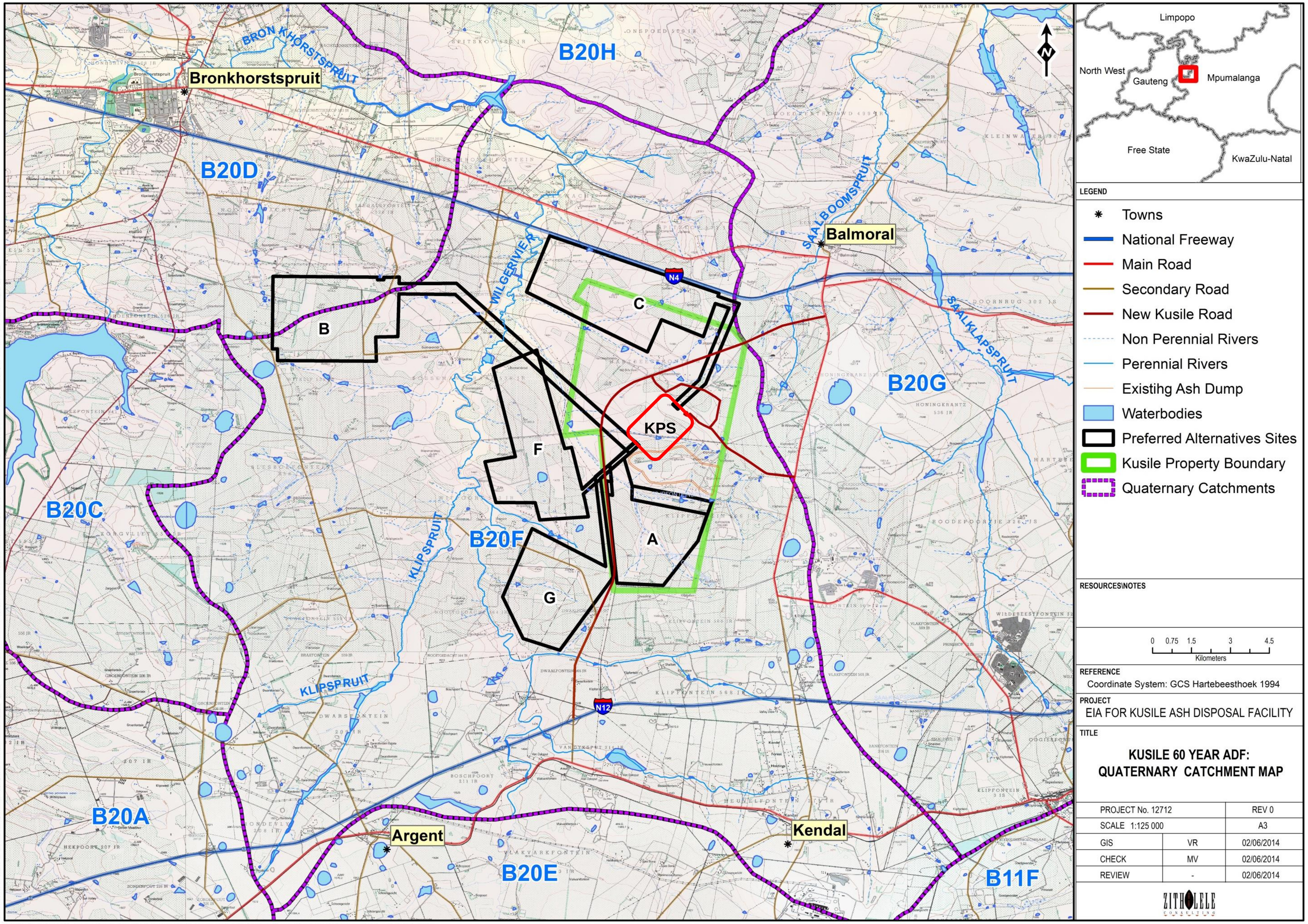

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Figure 6-9: Sub-catchments of the project study area

The Wilge River water quality is currently good and serves to dilute the poorer quality water in the Olifants River impacted by the coal mining activities in the upstream Witbank Dam, Middelburg Dam, Spookspruit and Klipspruit catchments.

The Wilge River catchment is largely agricultural with Bronkhorstspruit being the major urban area in the catchment. There are numerous farm dams in the catchment which support irrigation. The catchment is not as extensively mined as the Witbank and Middelburg Dam Catchments. There are however some coal mines located in the catchment. The available mine plans show that the mining areas are going to grow in the catchment in future. The downstream Loskop Dam supplies large volumes of water for irrigation. The sizes of the catchment areas are listed in Table 6-3.

Table 6-3: Catchment Areas

Catchment	Area (km^2)
Quaternary B20E	620.0
Quaternary B20F	505.0
Wilge River Catchment	4277.0
Loskop Dam	4356.0

6.7.3 Classification of the Resources

The Department of Water and Sanitation (DWS) has completed the classification process for the significant water resources of the Olifants Water Management Area (WMA). The process included stakeholder engagement for input in recommending the classes for the Integrated Units of Analysis (IUA) defined for the WMA. The management class for the Wilge River was set as a 2 with an overall ecological category of a C for the IUA. A class of 2 implies moderate usage of the water resource in future. In fact the status quo in the river system has to be at least maintained. The recommended classes resulting from the study still have to be gazetted. The classes will be gazetted in 2014 together with the Resource Quality Objectives (RQO). The DWS study to set RQO for the Olifants WMA has started. The RQO set will be based on the classes set during the classification process. The level of protection provided by a Class 2 means that any developments in the Wilge River will have to ensure that loads discharged to the receiving environment and the impacts on the flow are small.

6.7.4 Water Quality

Grab samples were taken during the period of 2008 to 2013. Once-off sampling was also undertaken in the upper reaches of Wilge River just before the Klipspruit tributary and further downstream on tributaries flowing into the Wilge. This was done mainly to determine the baseline water quality in the area as the sampling points were in close proximity to where the sites G and B are to be located. A summary of these results showing a comparison of the 95th percentile concentration for each parameter against the interim RWQOs can be found in Appendix F. The locations of sampling points can be seen in Figure 6-10.

The overall chemical water quality within the study area is relatively good. However some sampling points indicate high levels of total dissolved solids (TDS), conductivity (EC), fluoride (F), sulphate (SO4) and iron (Fe), all indicative of pollution from mining activities. These parameters were mainly detected at the following points:

- SW1 and SW7 both of which are tributaries that drain Kusile co-disposal area,
- Spring 6 which is the most downstream point from New Largo mine on Klipfonteinspruit, and
- SW11 which is at the confluence of the Wilge River and the Klipfonteinspruit.

The overall microbiological results show high levels of *E. coli*, possibly indicating cattle and human impacts within the study area.

Additional samples taken in February 2013 at points KSA01- KSA09 show good chemical and physical water quality with some exceedances in iron and manganese concentrations, but the bacteriological quality at the time of sampling was generally poor.

6.7.5 Present Ecological State and Ecological Importance and Sensitivity

The Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) were determined during the recently completed classification study. The Bronkhorstspruit, Saalboomspruit and Upper Wilge rivers were found to be in a moderately modified state (Category C) with less developed areas present in the catchment. The importance of the resources is moderate especially in terms of good water quality contributed to the main stem Olifants River above Loskop Dam. Therefore, it was proposed to maintain the current PES category within the catchment. A Management Class II was recommended. This means that the area can be moderately used and that the water resource could be moderately altered from its pre-development condition.

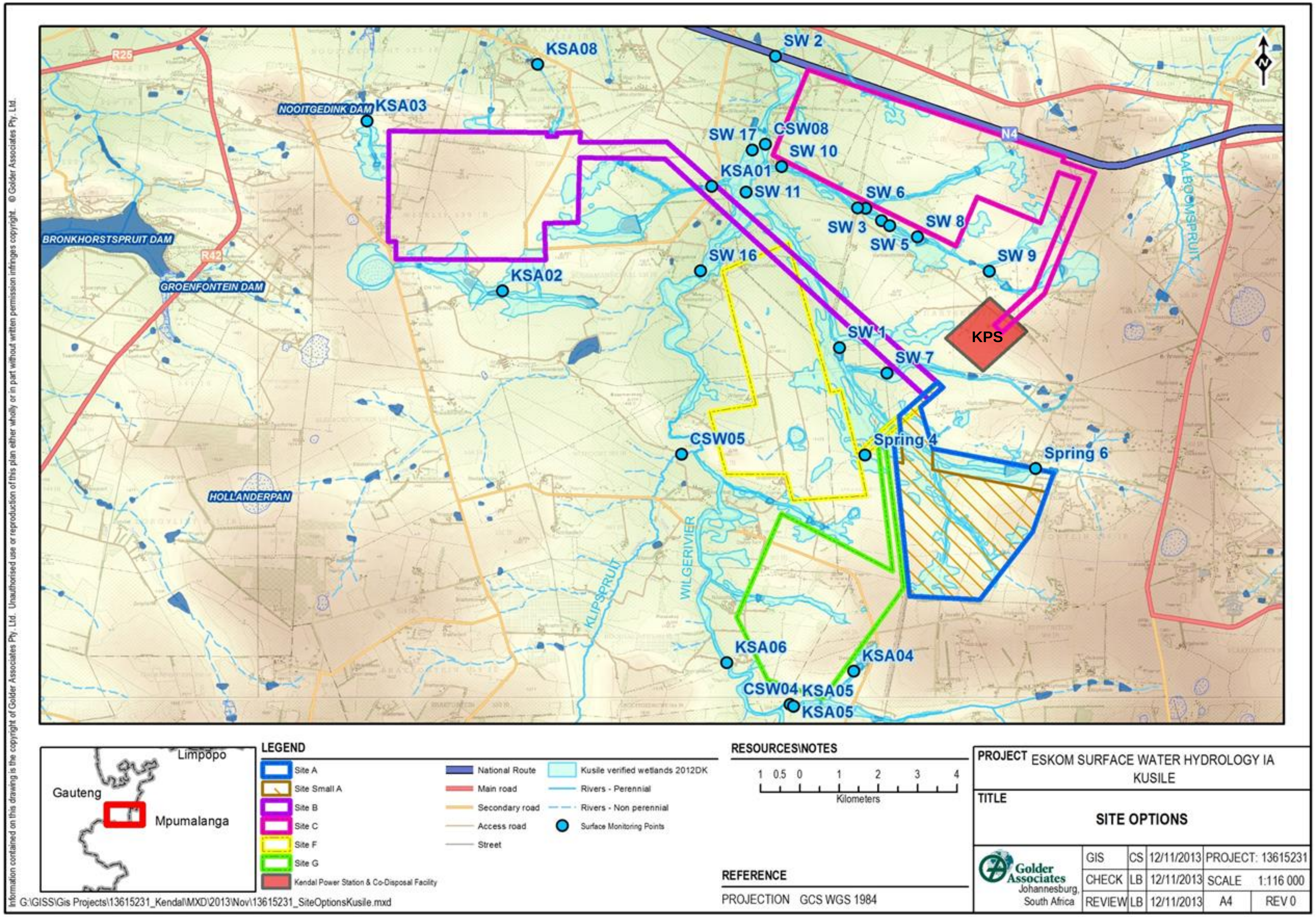

Figure 6-10: Water monitoring points in relation to the proposed site alternatives

6.8 GROUNDWATER

6.8.1 Data Collection

Several field investigations were conducted between December 2012 to February 2013 as part of the groundwater investigations, to better understand the baseline geohydrological conditions (flow and quality). Information was collected from the existing groundwater and surface water monitoring network and included depths to groundwater levels in the boreholes, and water quality. Groundwater samples were also collected from newly drilled boreholes and submitted to UIS analytical services laboratory in February 2013 for analysis.

Information from the groundwater report for New Largo (conducted by JMA consulting, July 2012) was also used to better understand the geohydrological conditions (aquifer mechanics and geo-hydrochemistry) in the study area, especially in the south-eastern section (around alternative sites A and G) of the present study area.

A Hydrocensus was conducted within a two kilometre radius of all the proposed site alternatives, resulting in a hydrocensus footprint of 459.2 km^2. A total of 131 (102 boreholes, 2 natural springs, and 27 surface water points) water points were considered during the hydrocensus. Detailed results for the hydrocensus are presented in the groundwater specialist study in Appendix F.

Constant pumping tests undertaken to determine drawdown of aquifers was analysed using different methods provided in the programme Flow Calculation (FC) developed at the Institute of Groundwater Studies (IGS/UFS).

6.8.2 Regional Description

The general hydrogeological characterisation of each geologic unit (formation) present in the study area is summarised in the. The very poor storage capacity due to ortho-quartzite in the Daspoort formation, has to be noted. The occurrence of springs in the area are generally originated from the Magaliesberg formation, or associated with contacts between sandstone and shale, along fault zones and along impermeable dolerite dykes in the Vryheid formation.

Very little information was found on recharge in the study area. Bredenkamp (1978) estimated an average recharge value of 8 % by correlating groundwater level fluctuation with rainfall in the Silverton formation. The recharge is estimated by Vegter et al. (1968) at 4 to 5% of the mean annual rainfall in Vryheid formation.

Table 6-4: Geological sequence with associated aquifer(s)

Formation	Class of aquifer	Groundwater occurrence	Maximum borehole yield l/s	Range of water level (m) bgl
Daspoort		Faults; shear zones; contact zones of intrusive diabase sills with shale and quartzite horizons; occasional joints in fresh diabase	--	10 and 30
Magaliesberg	(B) Fractured aquifer	Fractures, contact zones with diabase sills, faults and associated shear zones	9.30	10 and 40
Rayton	(D)Intergranular and fractured aquifer	Zones of its different quartzite horizons and shale beds	--	20
Silverton	(D)Intergranular and fractured aquifer	Shale brecciated (jointed) zones, contacts zones between intrusive diabase sheets and the shale.	20.00	10 – 80
Loskop	(D)Intergranular and fractured aquifer	Fractures associated with the intrusion of acidic lava, contact zones between its different sediments	6.40	10 and 30
Dwyka	(D)Intergranular and fractured aquifer	Upper weathered tillite	4.4	--
Vryheid	(D)Intergranular and fractured aquifer	Weathered and fractured sedimentary rocks not associated with dolerite intrusion, indurated and jointed sedimentary rocks alongside dykes, narrow weathered and fractured dolerite dykes, weathered dolerite sills and jointed sedimentary rocks, weathered and fractured upper contact-zones of dolerite sills, weathered and fractured lower contacts-zones, and coal seams.	12.60	5 – 25
Ecca	(D)Intergranular and fractured aquifer	Fractures and joints developed locally along bedding planes, contact zones between different lithologies, fault and associated shear zones, extensively developed fractures	9.20	--

The current Kusile Power Station monitoring network has been designed and developed to comply with the recommendations and requirements of the EMPr and existing Kusile Power Station Water Use Licenses. The depths to water levels in the Kusile Power Station area range from 1.48 to 28.94m with an average of 9.48 m below ground level. Based on the unacceptable quality of 82% of the samples, it was concluded that groundwater resources at the Kusile Power Station are not suitable for domestic water use as a result of high values for turbidity, iron, manganese, aluminium, and Coliforms concentration or a combination of any of these constituents.

The groundwater report for New Largo (conducted by JMA consulting, July 2012) revealed that the most prominent aquifer present in the New Largo project area is the unconfined to semi-unconfined laterally extensive shallow weathered zone aquifer within the Ecca, Dwyka, and Pretoria Geological Groups. The average thickness of this aquifer is of 20.77m. Some non-significant isolated perched aquifers have been identified in the north-eastern part of the New Largo project area. Depths to groundwater levels measured during JMA's study ranges from 2.14m to 19.86m below ground level, with an average of 8.78m. The blow yields recorded from the aquifers at the New Largo project area ranges from 0.01ℓ/s to 3.33ℓ/s with an average of 0.23ℓ/s. The transmissivity ranges from 0.02 to 42.22 with an average of 5.06 whereas the average storativity is 0.002. The effective porosity at the New Largo site is estimated to vary from 0.01 to 0.07, with an average value of 0.05. The groundwater recharge was estimated to be between 3% and 7%.

Background water quality in the New Largo area has been described as calcium/magnesium bicarbonate water to slightly sodium bicarbonate/chloride water with HCO3- predominant anion. The pH varies between 6.02 and 9.20 and the Electrical Conductivity (EC) varies between 1.5mS/m to 34mS/m. There is an artificial aquifer associated with the historical underground mine works in the New Largo project area.

EC profiling collected from 3 boreholes (LGW-B15, LGW-B16, LGW-B24) in the New Largo project area suggests that fresh water is flowing at depths between 12.5 and 13.5 mbgl.

6.8.3 Water Use

Based on information from the hydrocensus, 72% of the existing boreholes are utilised for crop farming and livestock, 23% are for domestic use and 5% for other purposes.

6.8.4 Water Level

The plot of these available elevations against the ground surface elevations indicated a correlation of 98.83%, suggesting semi-confined to unconfined aquifer types in the study area. The high correlation also indicates that groundwater drainage in the study area mimics that of the surface water as a function of the topography, and that the Bayesian interpolation technique can be used to generate water elevations where water levels could not be used. A few deviations from typical characteristics (correlation) are observed and may be related to over-pumping from some boreholes (KABH93, KABH87, KABH20), and geologic heterogeneity.

Groundwater elevations, in general fluctuate between 1330 m and 1580 m above mean sea level (Figure 6-11). The analysis of the depths to groundwater levels and groundwater elevation maps, suggests that the groundwater uses (quantitative) in and surrounding the different alternative sites, does not dramatically impact on the natural groundwater drainage, except in the alternative site F where a clear cone of depression can be seen around KABH93.

However analysis of the groundwater level time series data (May 2009 to May 2013) obtained from the monthly water monitoring at the Kusile Power Station, shows in general, a clear downward trend. This implies a general reduction in groundwater storage during this monitoring period. The reason of this decreasing trend in groundwater storage is unclear, but a combination of natural processes (climate) and man-made stresses are suspected.

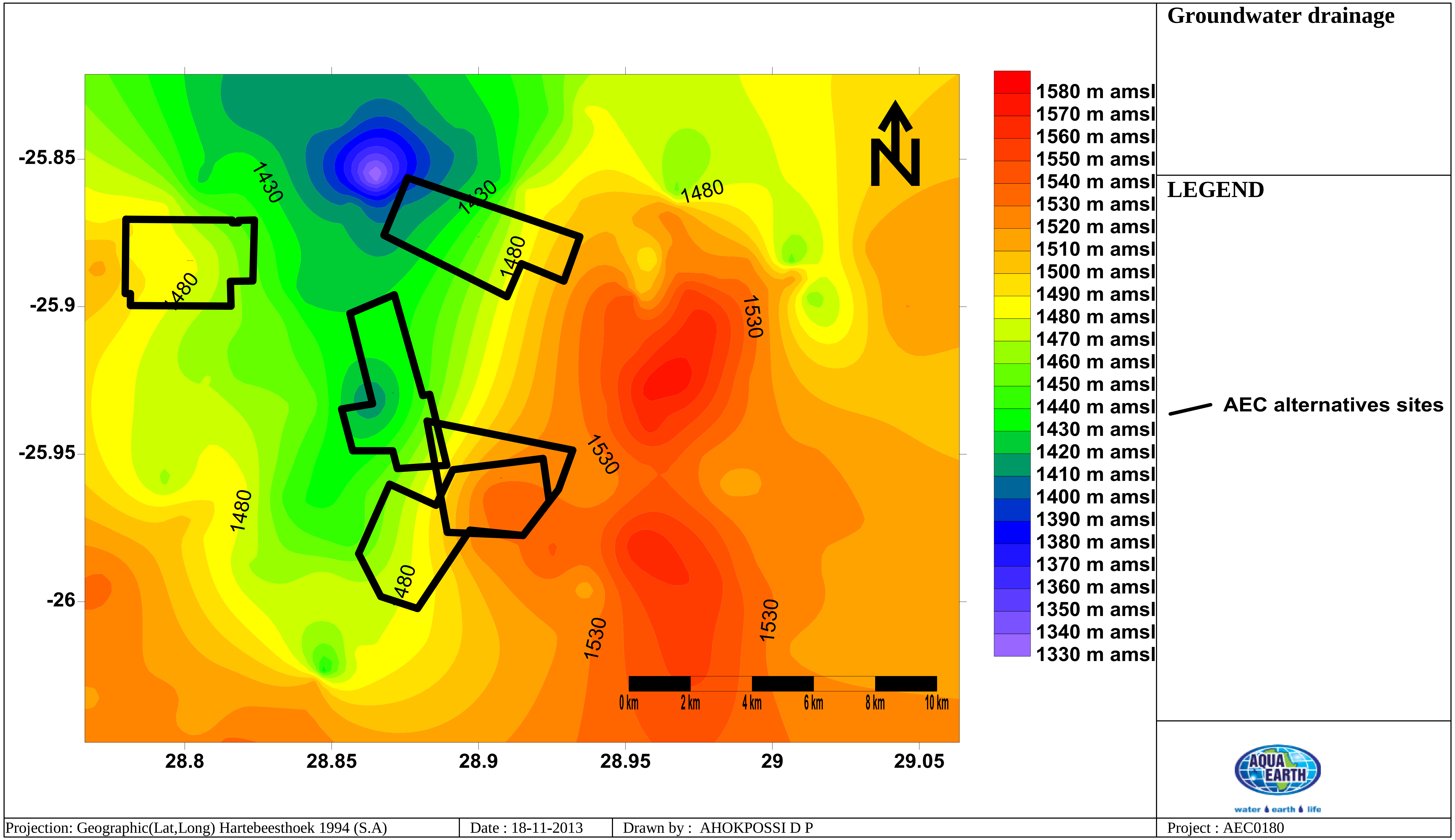

Figure 6-11: Groundwater drainage

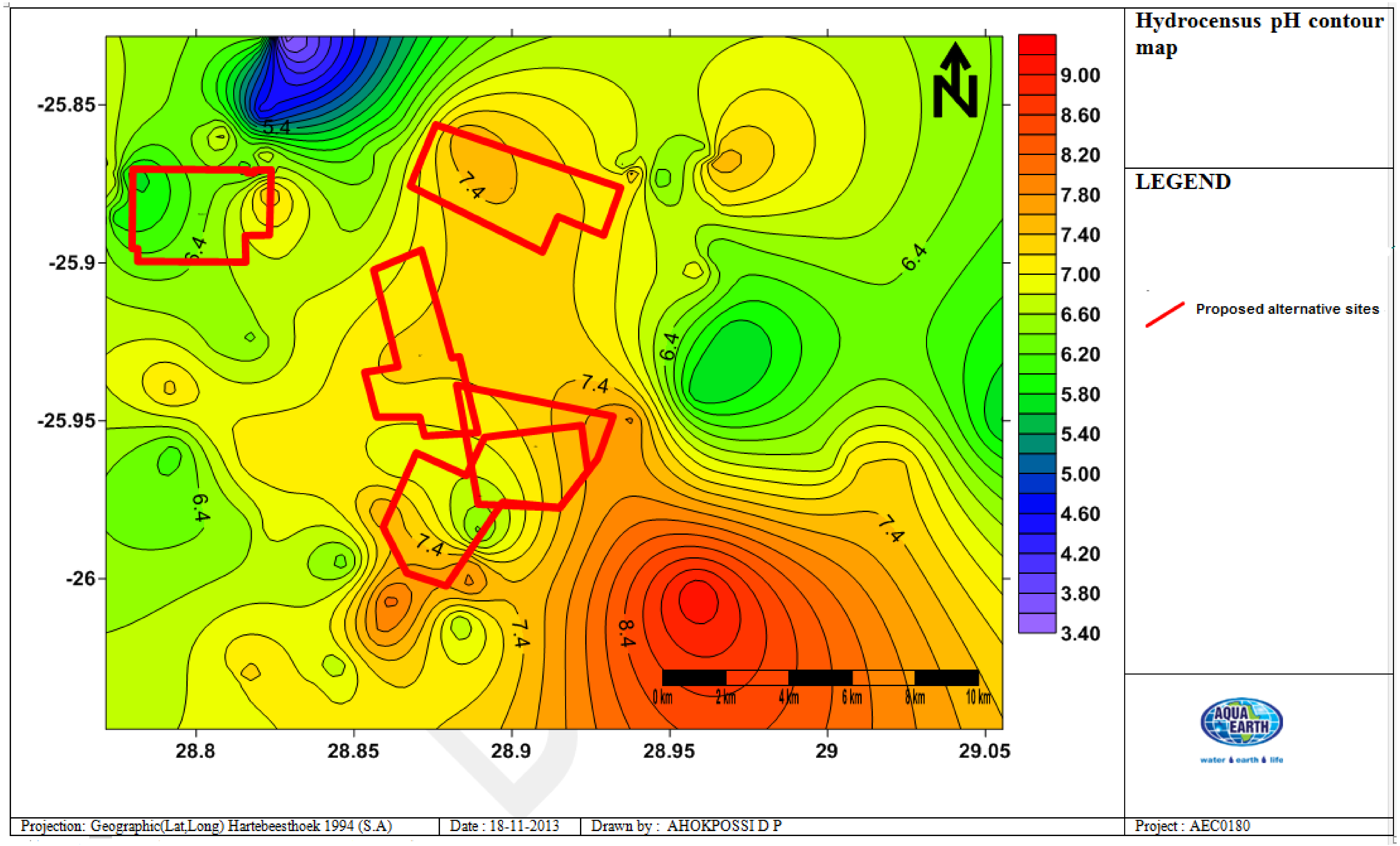

Figure 6-12: Hydrocensus results: pH contours

6.8.5 Water Quality

The pH contour map reveals slightly alkaline water occurring at the south-east of sites A and G (New Largo), within the boundaries and east of site C (Figure 6-12). Opencast mining areas (rehabilitated and not) were noticed at the east of site C during the hydrocensus, and may be the source of alkaline waters.

All the surface water samples indicated water quality that falls within the recommended operational limits for all the constituents measured, except for KASW20 for which the iron (Fe) content was above the operational allowable limit and for KABH96 situated south-west of site F, where the Manganese (Mn) concentration fell within class 2- maximum allowable limits,.

KABH10, situated north-east of site C, indicated sodium bicarbonate/ chloride water quality, which may be related to waste water discharge. The location of the site, in close proximity to Lynnville, supports this suggestion; but this quality could also be related to either irrigation return flow or seepage from the high extraction underground coalmine area, located approximately 700 m west of KABH10. KABH42, situated close to the north-western corner of site B, and KABH62 indicates calcium/sodium, sulphate water quality, suggesting opencast coal mine waters.

All the surface water samples were interpreted as calcium magnesium waters and can be considered as unpolluted.

6.8.6 Geophysical Surveys

Hydrogeological maps and geophysical data in this area has shown that the probability of striking water is greater where the weathering extends to below the piezometric level and on the fractured and contact zones. The majority of sites were selected using the magnetometer survey results. All sites indicated anomalies which were delineated as possible structures (lineaments) and/or contact zones between different geological formations. All these contact zones between geological formations seemed to be aligned along the boundaries of the feasible alternative sites (See Appendix F for detailed map and information).

6.8.7 Drilling

The Iron (Fe) concentrations of samples from KAM8, KAM7, and KAM3, as well as the pH of samples KAM10 fall into the South African National Standards (SANS) class 2 - maximum allowable limit. The fluoride concentration of sample KAM7 falls above the SANS class 2- maximum allowable limit. Except for the high concentration of iron and fluoride, all the other groundwater samples indicated water quality that falls within the class 1 recommended SANS limits.

Groundwater samples from KAM5, KAM2, KAM8, KAM9, KAM10, KAM3, and KAM6 are calcium/magnesium bicarbonate waters (zone B), and are interpreted as unpolluted groundwater. The groundwater samples from KAM7 and KAM1 fall into sodium bicarbonate / chloride waters quality zone (zone C), and are interpreted as polluted waters. Elevated concentrations in KAM7 may be related to the historical underground coal mine activities in the New Largo mining area. This may also explain the slight concentration changes of iron in KAM7 and KAM8, and of fluoride in KAM7.

The location of KAM1 (close to a pan) suggests that the source of the pollution in this borehole may be related to either waste water discharge or irrigation return flow. The same assumptions are made for the alkaline water in the KAM10 and the high concentration of water in KAM3 which are respectively located close to the Wilge River.

6.8.8 Aquifer Pump Testing

The response (drawdown) of the aquifer during the constant pumping tests was analysed using different methods provided in the programme Flow Calculation (FC) developed at the Institute of Groundwater Studies (IGS/UFS). Detailed test data as well as the fitted curves are presented in the groundwater specialist report in Appendix F. JMA consulting estimated the shallow aquifer average storativity to be 0.002, which was comparable to 0.0012 estimated by AEC.

6.8.9 Groundwater Recharge

Preliminary groundwater quantity and quality reserve determination was prescribed by DWS through previous water use licenses (Ref: 28/8/3/3/36; 26/8/3/3/36). Table 6-5 and Table 6-6 present the existing reserve prescriptions.

Table 6-5: Summary of the reserve

Catchment	Area	Recharge	Population	Base flow	EWR	BHN	Reserve as % Recharge
	km^2	Mm^3/a		Mm^3/a	Mm^3/a	Mm^3/a	Mm^3/a
B20F	504	16.81	5000	6.28	2.2	0.05	13.38

Table 6-6: Summary of the groundwater quality reserve

Parameters	Units	Basics human needs	Groundwater quality reserve
General chemistry			
Sodium	mg/l	<200	6.81
Magnesium	mg/l	<100	3.81
Calcium	mg/l	<150	5.39
Chloride	mg/l	<200	3.87
Sulphate	mg/l	<400	3.37
Nitrate	mg/l	<10	0.69
Fluoride	mg/l	<1	0.11
Physical parameters			
pH		5-9.5	7.89
Electrical conductivity	mS/m	150	9.90

6.9 TERRESTRIAL ECOLOGY

6.9.1 Data Collection

A literature review of existing reports, scientific studies, databases, reference works, guidelines and legislation relevant to the study area was conducted to establish a historical baseline condition of the site's ecology. Species lists of potential flora and fauna occurring in the study area, with specific emphasis on Red Data and protected species were compiled.

A field survey was also carried out aimed at determining the general ecological characteristics and flora and fauna composition of the study area. Based on satellite imagery, vegetation communities within the study area were delineated. These vegetation communities were then sampled, by means of line and belt transects for flora. Fauna were sampled at specific sampling sites, by means of traps, spot counts, active searches and observations of their presence (burrows, faeces, tracks etc.). Based on the findings of the field survey, the ecological integrity, suitability as habitat for Red data and protected species and conservation importance of each vegetation community was determined.

6.9.2 General Biophysical Environment

The study area is located in the Eastern Highveld Grassland and Rand Highveld Grassland vegetation types of the grassland biome (Mucina & Rutherford, 2006) (see Figure 6-13).

6.9.3 Conservation Plans

The study area straddles the Gauteng and Mpumalanga provincial boundary and therefore both the Gauteng Conservation Plan and the Mpumalanga Biodiversity Sector Plan are relevant. According to the Mpumalanga Biodiversity Sector Plan (MBSP, 2013) the study area consists of four of the province's biodiversity categories (Figure 6-14). While according to the Gauteng Conservation Plan (C-Plan Version 3.3, 2011) at a provincial level the Wilge River and associated tributaries, as well as various other natural areas in the Gauteng portion of the study area are designated as Irreplaceable, Important, or Ecological support areas (Figure 6-14).

Areas designated as either Irreplaceable or Important are categorised as such based on the presence of one or a combination of Red Data plant habitat, Red Data fauna habitat, primary vegetation and/ or they are form part of a quaternary catchment. As the name suggests, sites delineated as Ecological support areas may not possess features of conservation concern themselves, but these areas are often adjacent to Irreplaceable or Important sites and are thus essential in maintaining the integrity and ecological processes of these important sites.

6.9.4 Flora Assessment

Surrounding Landscape Matrix

The landscape matrix surrounding the study area is highly variable. The most dominate land uses are agriculture and livestock farming and consequently much of the surrounding land comprises either cultivated fields (mainly maize production) or natural/semi-natural grassland used to graze cattle.

Grassland habitats have varying levels of disturbance. Some areas are heavily degraded as a result of *inter alia*, erosion, artificial pasture maintenance, overgrazing and/or encroachment by exotic invasive species. Other natural areas, mostly associated with drainage features (wetlands and streams) and rocky soils, are in good ecological condition with low levels of disturbance.

Various anthropogenic developments and infrastructure are also present in the surrounding landscape and contribute to the overall levels of disturbance. These include inter alia, the Kusile Power Station, mining operations, roads (both gravel and tarred roads), farm fences, artificial dams, agricultural infrastructure (barns) and farms homesteads.

Study Area Characteristics

Seven vegetation communities, comprising three anthropogenic units and four natural communities were recognised in the study area during the 2013 field survey. These were recognised based on species composition, physiognomy, moisture regime, slope and disturbance characteristics. These included:

- Cultivated land (current and former);
- *Eragrostis* pastures;
- Exotic woodlots;
- Dry mixed grassland;
- Moist grass and sedge community;
- *Acacia karroo – Acacia caffra* thickets; and
- Rocky scarp vegetation community.

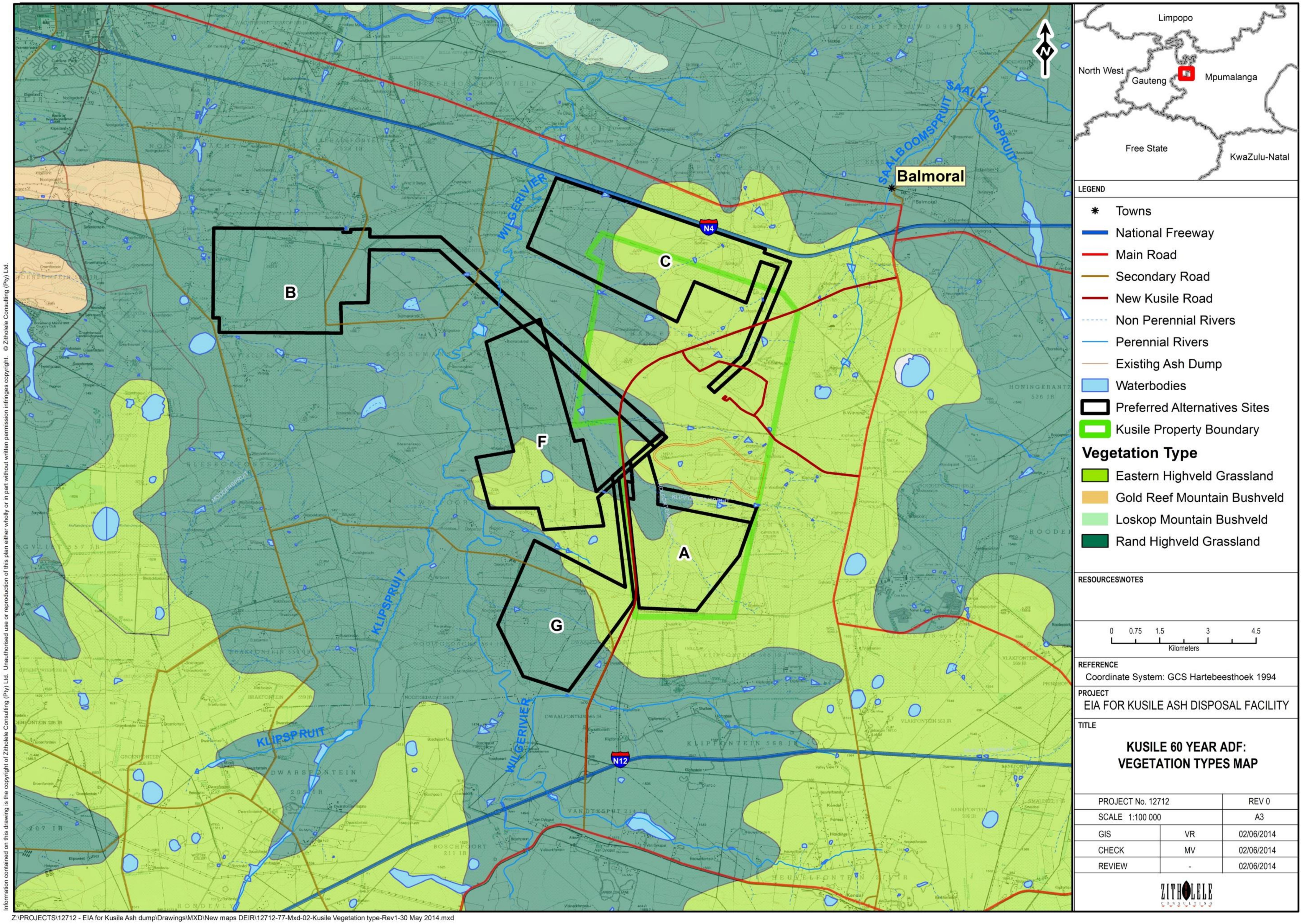

Figure 6-13: Vegetation types of the project study area

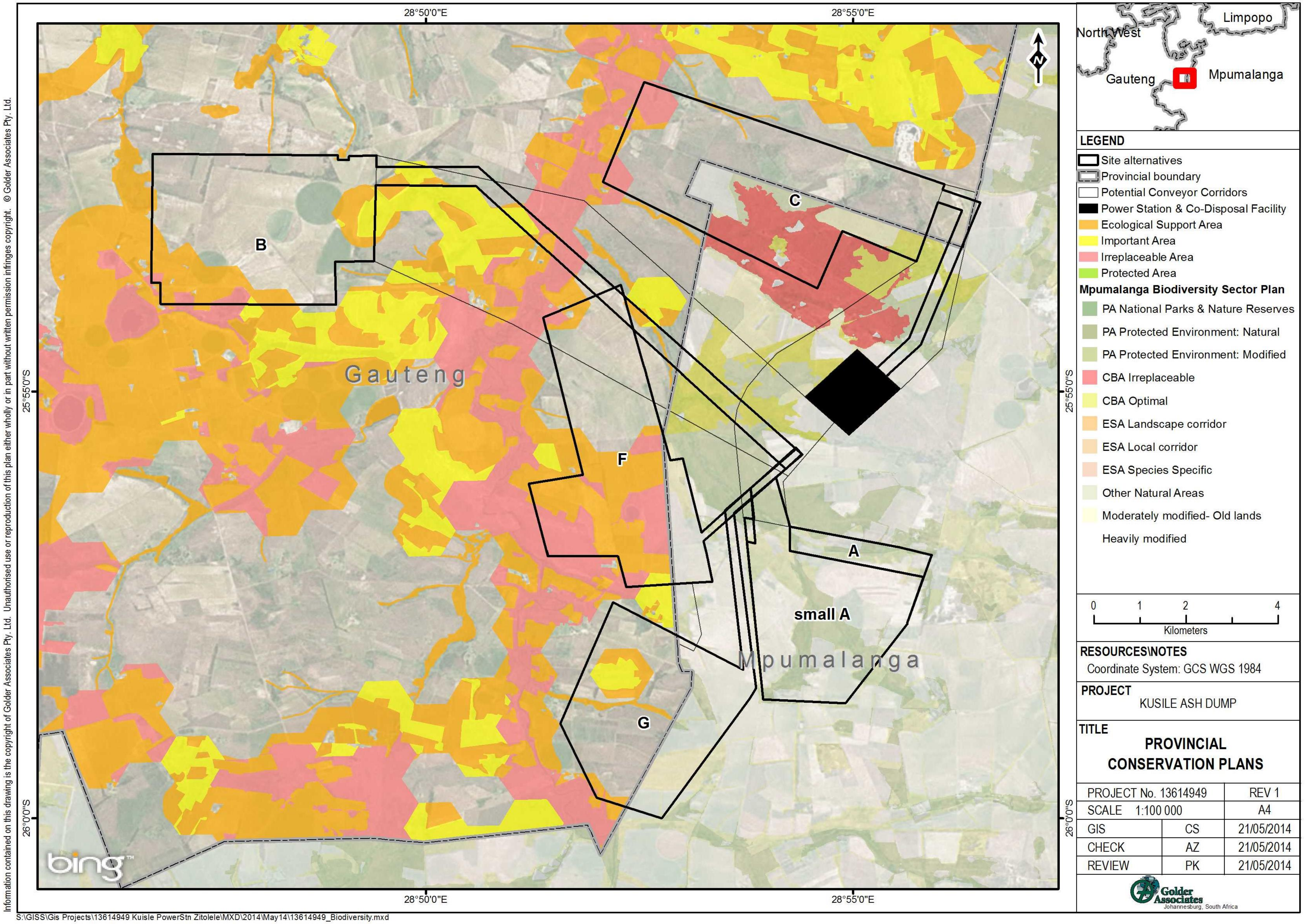

Figure 6-14: Site alternatives in relation to the Gauteng C-Plan and Mpumalanga Biodiversity Sector Plan

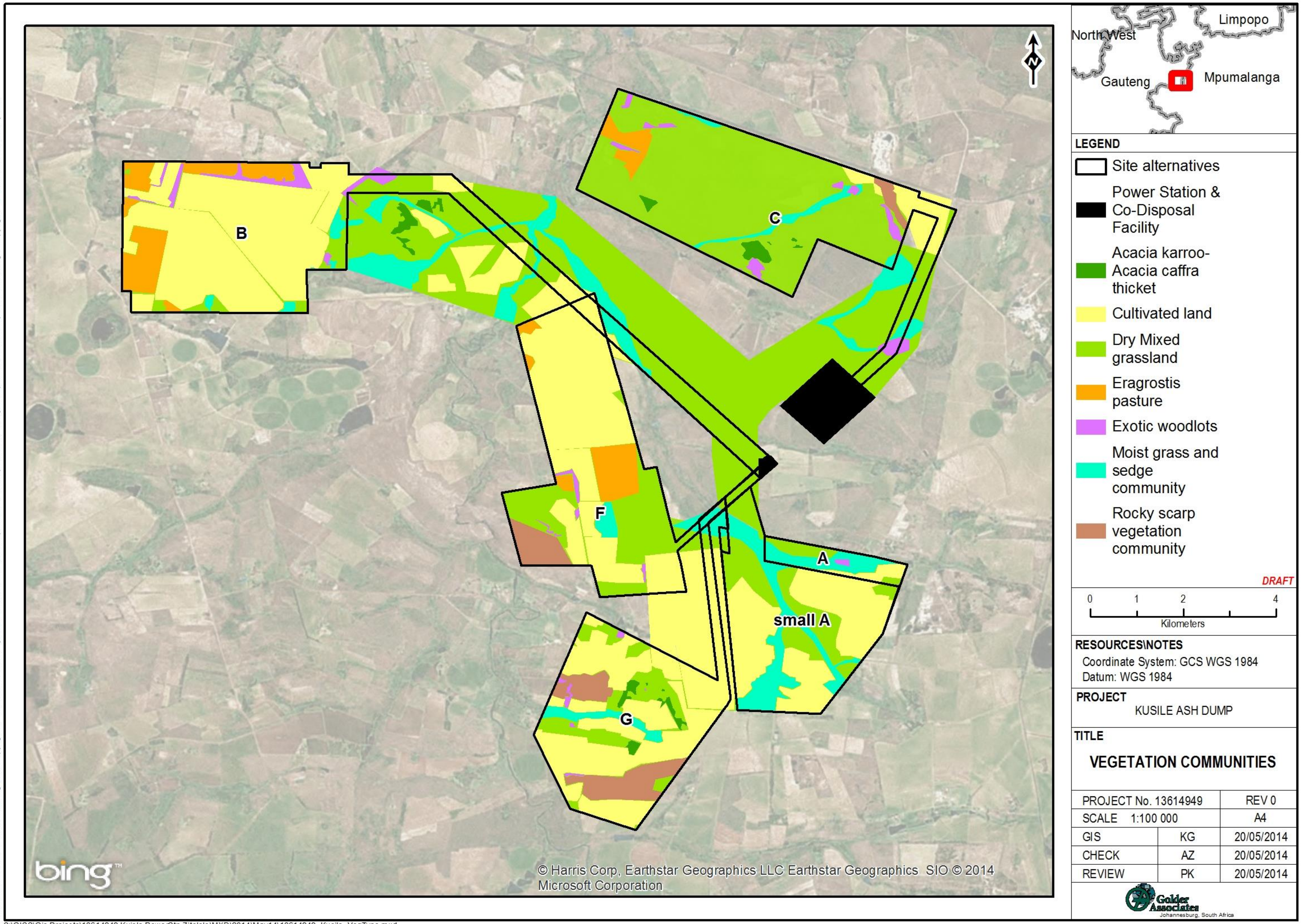

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Figure 6-15: Vegetation communities identified in the study area

Although recorded as such, there is considerable variation within the natural communities as a result of current and historic anthropogenic disturbance and various natural influences. Transformed sites associated with anthropogenic developments (farmsteads etc.) were noted, but were subject to no further investigation.

Table 6-7 reflects the approximate hectares of each vegetation community present in each of the site alternatives and Figure 6-15 shows their respective distributions.

Table 6-7: Approximate area of the vegetation communities at site alternatives in the study area

Vegetation community	Approximate area (ha)				
	Site A	Site B	Site C	Site F	Site G
Cultivated land (current and former)	882	968	39	750	1175
Eragrostis pastures	0	194	55	117	0
Exotic woodlots	3	48	38	12	7
Dry mixed grassland	339	93	1300	326	323
Moist grass and sedge community	253	24	48	24	167
Acacia karroo – Acacia caffra thickets	0	0	25	0	23
Rocky scarp vegetation community	0	0	22	71	165

Refer to Appendix F for a list of flora species recorded in the study area during the 2013 field survey and a list of potential flora species according to the PRECIS database.

Vegetation Community Sensitivities

- **Cultivated land:** These areas are either completely transformed with no natural habitat remaining or are highly degraded. Accordingly, areas of cultivated land, whether they are under current cultivation or not, are considered to have low ecological integrity. No endemic, Red Data or protected species were recorded in the cultivated lands and the probability of such species occurring in this vegetation community is considered low. As a result, the conservation importance of cultivated land is considered **low**.
- **Exotic woodlots**: This vegetation community is regarded as a highly disturbed, exotic vegetation community, with low floristic diversity and low ecological integrity. Furthermore the probability of endemic, Red Data or protected species occurring in this community is considered low. As such, the conservation importance of the Exotic woodlots is considered **low**.
- ***Eragrostis* pastures*:*** This vegetation community is artificial and subject to active management, which includes mowing and the application of fertiliser. Such areas have low floristic diversity and similarly low ecological integrity. Furthermore, the probability of endemic, Red Data or protected species occurring in this community is considered low. As such, the conservation importance of the *Eragrostis* pastures is considered **low**.
- **Dry mixed grassland:** Although many areas comprising Dry mixed grassland are negatively impacted by overgrazing, within the context of the broader landscape matrix, this vegetation community provides valuable and important natural grassland habitat. The ecological integrity of this vegetation community ranges from medium in disturbed areas (dominated by *Hyparrhenia hirta*) to high in less disturbed areas.

Two protected flora species (*Boophane disticha* and *Hypoxis* sp.) were recorded in the Dry mixed grassland during the 2013 field survey and the suitability of this vegetation community as habitat for other Red Data and/or protected species is considered high. Accordingly, the conservation importance of areas of this vegetation community is also **high**.

- **Moist grass and sedge community**: Areas characterised by the moist grass and sedge vegetation community play a critical ecological role in the purification and supply of water and are thus highly valuable hydrological features. Moreover, they also provide important breeding, feeding and dispersal habitat for a variety of fauna, some of which may be Red Data and protected fauna, as well as a threatened flora species such as *inter alia Eucomis autumnalis* and members of the genus *Gladiolus*, all potentially occur in this vegetation community. The ecological integrity of this vegetation community is therefore considered high and accordingly, the conservation importance of these areas is considered **high**.
- ***Acacia karroo - Acacia caffra* stands:** Stands of *Acacia karroo* and *Acacia caffra* are important natural woodland features within the grass dominated landscape. The ecological integrity of these areas is considered high and the probability of endemic, Red Data or protected species occurring in these areas is also regarded as being medium. Accordingly, the conservation importance of areas of *Acacia karroo - Acacia caffra* stands is **high**.
- **Rocky scarp vegetation community:** Areas of rocky scarp vegetation are important heterogeneity features within the larger grassland matrix of the study area. Through the creation of varied microhabitats they provide unique niche habitat for a variety of flora and fauna species that are unlikely to occur in more homogenous grasslands. The ecological functioning of this community is considered high and the probability of endemic, Red Data or protected species occurring in these areas is also regarded as being high. Accordingly, the conservation importance of areas of Rocky scarp vegetation is **high**.

Floral Species of Conservation Importance

Twenty five Red Data and/or protected plant species have historically been recorded in the general vicinity of the study area according to the SANBI SIBIS database and data received from the Mpumalanga Tourism and Parks Agency. These are primarily from the families Mesembryanthemaceae (5 species), Iridaceae (4 species), Orchidaceae (4 species). All have a high probability of occurring in the study area. Plant species of conservation importance recorded in the study area include *Boophane disticha*, *Crinum bulbispermum*, *Hypoxis* sp. and *Gladiolus* sp.

Declared Weeds and Invader Plants

Regulations 15 and 16 of the Conservation of Agricultural Resources Act (CARA) (No. 43 of 1983)[5], as amended, are the only current, active regulations concerning exotic and invasive species in South Africa. Although the National Environmental Management: Biodiversity Act (NEMBA) (No. 10 of 2004) does include provision for exotic invasive species management, this legislation has yet to be finalised and remains in draft format (ARC, 2010).

The following list of plants occurs in the study area and is declared weeds or invasive plants according to the CARA: *Acacia* sp., *Campuloclinium macrocephalum*, *Cirsium vulgare*, *Datura stramonium*, *Eucalyptus* sp., *Solanum mauritianum*, and *Populus x canescens*.

6.9.5 Fauna Assessment

Mammals

Based on the 2013 field survey and previous studies (Golder 2007, Report no. 10613-5792-1 and Du Preez, 2006), 16 mammal species have been recorded in, or adjacent to the study area. These range from small rodents to medium-sized ungulates, the majority of which are fairly-common, to common species with widespread distributions (refer to the Terrestrial Ecology specialist report in Appendix F for species list).

Two Red Data/protected mammal species, namely the Aardvark (*Orycteropus afer*) and Cape clawless otter (*Aonyx capensis*) have been recorded in the study area. The Aardvark (*Orycteropus afer*) is protected in terms of Schedule 2 of the Mpumalanga Nature Conservation Act (No 10 of 1997), while the Cape clawless otter (*Aonyx capensis*) is protected according to the aforementioned Act, as well as the NEMBA TOPS list (2007). Twenty one Red Data and/or protected mammal species potentially occur in the study area (refer to the Terrestrial Ecology specialist report in Appendix F for species list).

Birds

Forty one bird species were recorded in the study area during the 2013 field survey. These are common and widespread species, typically associated with grassland and wetland habitats on the Highveld. Refer to Terrestrial Ecology specialist report in Appendix F for the list of birds species potentially occurring in the study area.

According to Emery, Lotter and Williamson (2002) many of Mpumalanga’s most threatened bird species are dependent on wetlands and the short, dense grasslands and tall grasslands in the province, all of which are found to some measure in the study area.

[5] CARA is in the process of being revised.

Several Greater flamingos (*Phoenicopterus ruber*) were recorded in a pan immediately adjacent to site B in the study area during the 2013 field survey (Co-ordinates 25°54,137' S; 28°46,622' E). This species is listed as Near Threatened by the IUCN and inhabits shallow water bodies, such as pans and lakes where it feeds upon inter alia, small fish, aquatic insects and crustaceans. An additional 15 Red Data species may occur in the area (refer to Terrestrial Ecology specialist report in Appendix F for species names).

Herpetofauna

Seventeen species of herpetofauna have been recorded in the study area and its immediate surrounds (Golder, 2007 Report no. 10613-5792-1 and Du Preez, 2006). These include ten reptile and seven amphibian species. All recorded species are common and not restricted in terms range or habitat. Refer to Appendix F for a list of all herpetofauna species recorded as well as those potentially occurring in the study area.

According to Schedule 2 of the Mpumalanga Nature Conservation Act (No 10 of 1997), all species of reptile excluding both monitor species (*Varanus exanthematicus* and *Varanus niloticus*) and all snakes, are listed as protected. This notwithstanding, the Spotted Harlequin snake (*Homoroselaps lacteus*) which may potentially occur in the study area, has been categorised by provincial authorities as Near-Threatened, while two other species which may also occur in the study area, the Breyer's long-tailed seps (*Tetradactylus breyeri*) and the Striped Harlequin snake (*Homoroselaps dorsalis*), are listed by the IUCN as Vulnerable and Near-Threatened, respectively. The probability that these species occur in the study area is considered moderate.

In terms of amphibians, the Giant bullfrog (*Pyxicephalus adspersus*) is the only listed amphibian that may potentially occur in the study area. According to Schedule 2 of the Mpumalanga Nature Conservation Act (No 10 of 1997) this species is Protected, while the NEMBA TOPS List (2007) and IUCN categorise it as Near-Threatened. The probability of Giant bullfrog (*Pyxicephalus adspersus*) occurring in the moist grass and sedge vegetation community in the study area is considered high.

Arthropoda

Ninety five arthropod taxa have been recorded in, and/or adjacent to the study area. These are all common and widespread species. Refer to Appendix F for a list of arthopoda recorded during the 2013 survey and previous surveys.

The Marsh sylph (*Metisella meninx*) has a high probability of occurring in the study area. This species is listed as Vulnerable according to Henning et al. (2009) and favours wetland and marsh habitats on the Highveld. Within the study area this species potentially occurs in undisturbed sites comprising the moist grass and sedge vegetation community.

Other arthropods of conservation importance that potentially occur in the study area include members of the Ctenizidae (trapdoor spiders) and Theraphosidae families (Baboon spiders). These spiders usually live in burrows or silk-lined retreats, none of which were observed in the study area. That said, on-site habitat is suitable for these species and the probability that they are present is considered moderate.

The following scorpions may occur in the area and are of conservation importance; *Opistacanthus validus* and *Opistophthalmus glabrifrons*. Although these were not recorded in the study area, the probability that they are present is also considered high, particularly in areas of rocky scarp.

6.10 AQUATIC ECOLOGY

6.10.1 Data Collection

Sites were selected to be representative of all the surface water ecosystems within the site alternatives, including the conveyor corridors. Where possible, watercourses were sampled upstream and downstream of the project so as to more accurately identify current impacts arising from the site and to provide a baseline against which future monitoring results could be compared.

6.10.2 Summary of Baseline Aquatic Environment

The Wilge River was considered the most sensitive in terms of aquatic ecosystems. Sites sampled within and downstream of the study area had a high diversity of aquatic macroinvertebrates and a high prevalence of sensitive biota, including the shortfin suckermouth (*Chiloglanis pretoriae*), which is sensitive to changes in water quality, substrate modifications and flow regime. The population of *C. pretoriae* in the Wilge River represents one of the few remaining populations in the upper Olifants River catchment.

A number of Wilge River tributaries had good water quality, notably sampling sites T1 and T2 (adjacent to site G), the Holspruit (site A) and all the tributaries draining site B (B1, B2, B4). It should be noted that site B is located on the catchment divide between two quaternary catchments and thus stands to impact on both the Wilge River and Bronkhorstspruit via the four spring-fed headwater streams draining the site. Water quality was assessed in greater detail in the surface water section.

The Klipfonteinspruit was identified as being the most severely impacted by upstream activities. In particular, high volumes and velocities of water entering the Klipfonteinspruit from upstream developments, including the Kusile Power Station, has caused severe erosion of the channel, thus seriously compromising habitats available to aquatic biota, as well as water quality. The tributary that enters the Klipfonteinspruit from the Kusile construction site had a critically low diversity of aquatic macroinvertebrates and a complete absence of fish as a result of erosion and turbidity.

Finally, the two seasonal pans were considered important and sensitive in terms of potential biodiversity support.

6.11 WETLANDS

6.11.1 Data Collection

Use was made of 1:50 000 topographical maps, 1:10 000 orthophotos and Google Earth Imagery to create digital base maps of the study area onto which the wetland boundaries could be delineated using ArcMap 9.0. A desktop delineation of suspected wetland areas was undertaken by identifying rivers and wetness signatures on the digital base maps. All identified areas suspected to be wetlands were then further investigated in the field.

6.11.2 Wetland Delineation and Classification

The delineated wetlands within the affected areas are shown in Figure 6-16. The wetlands and water resources of the area are dominated by the Wilge River that drains from south to north just 5 km west of the Kusile Power Station. With the exception of Site B, all proposed alternatives are located east of the Wilge River.

The upper section of the affected reach of the Wilge River is confined by a number of rocky ridges and outcrops, and the river is associated with a channelled valley bottom wetland and a narrow riparian zone. To the north of the rocky ridges the Wilge River is characterised by a floodplain wetland with numerous large cut-off meanders and a narrow riparian fringe along the channel. At its widest (the confluence with the Klipfonteinspruit), the floodplain is more than 600 m across.

In addition to the Klipfonteinspruit and its tributaries, a number of further unnamed streams drain towards the Wilge River from the east, though the Klipfonteinspruit is the largest of these.

Table 6-8 below indicates the wetland types and extent (in hectares) recorded within each of the proposed alternatives. In decreasing order of wetland extent (highest to lowest), the six alternatives rank as follows: Site A, Site F + small A, site G + small A, Site C, Site F + G and Site B.

Table 6-8: Wetland type and extent recorded in each of the proposed sites

Footprint	Channelled Valley Bottom	Unchannelled Valley Bottom	Floodplain	Pan	Hillslope Seepage	Dam	Total Wetland Extent in Footprint
A	36.61				187.94	3.11	227.67
B	2.36		3.80		45.55	1.04	52.74
C	8.50				115.23	1.61	125.34
G + small A	19.10	0.10			177.70	0.67	197.56
F + small A	19.64			10.57	180.49	0.22	210.93
F + G	1.27	0.10		10.57	92.03	0.90	104.86

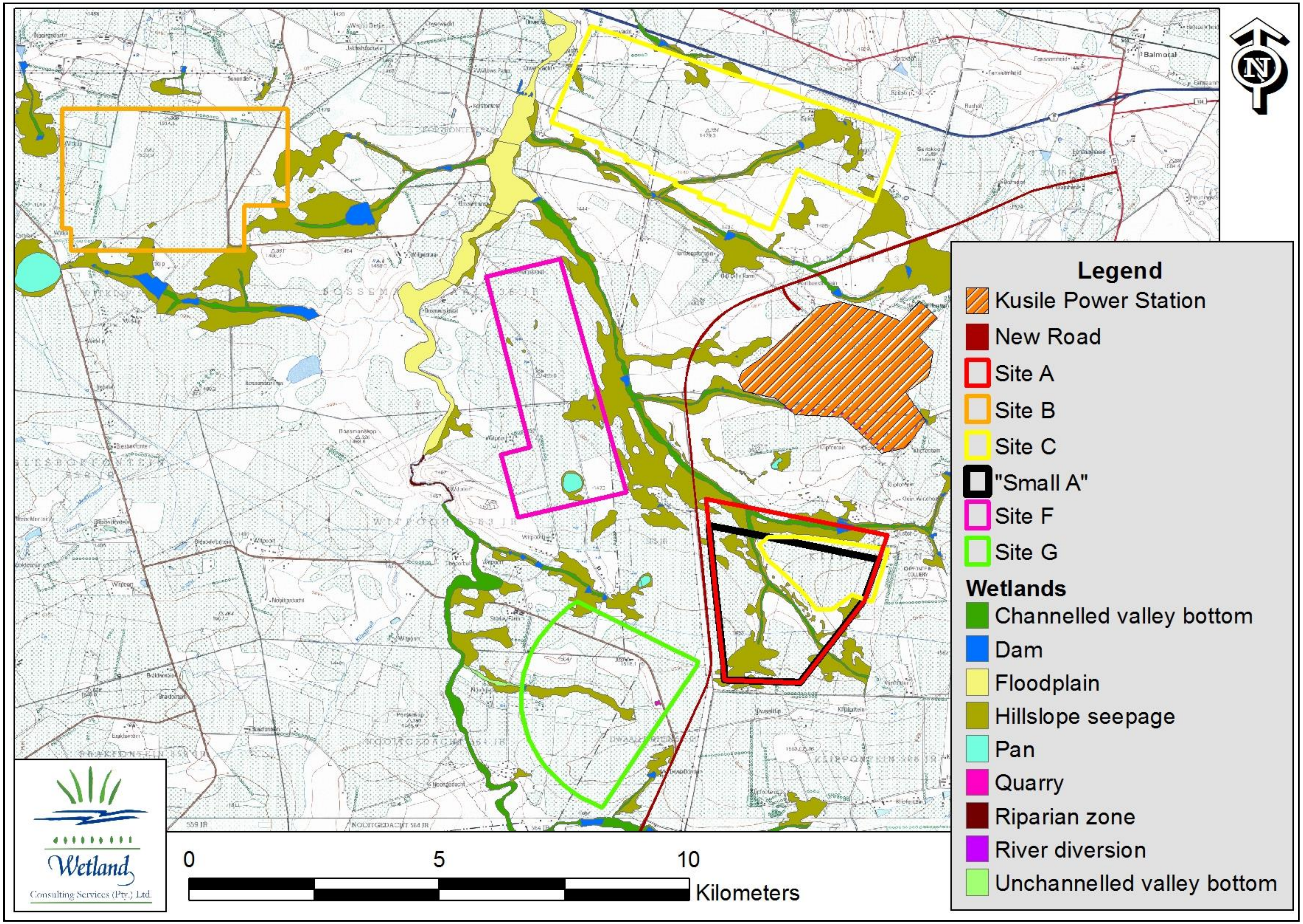


Figure 6-16: Map of the delineated wetlands of site

As the expected impact of the proposed ash dam on wetlands is not expected to be restricted only to the wetlands, the wetlands within the immediate vicinity of the ash dams were also considered. In this regard, a buffer of 500 m was utilised due to its applicability to Section 21 C and I water uses. Site C has the highest wetland extent within its direct vicinity, whilst site A has the lowest Table 6-9.

Table 6-9: Total wetland extent in site footprints and within a 500m buffer. Highest values in red and lowest in green

Footprint	Wetland extent in ash dam footprint (ha)	Wetland extent within 500m (ha)	Combined (ha)	Wetland extent in conveyor footprint (ha)	Wetland extent within 500m (ha)	Combined (ha)	Total (ha)
A	214.98	126.35	341.33	5.33	95.36	100.69	442.02
B	32.34	189.60	221.94	19.07	229.87	248.94	470.88
C	113.38	321.46	434.84	7.73	75.46	83.19	518.03
GA	174.77	218.20	392.97	21.63	150.06	171.69	564.66
FA	185.97	284.74	470.71	24.3	190.87	215.17	685.88
FG	88.51	246.23	334.74	14.57	137.30	151.87	486.61

6.11.3 Wetland Fauna and Flora

Flora

A total of 104 plant species were recorded within the wetlands of the study area. This list is by no means considered complete and is included purely to provide an indication of the most common and dominant species within the wetlands. The list is provided in Appendix F. Given the close proximity of the sites to each other, as well as the fact that the sites are characterised by largely similar soils conditions and underlying geology, the vegetation within the wetlands across the sites is also largely similar. Differences in vegetation observed between individual wetlands was mostly related to differences in the hydrological regime, specifically the hydroperiod and the duration of saturation of the soil profile, as well as the level of disturbance within the wetland system.

Extensive areas of hillslope seepage wetland have been impacted by historical cultivation and are characterised by relatively species poor secondary grassland under current conditions. Species such as *Agrostis lachnantha*, *Andropogon eucomis*, *Cynodon dactylon*, *Cyperus denudatus*, *Eragrostis curvula*, *Hyparrhenia hirta*, *Kyllinga erecta*, *Paspalum dilatatum*, *Stoebe vul*garis and *Verbena bonariensis* typified these areas.

No Red Data plant species were observed within the wetlands on site, although a number of protected species do occur:

- *Crinum bulbispermum*;
- *Crinum graminicola*;
- *Erythrina zeyheri*;
- *Gladiolus crassifolius*;

- *Gladiolus eliottii*; and
- *Hypoxis hemerocallidea*.

All of these species are protected in terms of the Mpumalanga Nature Conservation Act (No 10 of 1998).

A number of alien invasive species were also observed within the wetlands on site. Of special concern are the species *Campuloclinium macrocephalum* (Pompom weed), which occurs in small, scattered stands throughout the study area, and the grey popular, *Populus canescens*, which occurs in small, dense stands within various wetlands in the area.

The pompom weed is a serious threat to grassland and wetlands, and spreads rapidly through wind dispersal of its fluffy seeds. Given the difficulty in controlling the weed, it is recommended that a management plan for the pompom weed (as part of the overall invasive/alien plant species management plan) be compiled and implemented as soon as possible. Once widespread and established, the weed will be extremely difficult to control and eradicate.

Fauna

No Red Data mammal species were observed within the study area during the wetland assessment. However, scats of the Cape Clawless Otter (*Aonyx capensis*) were observed within a number of the valley bottom wetland systems on site.

Numerous Red Data listed bird species were encountered, namely:

- Blue Crane – was observed within site C, and also within the vicinity of sites F and G (Albert Froneman, pers. comm.). Based on communication with the local landowner (Wessel Badenhorst, pers. comm.), the Blue Cranes appear to have successfully bred within the valley bottom wetland immediately to the south of site C in the past;
- Greater Flamingo – was observed at the pan within site F and the pan adjacent to site B. They are expected to frequently utilise these pans;
- Black-winged Pratincole – was observed in large numbers at the pan adjacent to site B and over the planted pastures surrounding site B; and
- Secretarybird – was observed to the south of site C and is believed to breed in the vicinity (Wessel Badenhorst, pers. comm.).

In addition, the Lesser Flamingo is known to occur on site (Norma Sharratt, pers. comm.) and the African Grass Owl is expected to occur in numerous of the wetland habitats on site. Although no African Grass Owl was observed on site, the suitability of the habitat available would suggest they do occur.

6.11.4 Functional Assessment

Numerous functions are typically attributed to wetlands, which include biodiversity support, nutrient removal (and more specifically nitrate removal), sediment trapping (and associated with this is the trapping of phosphates bound to iron as a component of the sediment), stream flow augmentation, flood attenuation, trapping of pollutants and erosion control. Many of these functions attributed to wetlands are wetland type specific and can be linked to the position of wetlands in the landscape as well as to the way in which water enters and flows through the wetland. Thus not all wetlands can be expected to perform all functions, or to perform these functions with the same efficiency. The various wetland types specific to the study area were assessed using the WET-EcoServices tool, the results are illustrated in the radial plots below (Figure 6-17 to Figure 6-19).

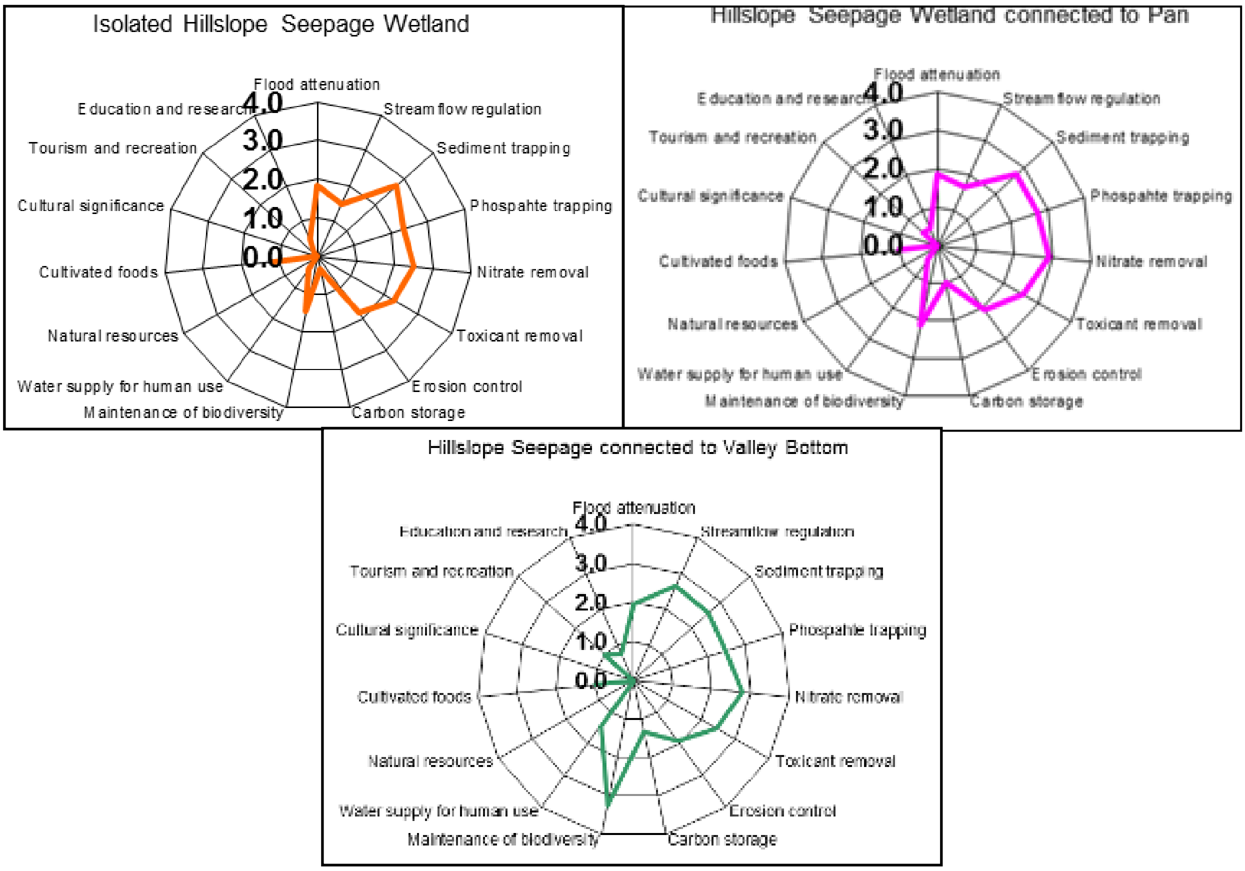


Figure 6-17: WET-EcoServices results for hillslope seepage wetlands

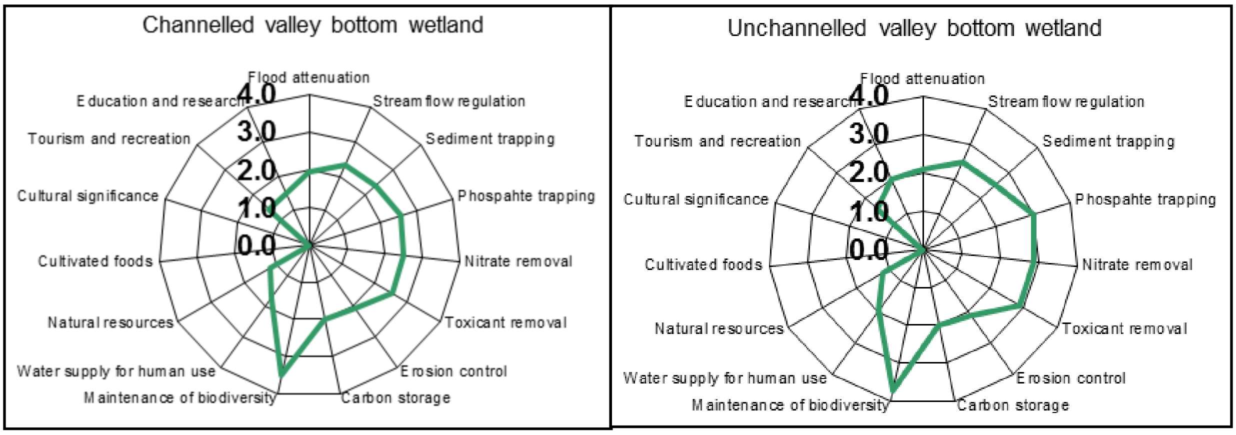


Figure 6-18: WET-EcoServices results for valley bottom wetlands

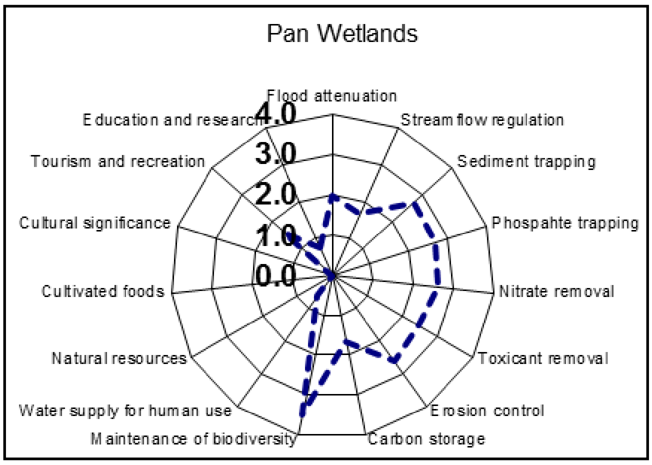


Figure 6-19: WET-EcoServices results for pan wetlands

6.11.5 Present Ecological Status

Of the wetlands within the various site footprints, over 70 % are considered to be *Moderately Modified* (PES category C), with only around 10 % of wetlands still within the *Natural* and *Largely Natural* (A & B) categories. Given that all the site alternatives investigated fall within close proximity to each other and their land uses are similar, the impacts affecting the wetlands are alike and the results of the PES assessment differ only marginally between the various sites.

6.11.6 Ecological Importance and Sensitivity

Considering all of the wetlands delineated across the various sites, roughly 77 % of the wetlands assessed are considered to be of *Moderate* ecological importance and sensitivity (EIS category C), with roughly half the remaining wetlands considered to be of *High* importance and sensitivity (EIS category B).

Most of the wetlands rated within EIS category B are hillslope seepage wetlands that are still characterised by primary vegetation and are located within catchments consisting mostly of natural grasslands. Both the pans, in site F and adjacent to site B, were also rated as *High* importance and sensitivity due mainly to the role they play in supporting Red Data bird species.

The wetlands rated as category D are mostly hillslope seepage wetlands, though wetlands that have been significantly impacted by previous cultivation and, in the case of the wetlands around site B, have also been impacted by increased wetness derived from the centre-pivot irrigation systems in their catchments.

6.12 AVIFAUNA

6.12.1 Data Collection

Data collection for the Avifaunal specialist study involved a desktop study of recognised literature considered to be well representative of the study area and Mpumalanga Province as a whole. A Senior Field Officer involved in the Highveld Crane Conservation Project was interviewed to advise on the occurrence of cranes and other Red Data species in the Ermelo district. The second part of the study was a field trip that was undertaken in January 2012. Birds were identified and counted at each of the sites and their habitats recorded.

6.12.2 Regional Description

Whilst much of the distribution and abundance of the bird species in the study area can be explained by the description of the broad vegetation type - sour grassland, it is as important to examine the micro habitats available to birds. These are generally evident at a much smaller spatial scale than the vegetation types, and are determined by a host of factors, such as vegetation type, topography, land use and manmade infrastructure. The land use in the study area is a variety of mixed farming practices. Livestock grazing is practised in parallel with crop farming. The most important bird micro-habitats other than natural sour grassland that were identified during the field visit are the following: agriculture - dryland cultivation, dense stands of trees, and wetlands, dams and rivers.

6.12.3 Avifauna in the Study Area

The Blue Crane (*Anthropoides paradiseus*) which is one of the priority avifauna species listed in the Mpumalanga Biobase Report (Emery et al. 2002) was recorded during the on-site survey. Five Red Data bird species (Blue Crane - *Anthropoides paradiseus*, Lesser Kestrel - *Falco naumanni*, Lesser Flamingo - *Phoenicopterus minor*, Secretarybird - *Sagittarius serpentarius* and Greater Flamingo - *Phoenicopterus roseus*) have been prioritised by the Gauteng Department of Agriculture, Conservation and Environment (GDACE) were recorded during the field surveys conducted in the area. The occurrence of other species included on these provincial priority lists cannot be ruled out (see Appendix F for the list of priority species that could potentially occur in the study area).

As aforementioned, the following avian habitat types were identified in the study area, the bird species associated with such vegetation are described as follows:

- **Grassland:** The CAR data indicates that natural grassland remains the preferred habitat of large terrestrial birds in the eastern Gauteng and Mpumalanga Highveld (Young et al. 2003). The presence of typical grassland Red Data bird species in the SABAP2 dataset for 2528DD (Blue Crane, White-bellied Korhaan - *Eupodotis senegalensis*, Blue Korhaan - *Eupodotis caerulescens*, Melodius Lark - *Mirafra cheniana*, Secretarybird, Denham's Bustar - *Neotis denhami* and Southern Bald Ibis - *Geronticus calvus*) indicates that enough natural, un-fragmented grassland still exists in the QDGC to support these species. There is however quite significant habitat fragmentation (especially of grasslands) evident in the study area, largely due to cultivation. Several of the aforementioned species were recorded during on-site surveys, and the data collected during the surveys clearly indicated that grassland supported a higher variety of species than agricultural lands.
- **Dryland cultivation (agriculture):** Data from the CAR project indicates that agricultural land in the eastern Gauteng and Mpumalanga Highveld is used to a limited extent by large terrestrial birds, but that they prefer natural grassland habitat. Although their preference is for grassland, fallow fields are used to a limited extent by Blue Cranes in summer whilst they might use recently ploughed fields in winter (Young et al. 2003). Other grassland Red Data species that may make limited use of the agricultural areas are the Blue Korhaan, Southern Bald Ibis, Lesser Kestrel and Black-winged Pratincole - *Glareola nordmanni*. A pair of Blue Cranes was however recorded in cultivated fields during on site surveys. Lesser Kestrels were also recorded foraging over agricultural fields during the surveys albeit in lower numbers than over natural grasslands. Overall, the cultivated areas in the study area have significantly fewer species than the remaining grassland.
- **Wetlands and dams:** As indicated earlier each of the site alternatives contains some form of wetland habitat. Site B contains the least amount of wetland on site but there are wetland habitats in its immediate vicinity. Small intermittent streams and drainage lines with associated moist grassland habitat are present on all other site alternatives and these habitats could support African Grass Owl - *Tyto capensis*, African Marsh Harrier - *Circus ranivorus* and Blue Crane, all of which are wetland associated Red Data priority species. An ephemeral pan occurs on site F which during the on-site surveys supported both Greater and Lesser Flamingos as well as numerous other water birds.
- **Dense stands of trees:** Stands of trees both indigenous and exotic occur scattered across all the site alternatives. Although the trees support some passerine bird species not recorded in the other habitat types this habitat on its own does not support any of the Red Data priority species. Lesser Kestrels that hunt over the grassland and agricultural lands could use some of these stands of trees as roosting sites.

6.13 Bats

6.13.1 Data Collection

Since bats are secretive, nocturnal, hibernators (or at least enter torpor) and/or seasonal migrators, distributional ranges and the presence of suitable habitats and appropriate daytime roosts were used to deduce the presence or absence of species based on authoritative tomes, scientific literature, field guides, atlases and data bases. This can be done with a high level of confidence irrespective of season. During the field work phase of the project, the derived list of occurrences is audited.

Site visits were conducted on 20 November 2012 and again on 3, 4, and 8 January and 12 February 2013. During these visits the observed and derived presence of bats associated with the recognized habitat types and daytime roosts on the study site, were recorded. This was done with due regard to the well recorded global distributions of Southern African bats, coupled to the qualitative and quantitative nature of recognized habitats roosts. The 500 meters of adjoining properties was scanned for important bat habitats. During field work the site was surveyed for Red Data species.

Locals were interviewed to confirm occurrences or absences of bats. Further, distributional ranges and the presence of suitable habitats and appropriate daytime roosts were used to deduce the presence or absence of species based on authoritative tomes, scientific literature, field guides, atlases and data bases.

6.13.2 Regional Description

Insectivorous bats have two indispensable environmental requirements, namely airspace partitions in which to hunt for invertebrate prey, and daytime refuges. From the perspective of nocturnal bat habitats and roosting opportunities by day, it is contended that all four major mammal habitats are present on the site. However, within the context of niche specialisation, these are exploited in different manners by bats than those other quadruple mammals do.

The ecological complexity of the Kusile study sites is restricted to grassy plains where invertebrates multiply and when becoming airborne during dusk they provide prey opportunities for hawking bats. However, such depauperate environmental production capacity is further impaired by large areas under cultivation which are functionally ecological sterile deserts.

There is, on the other hand, a strong propensity for invertebrates to swarm over water surfaces and swamps where humidities and temperatures remain higher than those over grassy plains. Wetlands, streams, dams, pans in the study area, as well as the Wilge River are of cardinal importance to the nutritive requirements of insectivorous bats and especially their energy budgets. From the perspective of insectivorous bats, but particularly from a wider ecological importance, the health of these systems is non-negotiable.

Daytime roost preferences are specific and vary greatly to include deep, moist and cool caves (and manmade cave-like structures) to narrow nooks and crannies in rocky outcrops and manmade structures, and in trees. The general Kusile study areas contain a number of buildings offering adequate roosting sites for common species such as the Cape serotine bat, African yellow house bat, greenish yellow house bat, and possibly some of the whispering bats (horseshoe bats, Egyptian slit-faced bats, Sundevall's round-leaf bats, slit-faced bats, short-eared trident bats). Culverts, drainage pipes, attics, basements and tunnels may, if present, be frequented by whispering bats. The study area lacks indigenous trees, but large exotic trees (viz. Eucalyptus trees) may offer specialised roosting opportunities such as for Mauritian tomb bats. None of the areas, however, have randjies or rocky outcrops with caves or deep crevices or overhangs in rock faces.

A desk top study reviewing the extensive distributional data of Southern African bats, strongly suggest that 17 species can be expected to at least occasionally roost and utelise the airspace over the study site. Considering the extent of cultivation, extant bat population densities will be lower than during historical times.

The Cape serotine bat, African yellow house bat, greenish yellow house bat and the Egyptian free-tailed bat are very adaptable and thus widespread and particularly common in the Subcontinent. They are certain to be residents in the area, as such roosting in buildings and hawk for insects over water. Harems of the seasonally migrating Mauritian tomb bat are also very likely to return during spring to regular roosts in large *Eucalyptus* trees in the vicinity, whereas flat-headed free-tailed bats with their predilection for narrow crevices are also likely to be tenants in buildings.

The local occurrence of seasonally-migrating cave-dwelling bats (Schreibers' long-fingered bat, Temminck's hairy bat, Egyptian slit-faced bat, Geoffroy's horseshoe bat, Darling's horseshoe bat, Blasius's horseshoe bat, bushveld horseshoe bat, Sundevall's roundleaf bat and short-eared trident bat) are likely given dark, moist and cool daytime roosts such as culverts, mine adits, attics, basements, abandoned buildings, aardvark burrows, etc. Fruit bats are absent from the study area since fruiting trees are absent.

The following threatened and endangered species are probable residents or occasional visitors: Schreibers' long-fingered bat (Near Threatened), Welwitsch's hairy bat (Near Threatened), Temminck's hairy bat (Near Threatened), Geoffroy's horseshoe bat (Near Threatened), Darling's horseshoe bat (Near Threatened), Sundevall's roundleaf bat (Data Deficient) and Short-eared trident bat (Critically Endangered).

6.14 NOISE

6.14.1 Data Collection

The assessment included a study of the legal requirements pertaining to noise impacts, a study of the physical environment of the area surrounding the project and the analyses of existing noise levels in the area. The impact assessment focused on the estimation of sound power levels (noise 'emissions') and sound pressure levels (noise impacts) associated with the transport and disposal of ash at either Site A or B. The findings of the assessment components informed recommendations of management measures, including mitigation and monitoring. Individual aspects of the noise impact assessment methodology followed in the study are discussed in more detail below.

A site visit was conducted on the 30th of May 2013. Sampling measurements were undertaken at locations deemed to be representative of noise sensitive receptors within the study area. Noise measurements were taken in accordance with the methods stipulated by SANS 10103 (SANS 10103, 2008)

6.14.2 Baseline Findings

Both Sites A and B are surrounded by several farmsteads and residences, with some as close as a 100 m from the footprint/laydown areas and overland conveyor routes. These will be most affected by disposal activities. The towns of Ogies, Phola and Bronkhorstspruit are too far away to be affected by noise generated by the disposal of ash at either Site A or B.

As is typical of rural areas, sampled environmental noise levels were mostly affected by the wind (specifically during the day), traffic on local roads and distant highway traffic, birds and insects. Sampled night-time noise levels correspond with the equivalent continuous night-time rating for rural areas (LReq,n of 35 dBA). Sampled day-time noise levels were notably higher than what is reported for rural areas because of moderate to strong wind conditions. Levels corresponded with the equivalent continuous day-time rating for rural areas (LReq,d of 45 dBA) during times when wind died down momentarily.

From observations in the project area, baseline noise levels at site B are expected to be similar to those at site A. Existing sources of noise and the physical environment, including weather conditions, were noted during measurements. A summary of measurement results is provided in Table 6-10.

Table 6-10: Summary of baseline noise level measurement results

Time of Day	Location	Start Time	L_{Aleq} (10 min) (dBA)	L_{Aeq} (10 min) (dBA)	L_{90} (dBA)	Notes
Day-time	KMP1	30-May-13 14:53	53.6	48.0	35.6	Moderate to strong wind, wind rustling grass, birds, aircraft and frequent traffic.
	KMP2	30-May-13 14:24	55.9	51.0	38.0	Moderate to strong wind, grass rustling, birds and insects.
	KMP3	30-May-13 13:49	57.2	52.0	39.9	Moderate to strong wind, wind rustling grass, birds and frequent traffic.
Night-time	KMP1	30-May-13 22:53	21.5	19.4	18.6	Slight wind, wind rustling grass, insects.
	KMP2	30-May-13 22:32	36.2	32.7	20.2	Slight wind, wind rustling grass, insects. Passing car.
	KMP3	30-May-13 22:07	40.8	37.9	34.1	Moderate wind, wind rustling grass, insects and distant traffic.

6.15 VISUAL

6.15.1 Data Collection

The study area was visited and photographs taken from potential sensitive viewing locations to enable a comparative analysis of the site alternatives.

6.15.2 Regional Description

The baseline environment has been altered by mining and agricultural activities to such an extent that minimal indigenous or natural vegetation occurs. Where natural vegetation occurs, it has been infested with exotic and invasive species. Originally the natural vegetation consisted of grassland species and wetland species. Shrubbery and trees were very sparse and scattered. In terms of seasonal variation, the study area has warm wet summers which result in an undulating sea of rolling green whereas winter months are characterised by cold, dry weather with heavy frost resulting in bleak yellows from the dry grass. Crop production also adds to the seasonal variety in colours.

6.15.3 Landscape Character

The study area consists of the following dominant natural landscape types: hills and koppies, gently to moderately undulating plains with ridge lines and valleys, which form part of the Saalklapspruit sub catchment. The landscape is characterised by an undulating topography in the east growing more mountainous towards the west. A couple of small koppies, and perennial and non-perennial streams populate the study area. Grassland is also associated with wetlands and water bodies that exist within the study area.

6.15.4 Visual Resource

Scenic quality ratings (see visual specialist report in Appendix F) were assigned to each of the landscape types. The highest value is assigned to the ridge lines, hills and koppies, rivers, wetlands, water courses and water bodies as well as ‘natural’ grassland vegetation. The agricultural fields and roads were rated as moderate. The landscape types with the lowest scenic quality were railway lines, power lines, towns / townships and built up areas as well as the mining / industrial areas and power stations. The combination of these ratings resulted in the overall study area to be regarded as having a moderate to low visual resource value.

The sense of place for the proposed study area derives from the combination of all landscape types and their impact on the senses. The combination of the various landscape elements, as mentioned above, gives the area a mixed industrial / pastoral sense of place.

6.15.5 Visual Receptors

Views

Due to the moderately undulating topography in combination with the low height of the grassland and crop vegetation, views within the study area are expansive and mostly open. The project would be visible from public roads running through the study area as well as from point locations such as farmsteads and residences.

Sensitive Viewers and Sensitive Viewer Locations

Views from roads would be temporary and as the study area is not a tourist destination; travellers through the study area will not be regarded as sensitive. Sensitive viewer locations would be those from farmsteads and residences within the study area.

6.16 CULTURAL HERITAGE AND ARCHAEOLOGY

6.16.1 Data Collection

A search was conducted of published literature regarding the history and archaeology of the general study area. Both historical and recent topographical maps as well as satellite information (Google earth) were analysed for indications of possible historic or archaeological structures. A desktop palaeontological impact assessment was also commissioned.

An initial field survey was conducted over a period of four days in total (10-11 and 24-25 January 2013). Four of the alternative areas were visited (sites A, C, F and G). Written descriptions, photographs and GPS coordinates were taken of all heritage sites identified during the survey.

6.16.2 Regional Description

The aim of the analysis was to identify areas that could have possible heritage significance. From a regional analysis perspective the delineations cover the following possible heritage finds: archaeological sites, cemeteries and grave sites and historical structures.

Augmented with the site survey information, the sites identified during the field work were overlain with the sensitivity map (Figure 6-20) developed, to gain a better understanding of the landscape's cultural fabric.

This analysis and identification of possible heritage sensitive areas does not show these areas as no-go areas but only as possibly sensitive towards heritage and needs to be treated as such until the final preferred site/s have been identified and detailed groundtruthing could prove the contrary.

6.16.3 Fieldwork Findings

- **Site A** - Four cemeteries (A1, A4, A5 and A6), consisting of 47 graves in total, were identified in the study area. The cemeteries contain African farmworker graves. It is likely that some of the graves will be 60 years or older and thus protected under Section 36 of the NHRA. The remains of a recent farmhouse (A3) and farm workers housing (A2) were also identified.
- **Site B** - A total of 11 heritage sites were identified inside or close to the borders of the study area: nine grave sites, six historic structures, and one historic spring. One heritage site was identified outside the study area but possibly close enough to be affected by an indirect impact from the proposed ash disposal facility. This is the memorial site for the Battle of Bronkhorstspruit, which dates to the first South African (Anglo-Boer) War of 1880-1881. (It is not clear from the information available on the SAHRIS database if this memorial site is a declared Provincial Heritage Site or protected as a public memorial).

6.16.4 Palaeontological Desktop Study

Palaeontological sensitivity is predicted after identifying potentially fossiliferous rock units; ascertaining the fossil heritage from the literature and evaluating the nature and scale of the development itself. The palaeontological sensitivity assessment of site B shows that there is a large area in the western half of site B which is underlain by geological formations that are of a high palaeontological sensitivity.

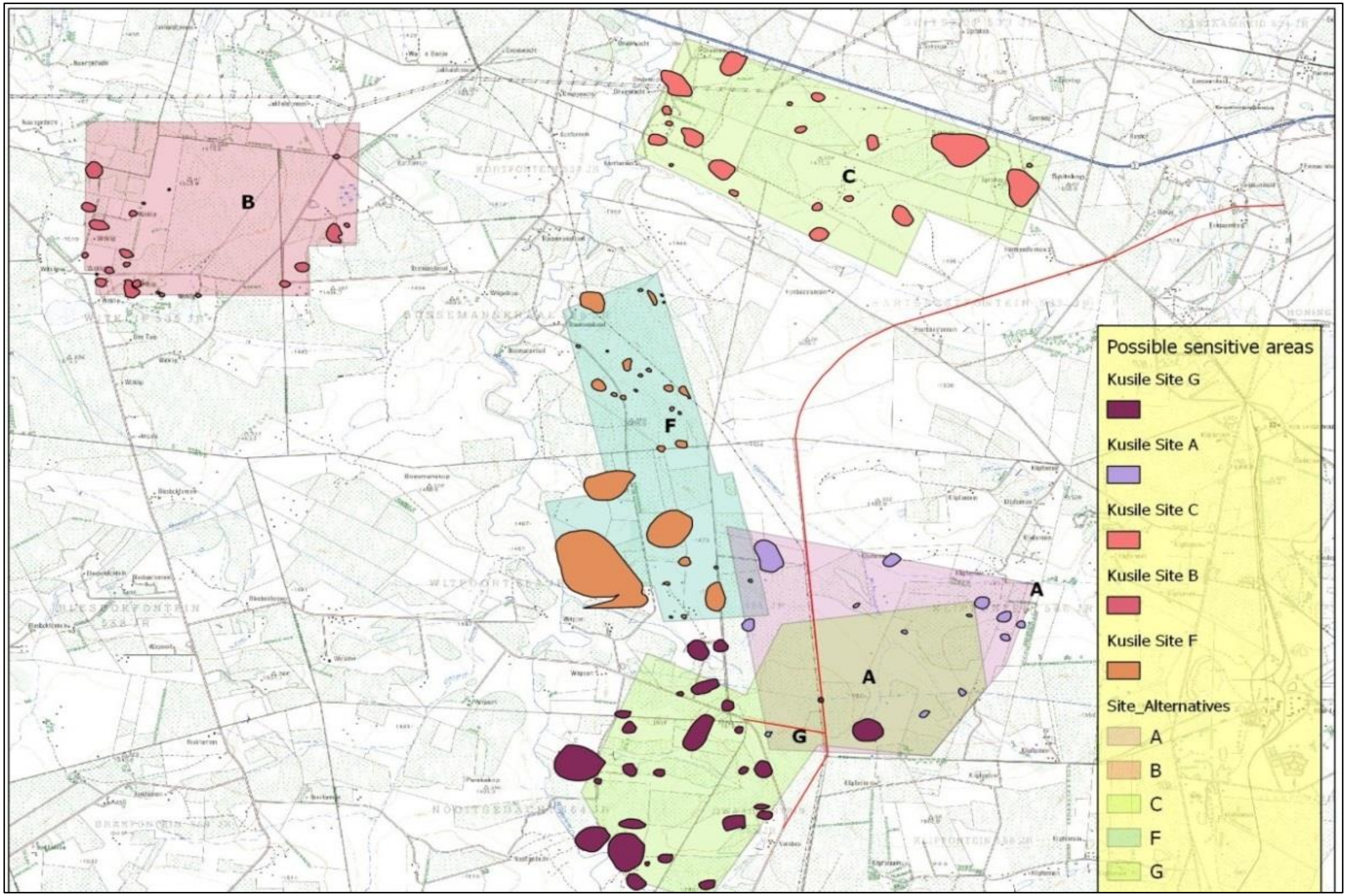


Figure 6-20: Heritage Sensitivity map

6.17 SOCIAL ENVIRONMENT

1.16.1 Data Collection

A detailed literature search was undertaken to obtain secondary data for the baseline description of the socio-economic environment. The information in this report was acquired via statistical data obtained from Statistics South Africa, Social Impact Assessment literature as well as information from reputable sources on the World Wide Web.

6.17.1 Study Area

Site A is located in Ward 9 of the Victor Khanye Local Municipality that is situated in the Nkangala District Municipality in the Mpumalanga Province and Site B is in Ward 105 of the City of Tshwane Metropolitan Municipality in the Gauteng Province (). Ward 29 of the eMalahleni Local Municipality that is situated in the Nkangala District Municipality is in close proximity to the site and is a potential labour sending area.

6.17.2 Mpumalanga Province

The Mpumalanga Province covers an area of approximately 82 333 km2 and consists of three district municipalities, namely Gert Sibande, Nkangala and Ehlanzeni. Nelspruit is the provincial capital.

Mpumalanga is South Africa’s major forestry production area and is also the world’s largest producer of electrolytic manganese metal. Six major industrial clusters have been identified in Mpumalanga which offer numerous investment opportunities, namely stainless steel; agri-processing; wood products; chemical industry and chemical products; agri-products and tourism.

Extensive mining is done in the province. Minerals found include: gold, platinum group metals, silica, chromite, vanadiferous magnetite, argentiferous zinc, antimony, cobalt, copper, iron, manganese, tin, coal, andalusite, chrysotile asbestos, kieselguhr, limestone, magnesite, talc and shale.

Mpumalanga also accounts for 83% of South Africa's coal production. Ninety percent of South Africa's coal consumption is used for electricity generation and the synthetic fuel industry. Coal power stations are situated close to the coal deposits.

<u>Nkangala District Municipality</u>

The district is approximately 17 000 km^2 and consists of about 165 towns and villages, with eMalahleni and Middelburg being the primary towns. According to the municipality’s website, the Nkangala DM is at the economic hub of Mpumalanga and is rich in minerals and natural resources. The district’s economy is dominated by electricity, manufacturing and mining.

Community services, trade, finance, transport, agriculture and construction are also important sectors. Nkangala's Integrated Development Plan (IDP) states that the district has extensive mineral deposits, including chrome and coal. There are six coal-fired power stations in the Nkangala District (Nkangala IPD 2012/2013), with a seventh currently under construction.

Another important economic activity in Nkangala is agriculture. The southern regions of the municipality are suitable for crop farming, specifically for fresh produce such as maize and vegetables, while cattle and game farming occur in the northern regions. In terms of the population profile of the Nkangala DM, the majority of its inhabitants are extremely poor and do not have access to mainstream economic activities.

Victor Khanye Local Municipality

The Victor Khanye Local Municipality covers a geographic area of approximately 1 567 km^2. The municipality is mainly rural in nature and is highly dependent on the neighbouring Ekhurhuleni Metro for job opportunities (Victor Khanye LM IDP, 2010/2011). The local economy is relatively diversified with the largest sector both in terms of output as well as proportional contribution being the trade sector, followed by the agriculture sector and the mining sector. The municipality views agro-processing of local agricultural goods as a key component of any Local Economic Development strategy in the municipality.

The area is characterised by an increase in the number of mining and related activities in the Leandra area, mainly coal and silica mining (Nkangala IDP 2012/2013). Other important sectors in the area include agriculture, finance and manufacturing.

eMalahleni Local Municipality

The eMalahleni Local Municipality (ELM) is one of the six local municipalities forming part of the Nkangala District Municipality and borders the Gauteng Province. The southern parts of the municipality form part of the region referred to as the Energy Mecca (eMalahleni IDP, 2012/13) due to its rich coal reserves and a number of power stations in the area such as Kendal, Matla, Duvha, Ga-Nala and the new Kusile power station.

The main urban centre is the town of eMalahleni with the other towns / activity nodes being Ogies, Phola, Ga-Nala, Thubelihle, Rietspruit, Van Dyksdrift and Wilge. The development patterns in the area are fragmented, not only because of previous policies of segregation by race, but also due to the fact that large areas are undermined or have mining rights which resulted in further physical separation of areas, and the presence of natural features like flood plains and marshlands (eMalahleni IDP, 2012/13).

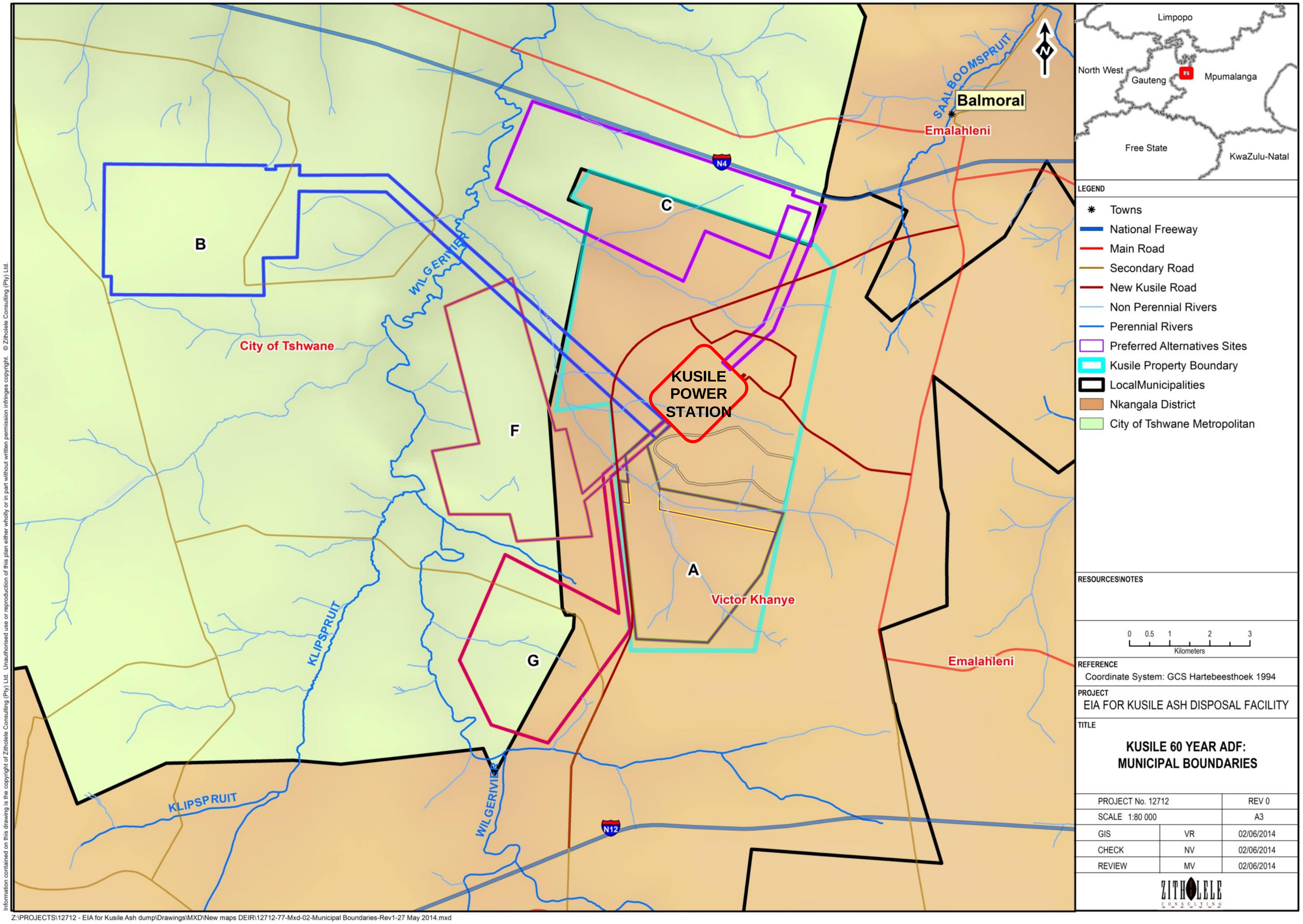


Figure 6-21: Municipal boundaries applicable to the project study area

6.17.3 Gauteng Province

Gauteng was built on the wealth of gold (40 % of the world's reserves). The economy has since diversified, with more sophisticated sectors such as finance and manufacturing being of major importance. With only 1.4 % of South Africa's land area, Gauteng contributes 33 % to the national economy and a noteworthy 10 % to the Gross Domestic Product (GDP) of the entire African continent.

The population of the province are from all walks of life and the major cities have a reputation for being cosmopolitan. The province has an urbanisation level of about 97 % and as such all major activity happens in and around urban centres. Gauteng is South Africa's main manufacturing base with almost half of all factories situated in the province. Although the province is the commercial heartland of the country, the agricultural sector still plays a role. A large area of the province falls within the Maize Triangle and groundnuts, sorghum, cotton and sunflowers are produced in the province. Gauteng holds the largest number of educational centres in the country. Other large industries are mining, technology and tourism.

City of Tshwane Metropolitan Municipality

City of Tshwane is the single largest metropolitan municipality in the country. The CTMM is the administrative capital of South Africa. The municipality covers an area of 6 298 km^2 and consists of seven regions, 105 wards and about 2.5 million residents.

The city is a national centre of research and learning, with four universities and the headquarters of both the Council for Scientific and Industrial Research and the Human Sciences Research Council.

Population and Household Sizes

The estimated population growth for the Mpumalanga Province (20.04 %) was greater than the national average of 15.5 %, while that for the Gauteng Province was slightly more than double (33.70 %) the national average. The eMalahleni LM showed the greatest increase (43.07 %) in population since 2001.

The average household size for the Mpumalanga Province is slightly above the national average (3.58), whilst the average household size for the Gauteng Province just below the national average. The household sizes for all the areas under investigation have decreased since 2001, but the number of households has increased. This could indicate that people are having smaller families.

6.17.4 Population Composition

In all the areas under investigation, the majority of the population belongs to the Black population group, but the proportions differ slightly as is evident in Figure 6-22.

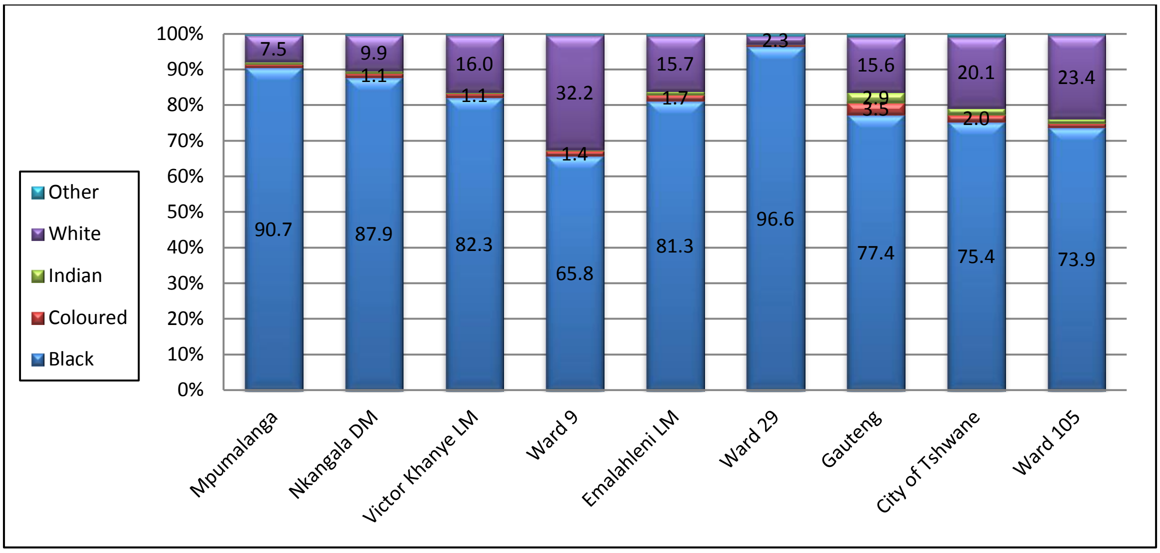


Figure 6-22: Population distribution (Census, 2011)

6.17.5 Age

The age distribution of the areas under investigation showed that Ward 29 of the eMalahleni LM has a much greater proportion of children aged 14 years or younger and a much smaller proportion of people older than 65 years of age than Ward 9 of the Victor Khanye LM or Ward 105 of the City of Tshwane Metropolitan. This holds the potential for greater future demands on infrastructure as well as a need for employment from people in Ward 29. Ward 29 has a total dependency ratio (proportion of dependants per 100 working-age population) of 47.40 compared to 45.43 for Ward 9 and 46.26 for Ward 105. The youth dependency ratio for Ward 29 (44.14) is much greater than for Ward 9 (37.72) and Ward 105 (36.35), indicating that there is greater pressure on the working-age population in Ward 29.

6.17.6 Gender

The gender distribution for the areas under investigation was fairly equal, but the Victor Khanye LM and the eMalahleni LM, as well as Wards 9 and 29, showed a slight bias towards males (>51 %). This could be ascribed to the presence of mines in the area and the resulting in-migration of male workers.

6.17.7 Language

In Ward 9 of the Victor Khanye LM almost a third of the population has Afrikaans as their home language, followed by IsiNdebele and IsiZulu. IsiZulu is the most dominant home language in Ward 29 of the eMalahleni LM, followed by Sepedi and IsiNdebele. In Ward 105 of the City of Tshwane Metropolitan, IsiNdebele, followed closely by Afrikaans are the most dominant home languages, followed by Sepedi. Home languages should be taken into consideration when communicating with the local communities, particularly during stakeholder engagement.

6.17.8 Education

Figure 6-23 shows the education profiles for the areas under investigation for those aged 20 years or older. Ward 9 in the Victor Khanye LM has the lowest proportion of people who completed Grade 12, as well as the greatest proportion of people with no schooling on a local level. Compared to the other areas under investigation, a fairly large proportion of people have an education higher than Grade 12. Ward 29 of the eMalahleni LM has the lowest proportion of people with no schooling, as well as the lowest proportion of people with an education higher than Grade 12, but it has the greatest proportion of people who have completed only some secondary schooling. Ward 105 of the City of Tshwane Metropolitan has the greatest proportion of people who have completed Grade 12 or higher.

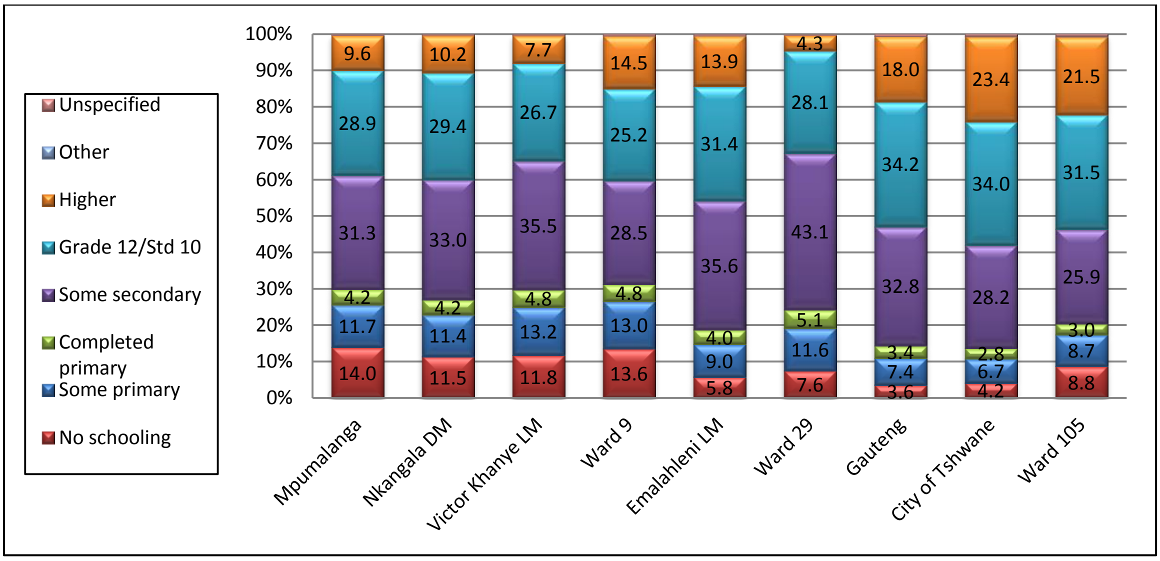


Figure 6-23: Education profiles (for those aged 20 years or older; Census, 2011)

6.17.9 Employment

Ward 9 of the Victor Khanye Local Municipality was found to have the highest proportion of employed people, aged between 15 years and 65 years (Figure 6-24). Ward 29 of eMalahleni LM had the lowest proportion of employed people at a ward level.

The majority of the employed people in the areas under investigation work in the formal sector (64.3 % - 77 %). Ward 29 in the eMalahleni LM has the highest proportion of people working at private households (14.6 %), while Ward 9 in the Victor Khanye LM has the highest proportion (19.7 %) of people working in the informal sector.

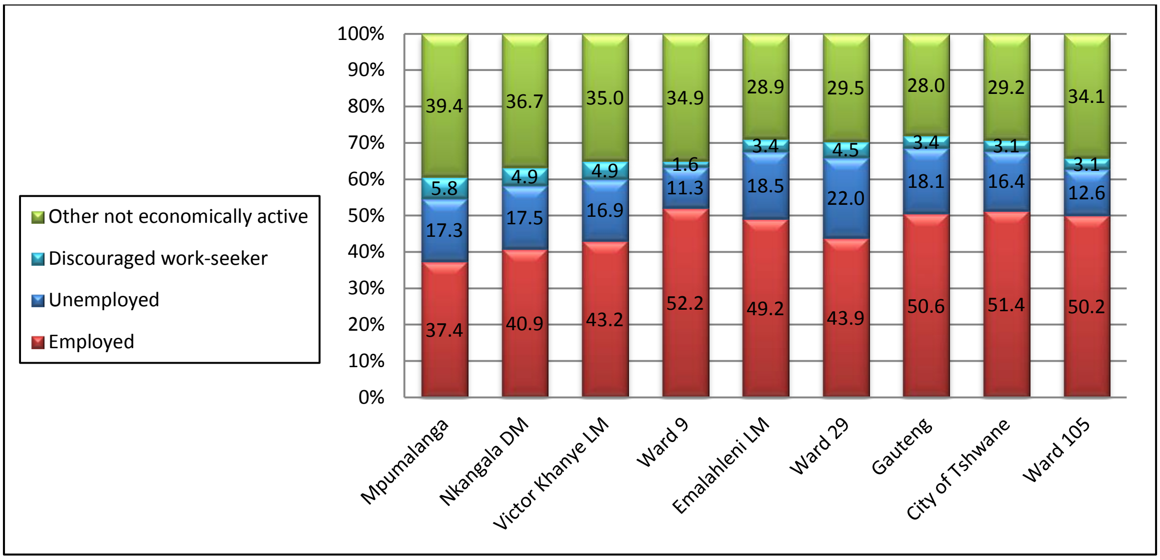


Figure 6-24: Labour status (for those aged 15-65 years; Census, 2011)

6.17.10 Household Income

More than 60 % of the households in Ward 29 of the eMalahleni LM have a household income of less than R38 201 per annum, compared to more than 50 % of households in Ward 9 of the Victor Khanye LM and just over 40 % of households in Ward 105 of the City of Tshwane Metropolitan. This suggests that households in Ward 29 are on average poorer than households in the other areas.

6.17.11 Housing

Almost half of the households in Ward 9 of the Victor Khanye LM live on farms and about a third in formal residential areas (Figure 6-25). There are also fairly large proportions of people residing on smallholdings or in industrial areas. More than a third of households in Ward 29 of the eMalahleni LM live in informal residential areas and about 14 % on land classified as vacant, with less than half of the households living in formal residential areas. In Ward 105 of the City of Tshwane Metropolitan Municipality, most of the households live in formal residential areas, followed by farms and smallholdings.

Most of the dwellings in the area are houses or brick/concrete block structures that are in a separate yard, stand or farm. A large proportion of households in Ward 29 of the eMalahleni LM live in informal dwellings. A small proportion of the informal dwellings are in the backyard of another house. In Ward 9 of the Victor Khanye LM, the second most common dwelling type is dwellings made of traditional materials, although there is no traditional land in the Victor Khanye Municipal area. This could be due to farm worker residences.

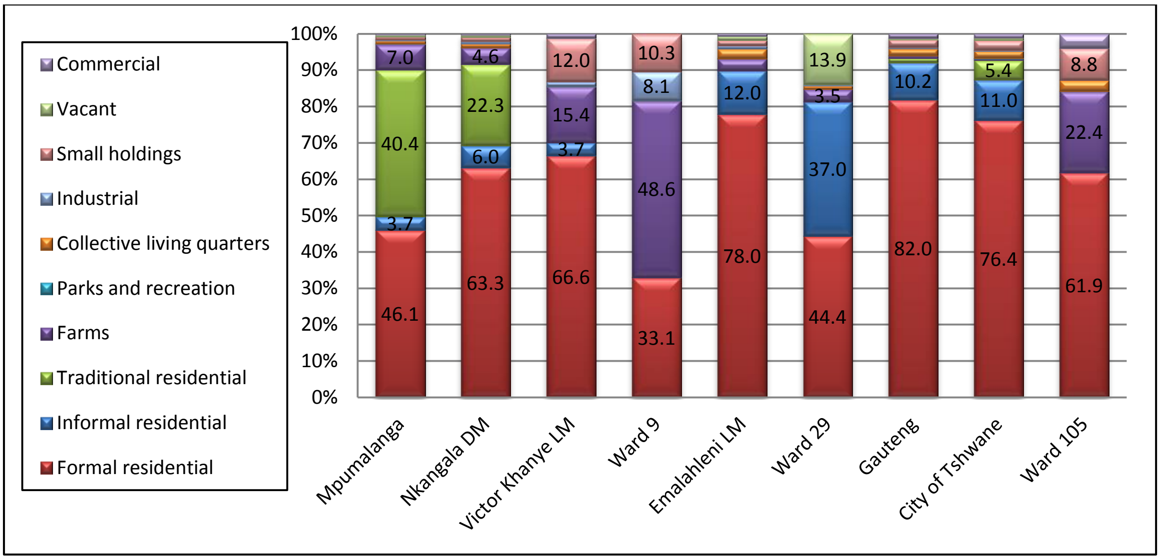


Figure 6-25: Enumeration area types (Census, 2011)

In Ward 29 of the eMalahleni LM more than 40 % of households occupy their dwellings rent-free. Most of these households are likely to be found in the informal settlements. More than 40 % of households in Ward 9 have indicated that they own their dwellings and have paid them off in full. Ward 9 of the Victor Khanye LM has the largest proportion of households that rent their dwellings.

6.17.12 Household Size

Almost 80 % of households, at ward level, consist of four or less members. Although only about a fifth of households consist of more than four people, a large proportion of the population (up to 50 % or more) reside in these households.

6.17.13 Access to Water

In Ward 9 of the Victor Khanye LM just over 40 % of households get water from a regional or local water scheme, while about 37 % of households get their water from boreholes (Figure 6-26). In Ward 29 of the eMalahleni LM almost 80 % of households get their water from a regional or local water scheme. Almost 70 % of households in Ward 105 of the City of Tshwane Metropolitan Municipality get their water from a regional or local water scheme and about 22 % from boreholes.

Access to piped water, electricity and sanitation relate to the domain of Living Environment Deprivation as identified by Noble et al. (2006). More than 70 % of households in Ward 105 of the City of Tshwane Metropolitan Municipality have access to piped water inside the dwelling, compared to just over 16 % in Ward 29 of the eMalahleni LM and almost 42 % in Ward 9 of the Victor Khanye LM. Access to piped water is a challenge especially in Ward 29.

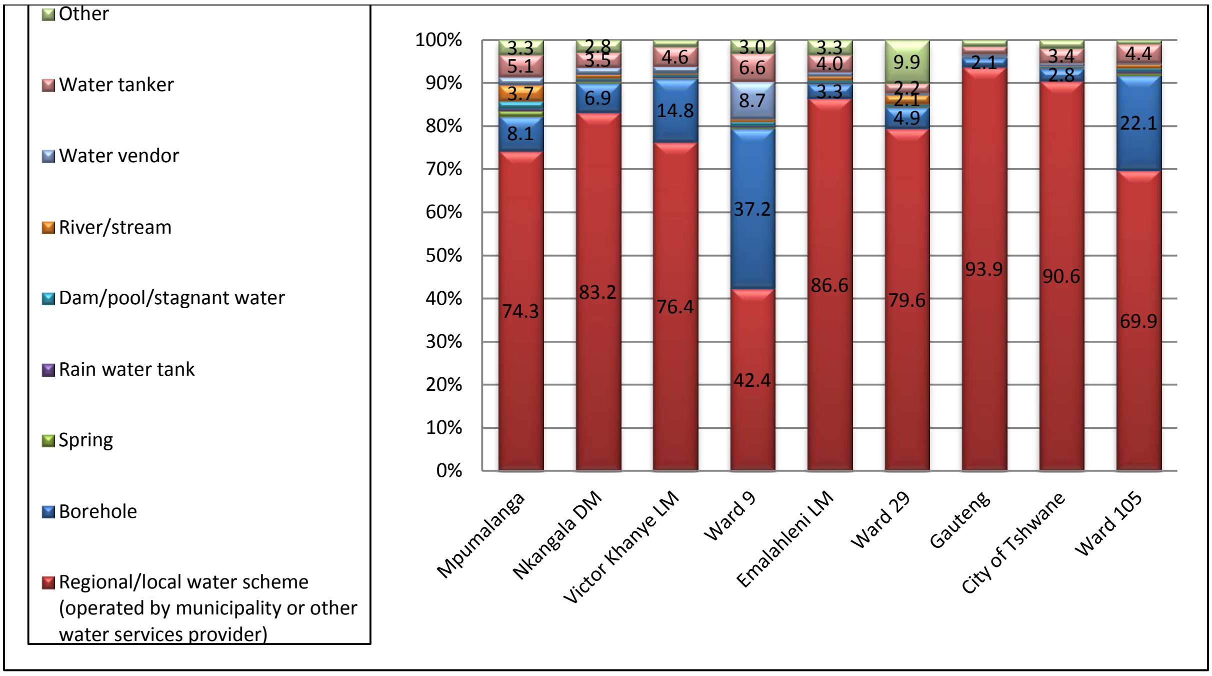


Figure 6-26: Water sources (Census, 2011)

6.17.14 Energy

Electricity is seen as the preferred source for lighting (Noble et al., 2006), and the lack thereof should thus be considered a deprivation. Even though electricity as energy source may be available, the choice of energy for cooking may depend on other factors such as cost. Ward 29 of the eMalahleni LM has a very low incidence of electricity as energy source of lighting. More than three quarters of the households in Ward 29 use candles as source if lighting. Ward 105 in the City of Tshwane Metropolitan Municipality has the highest incidence of households with electricity as source of energy for lighting.

6.17.15 Sanitation

According to Noble et al. (2006) anyone living in a household with either a chemical toilet, a pit toilet without ventilation, bucket latrine, or no toilet facility can be defined as deprived. Almost three quarters of households in Ward 29 of the eMalahleni LM have pit toilets without ventilation and can be considered the most deprived in this respect of all the areas under investigation. Just over two thirds of households in Ward 9 of the Victor Khanye LM and Ward 105 of the City of Tshwane Metropolitan Municipality have flush toilets that are connected to a sewerage system.

6.17.16 Refuse Removal

More than 60 % of households in Ward 29 of the eMalahleni LM have indicated that they have their own refuse dumps compared to less than 50 % of households in the Victor Khanye LM. Households with their own refuse dumps rely mostly on backyard dumping, burial and burning. These practices adversely impact on human health and the environment, specifically:

- Air pollution from smoke;
- Pollution of ground and surface water resources and home grown fruit and vegetables;
- People inhaling smoke from fires are at a risk of contracting disease (cancer, respiratory related illness); and
- Fires can destroy property.

Ward 29 also has the highest incidence (15.10 %) of people that have indicated that they have no rubbish disposal.

6.18 TRAFFIC

6.18.1 Data collections

The methodology adopted is as follows:

A Desktop Study was undertaken to review exiting data and identification traffic count locations. A site assessment was undertaken next which included taking traffic counts and visual site inspections. Detailed 12 hour classified traffic counts were undertaken 20th November 2012 at the following locations:

- R960 and R961
- Kusile Road and Kusile Power Station Construction Access
- Kusile Road and R545
- R545 (D686) and R545

Finally the Traffic Impact Assessment (TIA) was undertaken and included:

- Evaluation of the impact related to the construction activities including transportation of heavy machinery to the preferred alternative using some of the public roads;
- Evaluating the impact related to operations and maintenance of the proposed facility;
- Assessment of the access requirements from a provincial or a district road for the preferred alternative;
- Evaluating the impact of other developments both approved and not approved within the study area.

6.18.2 Description of road infrastructure

- **N4:** Paved Class 1 National Dual Carriageway Road traversing east west located north of Kusile Power Station with two lanes per direction carrying moderate volumes of traffic during critical peak hours. The road is in a good condition and carries a moderate to high volume of heavy traffic.

- **N12:** Paved Class 1 National Dual Carriageway Road traversing east west located south of Kusile Power Station with two lanes per direction carrying moderate volumes of traffic during critical peak hours. The road is in a good condition and carries a moderate to high volume of heavy traffic.
- **R960:** Gravel Provincial Class 4 road also known as R960 traversing north south located south west of Kusile Power Station with one lane per direction and carries low volumes of traffic during critical peak hours. The road intersects with N12 National Road south of Kusile Power Station.
- **R545:** Paved Provincial Class 3 road also known as D680 traversing north south located east of Kusile Power Station with one lane per direction and carries moderate volumes of traffic during peak hours but a high proportion of heavies throughout the day. This road forms district road D686 approximately 10.6 km south of the Kusile Road / R545 intersection. The condition is poor.
- **D961:** Gravel District Class 4 District road also known as R961 traversing north south located west of Kusile Power Station with one lane per direction and carries low volumes of traffic during peak hours. The condition is poor.
- **Kusile Road:** Gravel Class 4 road traversing north south located west of Kusile Power Station with one lane to each direction. Kusile Power Station and the planned New Largo Mine will gain access off this road. Parts of this road were under construction when the manual count was conducted. Kusile Road will be a tarred road with one lane per direction when completed.

The traffic on immediate vicinity of the development is moderate to high in volume. Kusile Power Station and Kusile Road are currently under construction and therefore adding significant number of trips on Kusile Road and intersections within the study area. The travel patterns established from the traffic counts indicate clearly that the major source of employees or their residential areas are located in Delmas, Phola, Ogies, eMalahleni, Wilge and Bronkhorstspruit.

In terms of traffic and transportation, a suitable site should be easily accessible. All five alternative sites can be easily accessed off existing roads. Site A, C, F and G can be easily accessed off Kusile Road and Site B can be accessed off R961. The condition of the R961 is however putting Site B in a disadvantage unless it is upgraded to a tarred road.

7 COMPARATIVE ASSESSMENT

The site selection process that was undertaken identified five feasible alternatives sites or disposal combinations (see Chapter 5 and Appendix D). The sites include Site A (incl. small A), B, C, F and G. Broad-scale information on environmental, social and technical aspects within the study area was used to assess all the potentially feasible sites identified. Rating and ranking of all the sites / site combinations highlighted the top five identified sites. Site A ranked the highest (most preferred), followed by sites B, small A + G, C, and F + G (least preferred).

7.1 ASSUMPTIONS, LIMITATIONS AND KNOWLEDGE GAPS

Assumptions, limitations and knowledge gaps have been identified during the project by the EAP and specialists, and include the following:

7.1.1 Aquatic assessment

- Reference conditions are not fully known due to the lack of studies pre-dating development. This limits the confidence with which the present ecological category is assigned;
- Aquatic ecosystems vary both temporally and spatially. Once-off surveys such as this are therefore likely to miss ecological information, thus limiting accuracy, detail and confidence. The results in the specialist report therefore represent ecological conditions at the time of sampling.

7.1.2 Groundwater Assessment

- A numerical groundwater model is a simplified representation (approximation) of the real system, and the level of accuracy is sensitive to the quality of the data that is available. The available data constituted of:
  - All the groundwater monitoring data gathered by Zitholele on the Kusile Power station (from May2013 up to April 2013);
  - The data reported by JMA (2012) in the geohydrological study of the New Largo;
  - The data collected by AEC through the different field investigations.
- Errors due to uncertainty in the data and the capability of numerical methods to describe natural physical processes are always associated with groundwater numerical models. The building of a numerical model requires some assumptions to make an easier representation of the real aquifer systems. Such assumptions involve mainly:
  - Geological and hydrogeological features;
  - Boundary conditions of the study area (based on the geology and hydrogeology);
  - Initial water levels of the study area;
  - The processes governing groundwater flow; and
  - The selection of the most appropriate numerical code.
- Based on the available field data, the following additional assumptions have been made:

- The top of the aquifer is represented by the generated groundwater heads;
- Averages of the distribution of the determined parameters have been used as input of the model, and a homogenous and continuous aquifer system has been assumed;
- Where specific aquifer parameters have not been determined for some reason, text book values have been used where applicable, with reasonable estimates of similar geohydrological environments. The system is initially in equilibrium and therefore in steady state, even though natural conditions have been disturbed.
- No abstraction boreholes were included in the initial model.
- The boundary conditions assigned to the model are considered correct.
- The impacts of other activities (e.g. agriculture) have not been taken into account.

7.1.3 Surface hydrology and water quality

- Conditions may exist which were undetectable given the limited nature of the assessment with respect to the site. Variations in conditions may occur between investigatory locations, and there may be special conditions pertaining to the site which have not been revealed by the investigation and which have not therefore been taken into account in the report.
- Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by Golder for incomplete or inaccurate data supplied by others.

7.1.4 Wetland delineation

- While an effort was made to visit every wetland within the study area, not every wetland boundary was walked. Extensive cultivation (current and historical) along and within the wetland boundaries in some portions of the study area, which results in complete removal of wetland vegetation and disturbs the soil profile, also presented obstacles to accurate delineation of the wetland boundaries on site.
- Further to this, due to the scale of the remote imagery used (1:10 000 orthophotos and Google Earth Imagery), as well as the accuracy of the handheld GPS unit used to delineated wetlands in the field, the delineated wetland boundaries cannot be guaranteed beyond an accuracy of about 15m on the ground. Should greater mapping accuracy be required, the wetlands would need to be pegged in the field and surveyed using conventional survey techniques.
- Field work for the wetland delineation and assessment was undertaken over several days in December 2012 and January 2013.

7.1.5 Avifaunal Assessment

- This study made the assumption that the identified sources of information in the specialist report are adequately reliable. However, there are factors that may potentially detract from the accuracy of the predicted results. These were assumed to be:

- Sources of error in the SABAP2 database, particularly limited coverage of some QDGCs. This means that the reporting rates of species may not be an accurate reflection of the true densities in QDGCs that has to date been sparsely covered during the data collecting. The 2528DD QDGC has been fairly well covered by SABAP2 with a total of 103 checklists submitted. This provides a reasonably comprehensive set of data with regard to the species that are likely to occur in the area.
- The SABAP2 information was supplemented with actual counts at the different site alternatives. The counts were conducted in December following good rains. These are the type of conditions which is most suitable for instantaneous sampling bouts on the eastern Gauteng and Mpumalanga highveld i.e. in the wet season when the highest species diversity and abundance is to be expected of both migratory and resident species. However, it must be accepted that bird distribution patterns may fluctuate in response to climatic conditions, particularly rainfall, and that ideally sampling over several seasons would be required to get a representative picture of all the species that occur in the area.

7.1.6 Bat Assessment

- Eco-Agent conducted pioneer research and field work on Southern African bats, and has published widely with internationally-acclaimed bat ecologists. The specialist is thus confident that their baseline data are sufficiently accurate to support their conclusions and suggested mitigation measures.
- Even though every care is taken to ensure the accuracy of this report, environmental assessment studies are limited in scope, time and budget. Discussions and proposed mitigations are to some extent made on reasonable and informed assumptions built on *bone fide* information sources, as well as deductive reasoning. Deriving a 100% factual report based on field collecting and observations can only be done over several years and seasons to account for fluctuating environmental conditions and migrations. Since environmental impact studies deal with dynamic natural systems additional information may come to light at a later stage. Eco-Agent CC can thus not accept responsibility for conclusions and mitigation measures made in good faith based on own databases or on the information provided at the time of the directive. This report should therefore be viewed and acted upon with these limitations in mind.

7.1.7 Terrestrial Ecology Assessment

- Any assessments made in this specialist report are based on the conditions indicated from published sources and the investigation described.
- Data supplied by the client or other external sources, including previous site investigation data that have been used has been assumed to be correct unless otherwise stated.

7.1.8 Air Quality Assessment

- An ash sample was acquired from Kendal Power Station. It is assumed that the particle size distribution and elemental composition will be similar to that from Kusile, when operational.
- Meteorological data was acquired from Eskom for the Kendal Power Station, for January 2009 to October 2012. Due to the proximity between Kusile and Kendal, it was assumed that the meteorological data was representative of the site.
- A comprehensive list of sensitive receptors was not available. As such, schools - primary farm schools, primary schools and high schools – were identified via aerial photography (using Google Earth™) and used as identified sensitive receptors around the ash disposal facility alternatives. Schools were selected on the basis of sensitivity of children to airborne dust and that they are indicative of residences in the near vicinity.
- No sensitive receptors were identified near Alternative C, possibly due to the age of the aerial photograph consulted. In the comparison of alternative sites, this results in this alternative impacting none of the identified sensitive receptors. This will have influenced (skewed) the comparative assessment of the alternatives. It is understood that families (and individuals) that were displaced by the construction of the Kusile Power Station were relocated to Alternative C; however, the exact locations are unknown at this stage. The lack of identified sensitive receptors near alternative C was taken into account for the overall site alternative preference.
- The dispersion model cannot compute real-time processes. The end-of-life, worst-case, area footprint for each ash disposal facility alternative was used in the model. The range of uncertainty of the model predictions could to be -50% to 200%. There will always be some error in any geophysical model, but it is desirable to structure the model in such a way to minimise the total error. A model represents the most likely outcome of an ensemble of experimental results. The total uncertainty can be thought of as the sum of three components: the uncertainty due to errors in the model physics; the uncertainty due to data errors; and the uncertainty due to stochastic processes (turbulence) in the atmosphere.
- The selection of a modelling domain takes account of the expected impacts and it is possible that the impacts, when modelled, extend beyond the modelling domain. This occurred for alternative B. Although the impacts extend beyond the modelling domain it is possible to estimate the extent of the impacts outside of the modelling domain. It is expected that the area of impact is likely to be similar to alternatives A and C.
- Increased life-time cancer risk was calculated at the identified sensitive receptors for arsenic, nickel and chromium.
- Carcinogenic trivalent arsenic (As3+) was assumed to account for 10% of the total arsenic in the ash sample.
- The US-EPA unit risk factor (URF), 4.3 x 10-3, was used to calculate the increased cancer risk, due to the fact that it is more conservative than the WHO unit risk factor.
- There is much uncertainty in the literature regarding the species and the mechanisms through which nickel is toxic. A conservative estimate of increased life-time cancer risk was calculated assuming:

  - All forms of nickel present in the ash sample are carcinogenic.
  - The US-EPA IRIS unit risk factor (URF) of cancer as a result of exposure to nickel used was 2.4 x 10-4 (µg.m-3)-1.
- The following important assumptions were made with regards to Cr6+ emissions and impacts:
  - All forms of Cr6+ were assumed to be carcinogenic. Known carcinogenic Cr6+ compounds include chromium trioxide, lead chromate, strontium chromate and zinc chromate. Cr6+ was assumed to represent only 1.1% of the total Cr in the PM10 fraction, as per literature.
  - Uncertainty regarding the unit risk factor (URF) for Cr6+ is evident in the range of 1.1 x 10^{-2} (µg.$m^{-3})^{-1}$ to 13 x 10^{-2} (µg.$m^{-3})^{-1}$ as specified by the WHO. The US-EPA URF of 1.2 x 10^{-3} (µg.$m^{-3})^{-1}$ was used in the estimation of increased life-time cancer risk compensating for conservative approach followed in the estimation of Cr6+ emissions and impacts.

7.1.9 Soil and Land Capability assessment

- It should be noted, that no intensive or detailed mapping of any of the sites has been undertaken, and the results of this study are based on a high level reconnaissance site assessment of all possible sites.
- Detailed assessments of the candidate site will be needed before a full understanding of the potential impacts can be reported, and the study used for planning and/or design purposes.

7.1.10 Heritage Impact Assessment

- Not detracting in any way from the comprehensiveness of the fieldwork undertaken, it is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the area. Various factors account for this, including the subterranean nature of some archaeological sites and the current dense vegetation cover. As such, should any heritage features and/or objects not included in the present inventory be located or observed, a heritage specialist must immediately be contacted.
- Such observed or located heritage features and/or objects may not be disturbed or removed in any way until such time that the heritage specialist has been able to make an assessment as to the significance of the site (or material) in question. This applies to graves and cemeteries as well. In the event that any graves or burial places are located during the development, the procedures and requirements pertaining to graves and burials will apply as set out below.

7.1.11 Social Impact Assessment

- Not every individual in the community could be interviewed therefore only key people in the community were approached for discussion. Additional information was obtained using existing data, records of public meetings and via telephonic and personal interviews.

- The social environment constantly changes and adapts to change, and external factors outside the scope of the project can offset social changes, for example changes in local political leadership. It is therefore difficult to predict all impacts to a high level of accuracy, although care has been taken to identify and address the most likely impacts in the most appropriate way for the current local context within the limitations.
- Social impacts can be felt on an actual or perceptual level, and therefore it is not always straightforward to measure the impacts in a quantitative manner.
- Social impacts commence when the project enters the public domain. Some of these impacts are thus already taking place, irrespective of whether the project continues or not. These impacts are difficult to mitigate and some would require immediate action to minimise the risk.
- There are different groups with different interests in the community, and what one group may experience as a positive social impact, another group may experience as a negative impact. This duality will be pointed out in the impact assessment phase of the report.
- Social impacts are not site-specific, but take place in the communities surrounding the proposed development.

7.1.12 Visual impact assessment

- For the significance rating it is assumed that all proposed mitigation measures would be implemented correctly and effectively.

7.1.13 EIA and PPP

Initial site identification and selection process was undertaken based on course scale desktop geographical data and information that was available at the time of the selection process.

7.2 COMPARATIVE IMPACT ASSESSMENT

A detailed comparative assessment was undertaken of the feasible site alternatives (Sites A, B, C, FA, GA, and FG), as well as the “No-Go” alternative. The assessment was undertaken for all four phases of the development (Construction to Post Closure). The assessment was conducted using the impact assessment methodology as prescribed by the National Environmental Management Act (107 of 1998) and the EIA regulations (2010). A comparative assessment between the identified feasible sites was undertaken by each specialist during the impact assessments for their specific discipline.

7.2.1 Main impacts considered

The construction phase includes planning and site preparation phases. The comparison of alternatives by water related specialist studies hinged on protecting the sensitive Wilge River and hillslope seepage wetlands from water quality impacts and destruction of a potential source contaminant located upstream. During the construction phase the main impacts of the construction of the ADF and associated conveyor on water resources (**wetlands**, **aquatic biodiversity**, **surface water hydrology and water quality,** and **groundwater resources)** include:

- Direct loss of wetlands and riparian habitat;
- Potential adverse impacts on water resources, especially the Wilge River and diverted Klipfonteinspruit, due to ash contaminated runoff from the ash disposal facility and conveyor, erosion, sedimentation, impacts of turbidity, and decrease in water quality and aquatic biodiversity;
- The clearing of topsoil for footprint areas can increase infiltration rates of water to the groundwater system and decrease buffering capacity of soils to absorb contaminants from spills on surface;
- Groundwater recharge from surface may increase, especially in the potential recharge area;
- Groundwater contamination resulting from potential liner leakage; and
- Reduction in catchment runoff and flows.

During the construction phase the main impacts of the construction of the ADF and associated conveyor on terrestrial biodiversity (**Terrestrial Ecology**, **Avifauna**, and **Bats**) are based largely on the ecological integrity and conservation importance of the vegetation communities and the fauna dependant on them.

During the operational phase additional impacts of the operation of the ADF and conveyor on terrestrial biodiversity include cumulative negative impacts on the health of terrestrial fauna and avifauna due to the reduction in the habitat quality and quantity of the vegetation units impacted by the development. The main impacts on terrestrial biodiversity include:

- Loss of important and suitable natural habitat;
- Potential disruption of ecological processes; and
- Loss of local Red Data species and species richness.

Main impacts associated with the socio-economic environment (**Air Quality**, **Noise**, **Soil and Agricultural potential**, **Heritage**, **Social**, **Visual** and **Traffic**) within the study area include:

- Decreased air quality due to construction activities such as wind-blown dust, and windblown ash during disposal of the ash;
- Impact on noise levels due to construction activities, transfer of ash via conveyor, and ash stacking;
- Impacts on land use, characteristics and land capability/agricultural potential;
- Relocation / destruction of graves and / or heritage structures and resources;
- Loss of livelihoods and resettlement of people or communities;

- Impacts on visibility and landscape character; and
- Adverse impacts on traffic.

Impacts on air quality and noise levels, once mitigated would be of low significance with no discernable difference between the feasible sites. Air quality and noise impacts would thus not be distinguishing factors in general.

The soils and land capability assessment assessed the feasible site alternatives in terms of existing agricultural activities, land use and soil characteristics. Therefore areas with existing agricultural activities were favoured.

7.2.2 General considerations

Extensive consultation with the regulating authorities, Department of Environmental Affairs and Department of Water Affairs (see minutes in Appendix C), was also undertaken during the impact and comparative assessment phase. The DWS was consulted with on 7 December 2012, 10 April 2013, 14 August 2013 and 27 January 2014. From a DWS perspective it became clear that the Wilge River is the most important river system in the Olifants River WMA as it is still relatively pristine compared to the rest of the Olifants WMA river systems. The Wilge River thus remains a high priority for DWS to protect against pollution and decreasing ecological integrity. Resultantly, DWS was not in support of the sites F and G since both of these sites have a large frontage to the Wilge River, thus increasing the potential risk of direct pollution into the Wilge River. Consultation with the DWS further revealed that an area within the proposed site C has been earmarked as an offset area therefore excluded from future development.

DWS is further mandated to protect wetlands, especially in the Mpumalanga Province where development has impacted extensively on wetlands. Direct impact or destruction on wetlands within the proposed sites is therefore a limiting factor for further consideration of a proposed site. The conditions under which wetland or biodiversity offsets could be considered are very stringent and offsets are considered by DWS as the last resort. DWS thus recommended that site B be considered further together with site A.

The DEA also requested an extensive offset plan to be developed for impacts relating to the Kusile Power Station and the proposed ADF. DEA was consulted on 26 June 2013 and 27 January 2014, and included a site visit, together with DWS officials, on 30 October 2013.

Other factors that impacted on the suitability of the proposed ADF at the proposed site alternatives include location, topography and land ownership of the proposed site. The specific location of each proposed site relates to the distance to the power station. The closer the proposed site is to the power station, the less costly it is to construct the conveyance system, and the lesser the risk to assurance of power supply in emergency situations. Site A requires the shortest overland conveyance system of all the proposed sites, whereas site B requires the longest overland conveyance system, which is estimated to add approximately R 5 billion to costs when compared to site A.

Topography influences the suitability of a proposed site when the potential drainage of pollutants downstream of the ADF is considered. Sites F and G both drains directly towards the Wilge River, which is less than ideal when their close proximity to the Wilge River is also considered. Site B is situated on top of a watershed which results in the potential drainage of pollutants in four directions into two quaternary catchments and four sub-catchments. Resultantly, potential pollution risks exist to more than one catchment which inherently complicates measures to confine any potential pollution. Site A on the other hand drains in one direction and is situated in the same quaternary catchment as the Kusile Power Station and New Largo mine. Therefore, focused mitigation measures to eliminate potential pollution risks can be implemented more successfully in the catchment in question.

Land ownership is another factor that could influence the location of the ADF site. Land portions impacted by Site A are exclusively owned by Eskom, therefore negotiation and relocation of households is negated by this scenario. The other feasible sites are all privately owned with most of the land parcels characterised by commercial farming activities. The area impacted by the proposed site B is a particularly productive area, with large scale berry farming (largest in South Africa) and commercial farming being practiced at the location. Consideration of site B for the location of the ADF will require compensation of these commercially successful ventures as well as relocation of the affected land owners, which will be very costly, time consuming and could impact the country’s food security.

The major findings and conclusions of the comparative assessment are described in the sections below.

7.2.3 Site-specific considerations

During construction **Site A** will directly impact on a portion of wetland area in the upper reaches of the Klipfonteinspruit within the direct footprint of the ADF (~227 ha), sterilising the wetlands within the footprint of the site preparation and construction area. This loss of wetlands would need to be mitigated through a comprehensive offset strategy within the impacted quaternary catchment. Site A would also require a river diversion of the Klipfonteinspruit, which contains some sensitive aquatic taxa. The river diversion has been designed to maximise habitat re-establishment within the river diversion.

Additional adverse impacts associated with site A include:

- Loss of the moist grass, sedges and adjacent dry mixed grassland communities which will result in a loss of habitat for terrestrial fauna.

Positive features associated site A include:

- Impact indirectly on the smallest wetland area (~126 ha) compared to the other feasible sites;
- Located within a single sub-catchment already significantly impacted by the Kusile Power Station, New Largo which will mine 18 % of the catchment, and Kusile's co-disposal facility in the near future. Therefore the zone of impact resulting from all KPS activities remain limited to a small area;
- Located in the centre of the sub-catchment, therefore a large portion of watershed / catchment will remain largely intact;
- Shortest conveyor route – two crossings over the Klipfonteinspruit;
- No Red Data species were confirmed within water courses on site;
- Located more than 3.8 km from the Wilge River as the crow flies, and 7 km along the Klipfonteinspruit. Therefore in the unlikely event of a major pollution incident the 7 km of wetland could act as a buffer to the Wilge River;
- Low groundwater recharge potential, which translates into slow movement of a potential pollutant once it enters the groundwater;
- Site drains towards a single point, which will simplify water management significantly;
- All pollution control dams will also be located in the same area;
- Minimal reduction of surface water runoff from rehabilitated ADF;
- Impact potential lowest for bats as the ADF will not directly impact on the 2013 *status quo* of species richness and specific population dynamics, and offers no artificial roosting opportunities. Bats in the area obtain their sustenance from grasslands ~15-20 km from the KPS;
- From a heritage perspective, site A is most favourable as it contains the least amount of cemeteries (2), contains no historical structures and palaeontological resources may only be found localised.

Site B is considered highly unfavourable as it would require the longest conveyor crossing (>12 km) of all the alternatives, not only over the Wilge River, but also over the Klipfonteinspruit as well as a Wilge River tributary on the western bank. During construction a barrier system will be installed and the conveyor routes constructed from the power station across the water courses including the Wilge River to site B. These activities are required to allow delivery of ash to the ADF for development of the starter platform. The potential pollution impact risk from construction activities and the transported ash to the Wilge River is thus considered high due to the number of stream and river crossings that will be required for this alternative.

In addition, Alternative B will have the following adverse impacts associated with development of the ADF:

- Located on the watershed, therefore the catchments of the downstream wetlands area covered;
- Large extent of wetlands immediately adjacent to the proposed site. The deep soils of the site are expected to play an important role in supporting the surrounding hillslope seepage wetlands, and the loss of these from the catchment areas of the wetlands will

likely significantly reduce flows into the adjacent wetlands. This impact is also considered high;

- Impact upon the headwaters of 4 spring-fed tributaries within two quaternary catchments. The quality of the water within these tributaries is particularly good. Impacts due to use of Site B will significantly increase the impacted area and zone of influence;
- Water drains from the site in four different directions, thus complicating water management and increasing the risk of failure of mitigation measures;
- As a result of the multiple drainage directions, pollution control dams would be required in at least seven localities, thus increasing the impacted area and zone of influence;
- Indirectly impact on the water quality and habitats within the adjacent seasonal pan. The pan immediately adjacent to site B supports large numbers of avifauna, including the Red Data species;
- The aquifer associated with site B location has a high recharge potential, thus any contaminants entering the groundwater will be transported rapidly as opposed to a low recharge aquifer. This has been identified as a No-Go characteristic by the groundwater specialist;
- Located in an area with a shallow water table thus increasing the potential of contaminants to enter groundwater;
- Site B has a number of in situ and nearby structures serving as daytime roosts for bats, as well as a number of water surfaces attracting insect swarms to create feeding habitat for bats. The impact of the ADF on bats is thus considered high;
- Site B is located on an area with generally moderate to deeper soils, characterised by high agricultural potential relating to a high percentage of commercial cultivation subsistence usage;
- Five cemeteries and six historical structures are located within the development footprint of site B, thus impact on heritage resources is considered high;
- Large economic farming units will be broken up (e.g. Bio-select berry farm), leading to loss of livelihoods and large resettlement costs; and
- Least preferred alternative from a visual perspective as the ADF will be highly visible being located directly on a ridge line, and it would be in contrast to the landscape character due to its distance from Kusile and the prominence of agriculture.

Positive features associated site B include:

- Smallest wetland extent within the direct footprint of the ADF (~53 ha) of all sites investigated;
- The ADF site is located more than 3 km from the Wilge River, which allows for a sufficient buffer to the Wilge River from the ADF site. This, however, excludes the impact of the multiple conveyor crossings over the Wilge River; and
- Preferred alternative from an avifaunal perspective as the agriculturally dominated areas leave very little habitat for avifaunal species.

Construction of the ADF at **Site C** would result in the destruction and loss of ~125 ha of wetlands directly within the ADF footprint over the life of the facility. Impacts emanating from the construction phase would be possible erosion resulting in sedimentation and increased turbidity to the nearby Wilge River, which is situated less than 200 m from site C, although it does have a short river frontage to the Wilge River. Given that site C has the highest extent of wetlands in close proximity to the proposed ADF, and the highest extent of PES category A and B wetlands within the footprint, its value as a wetland offset area is understandable. A wetland earmarked for rehabilitation as a commitment emanating from the WUL for other Kusile activities, as well as from a commitment to a relocated community, falls completely within the footprint of solution C.

Additional adverse impacts associated with site C include:

- A number of Red Data bird species were confirmed on site, including a Blue Crane breeding site immediately adjacent to the site. Numerous Mpumalanga Protected plant species were also identified on site;
- The shallow soils that characterize this site have as a consequence that insufficient clay material for the liner system can be sourced on site and a borrow pit will be required. The borrow pit will be located in site A;
- The aquifer associated with the site C has a high recharge potential, thus any contaminants entering the groundwater will be transported rapidly as opposed to a low recharge aquifer. This has been identified as a No-Go characteristic by the groundwater specialist;
- Site C contains natural and planted grasslands used for grazing and includes a number of dams and drainage lines with wetland vegetation important in supporting breeding and swarming insect populations, which ultimately serves as ideal prey habitat to insectivorous bats;
- The least preferred site from a heritage perspective as the development footprint will contain eight cemeteries and six historical structures; and
- Contains families that were resettled from the Kusile Power Station site, so additional resettlement would be unacceptable. This can be seen as a fatal flaw and an unacceptable risk from a human rights and funding perspective.

Positive features associated site C include:

- Comparatively short conveyor route required with only two hillslope seepage crossings; and
- Minor changes in surface water runoff and flows are expected.

In consultation with the DWS, Site C has been identified as fatally flawed for reasons mentioned above and not considered further in this assessment.

Site AF (combination of site small A and site F) was introduced as a feasible disposal option to reduce the impact of site A on wetlands by reducing the footprint of site A from the valley bottom wetland associated with the Klipfonteinspruit (the northern valley bottom wetland). An unfortunate reality of the combination site AF is that it consists of two sites, thus increasing the disturbance footprint and extending the zone of impact. This is not an ideal situation and a single feasible site would be preferred above two separate sites in close proximity to one another.

The main negative impact associated with the proposed combination site is the significant risk this site poses to the Wilge River in terms of potential water quality deterioration and impact on sensitive and Red Data taxa within the Wilge River. Site F is situated in close proximity to the Wilge River, with extensive river frontage to the Wilge River (4.8 km) as the longitudinal axis of the site is located parallel to the Wilge. Site F is further situated on top of a watershed, therefore drainage from site F will be in the direction of the Wilge River westwards and to the Klipfonteinspruit eastwards. This site will thus require Pollution Control Dams in at least five locations, with PCDs situated close to the Wilge River and the Klipfonteinspruit.

Additional adverse impacts associated with site AF include:

- The second highest wetland extent of the six alternative disposal scenarios, and only marginally (16 ha) less than site A with the highest coverage;
- Highest potential indirect impact on wetlands with extensive wetlands situated close proximity to the site;
- A seasonal pan of high importance is located on site F, which supports both Red Data flamingo species;
- The western portion of site F is located within an unaffected catchment;
- Four wetland crossings will be required, including three crossings over the Klipfonteinspruit wetland system;
- The attempt to reduce the extent of wetland habitat directly impacted by using two sites rather than one has not been very successful in this combination site; and
- Contact zones and geologic boundaries on site F is considered as a No-Go zone by the groundwater specialist.

Positive features associated site AF include:

- The reduction of the footprint of site A has avoided the destruction and realignment of the Klipfonteinspruit; and
- The aquifer recharge potential associated with the combination site AF is relatively low thus less sensitive than the sites located to the north of the study area.

Site AG (combination of site small A and site G) was introduced as a feasible disposal option to reduce the impact of site A on wetlands by reducing the footprint of site A from the valley bottom wetland associated with the Klipfonteinspruit (the northern valley bottom wetland). As with site AF, an unfortunate reality of the combination site AG is that it consists of two sites, thus increasing the disturbance footprint and extending the zone of impact.

The main negative impact associated with the proposed combination site AG is the significant risk this site poses to the Wilge River. Site G is situated in close proximity (~600 m) to the Wilge River, and although still extensive it has less river frontage to the Wilge River than that of site F. Further, four (4) sub-catchments will be affected by site G that are currently unaffected by Kusile activities. Site G will therefore require Pollution Control Dams in six locations across the four (4) sub-catchments.

Additional adverse impacts associated with site AG include:

- Third highest wetland coverage amongst the alternatives and only 30 ha less than site A;
- Extensive wetlands (~218 ha) in close proximity to the combination site AG;
- Three crossings of the Klipfonteinspruit wetland system will be required;
- The attempt to reduce the extent of wetland habitat directly impacted by using two sites rather than one has not been very successful in this combination site; and
- Contact zones and geologic boundaries on site F are considered as a high sensitivity by the groundwater specialist.

Positive features associated site AG include:

- The reduction of the footprint of site A has avoided the destruction and realignment of the Klipfonteinspruit; and
- The aquifer recharge potential associated with the combination site AG is relatively low thus less sensitive that the sites located to the north of the study area.

Site FG (combination of site F and site G) was introduced as a feasible disposal option as neither site F nor G would individually be able to receive the total volume of ash generated over the 60 year lifespan of the Kusile Power Station.

The greatest concern regarding site FG is its proximity to the Wilge River and the combined extended frontage onto the Wilge River evident from the combination of F and G. The full length of this alternative will run parallel to the Wilge for a stretch of approximately 10 km, with the entire western edge within 1.5 km of the river channel. This results in a significant potential impact risk to the Wilge, which is considered even higher than the combination sites AF and AG. Impacts associated with construction will include erosion, sedimentation and possible turbidity increases to the Wilge River.

Additional adverse impacts associated with site FG include:

- Extensive wetland coverage (~246 ha) in close proximity to the combination site FG;
- A seasonal pan of high importance is located on site F, which supports both Red Data flamingo species;
- Site G and the western portion of site F is located within an unaffected catchment;
- Three crossings of the Klipfonteinspruit wetland system will be required;
- Pollution control dams will be required in 7 locations across the two sites; and

- Contact zones and geologic boundaries on site F are considered as a No-Go zone by the groundwater specialist.

Positive features associated site FG include:

- Second lowest wetland coverage (~104 ha) within direct footprint;
- Lowest coverage of PES category A and B wetlands within footprint;
- Only two wetland crossings will be required, including a crossing of the Klipfonteinspruit wetland system.

7.2.4 Comparative assessment matrix

Impacts or impact categories that are likely to have a significant influence on the choice of least sensitive (most preferred) site were identified by the EAP based on the impacts identified by the team of specialist and extensive consultation between the EAP, specialists and regulating authorities (DWS and DEA).

Most of these impacts or impact categories represents one or more impacts or features that aids in distinguishing which of these feasible sites have a more or less sensitive receiving environment. For example, Degree of difficulty of engineered solution represents the complexity in the proposed engineering designs resulting from the degree to which the ADF and conveyor must be designed to make it functional within the landscape, and complexity to which mitigation measures must be designed to prevent adverse impacts on the environment. A site is deemed less favourable if clean and dirty water infrastructure must be constructed across a large area at several locations, as this makes storm water and runoff management more complex.

Impacts for all the proposed sites, including combination sites were rated according to environmental sensitivity to each site. These ratings are based on those proposed by specialists in the comparative assessment sections of their specialist reports. Environmental sensitivity was rated according to the sensitivity scale provided below:

- Very low sensitivity: 1
- Low Sensitivity: 2
- Moderate Sensitivity: 3
- High Sensitivity (4): 4
- Very high sensitivity: 5

Comparative assessment of the feasible site alternatives are provided in Table 7-1.

Table 7-1: Comparative assessment matrix of feasible alternative sites

IMPACTS / IMPACT CATEGORIES	SITE ALTERNATIVES / DISPOSAL SCENARIOS					
	A	B	C	AF	AG	FG
Degree of difficulty of engineered solution	2	5	3	4	4	4
Land ownership	1	5	5	3	3	4
Impacts on Wilge River (distance, impact risk)	2	4	3	4	4	5
Direct impacts on wetland, aquatic habitat	5	2	5	4	4	3
Indirect impact on adjacent wetlands, pans	3	4	5	4	4	4
Impact on wetland biodiversity	3	3	5	4	3	3
Impact on groundwater	2	4	4	2	2	2
Loss of terrestrial vegetation / habitat for fauna	3	3	5	2	2	1
Avifauna	2	1	5	3	3	4
Loss of bat species richness	1	4	5	2	2	3
Air quality impacts	1	1	1	1	1	1
Noise impacts on residences / communities	1	1	1	1	1	1
Soil, Land use & Agricultural potential	3	5	1	3	3	2
Cemeteries, historical structures and resources	1	3	5	2	4	4
Loss of livelihoods / resettlement of people	1	5	5	4	2	4
Visibility and landscape character	1	4	5	3	3	3
Adverse impacts on traffic	1	4	4	2	2	3
SENSITIVITY SCORE	**33**	**58**	**67**	**48**	**47**	**51**

Site A shows the lowest overall sensitivity, even though the direct impact on wetlands is considered very high sensitivity.

7.3 SUSTAINABILITY AND COST-BENEFIT ANALYSIS

This section provides an overview of the ecological and socio-economic systems within which the ADF sites are located. It further presents the results of a multi-criteria analysis (MCA) performed by the study specialists to select the most preferred site.

Each of the specialist studies undertaken for the ADF environmental assessment may recommend a different site alternative based on criteria that are specific to their field of study. This could result in a situation where each specialist proposes a different preferred alternative and consensus around a single preferred development alternative may not be possible. A Sustainability Assessment for the selection of a preferred alternative was thus undertaken to assess the outcomes of all the specialist studies in order to identify a development alternative that has the lowest overall impact on the receiving environment, while maximising the benefits derived from this development locally, regionally and on a national level.

A cost-benefit analysis (CBA) analyses the financial costs of each of the sites and converts the specialist findings into an economic analysis by adopting an ecosystem services approach. A CBA was applied to conduct a comparative analysis of the six development alternatives.

The specialist studies used during the sustainability assessment and cost-benefit analysis included Wetlands, Aquatic Biodiversity, Surface Hydrology, Groundwater, Terrestrial Ecology, Avifauna, Bats, Social, Heritage, Soils, Air Quality, Geotechnical/Engineering, and Traffic Impact Assessment.

7.3.1 Sustainability Assessment

The sustainability assessment was undertaken through a multi-criteria analysis (MCA) to select the best possible site for the Kusile ADF using the specialist's inputs and reports. The MCA method used for the site selection for the Kusile ADF is a variation on the Analytic Hierarchy Process. Further details on the methodology used can be viewed in the Sustainability Assessment specialist report in Appendix F.

The specialists were then asked to score each of the six Alternatives in terms of criteria applicable to their study and assign a weight to the overall importance of each criterion. The overall score from each of the Alternatives for each of specialist studies is then ranked from the lowest score, as the best preferred to the highest which is the least preferred (Table 7-2).

Table 7-2. Specialist ranking for each of the six alternatives

Criteria	Development Alternatives					
	A	B	C	GA	FA	FG
Wetlands	1	3	6	2	4	5
Aquatic	1	4	2	3	5	6
Groundwater	1	4	6	3	2	5
Surface Hydrology	2	2	1	4	4	4
Terrestrial Ecology	5	6	4	1	2	2
Avifauna	2	1	6	3	4	5
Bats	1	3	4	2	5	6
Air Impacts	1	2	2	-	-	-
Soil	4	5	1	2	3	6
Social	1	5	6	4	2	3
Heritage	3	4	2	5	1	5
Traffic	1	5	5	2	2	2
Engineering	1	2	4	2	5	5
Number of specialists who most preferred the site	**8**	**1**	**2**	**1**	**1**	**0**

The analysis above concludes that **Alternative A is the preferred site** in terms of the MCA, while Alternative FG is least preferred. Alternative C is second most preferred, however due to social concerns Alternative C, is not likely to be chosen. Alternatives B, GA and FA are evenly scored at the third most preferred sites.

7.3.2 Cost-Benefit Analysis

The CBA analyses the financial costs of each of the sites and converts the specialist findings into an economic analysis by adopting an ecosystem services approach.

Analysis of the financial cost associated with each of the proposed alternatives (Table 7-3) was undertaken by considering the cost involved in developing, operating and rehabilitating the ADF. Major cost components considered were:

- Construction capital costs associated with the lining system (on average = 37% of financial cost),
- Conveyor costs (on average = 14% of financial cost),
- ADF rehabilitation costs (on average = 16% of financial cost), and
- Operations and maintenance costs (on average = 22% of financial cost).

The results of this analysis are shown in Table 7-3 below.

Table 7-3. Comparison of conceptual design costs for the six Alternatives

Costs (R'M)	Alternatives					
	A	B	C	GA	FA	FG
Capital Construction costs	2,219	2,908	3,375	3,328	3,218	3,398
Capital costs for Clay	-	-	488	-	-	-
Conveyor Costs (Overland and Extendable)	831	1,713	1,752	1,063	1,292	1,336
Conveyor Costs (Shiftable)	255	224	215	240	240	205
Conveyor River Crossings	36	216	72	108	108	72
Starter Platform Earthworks	125	83	64	159	194	125
Pollution control dams	9	33	23	37	33	42
Diversions and prep costs	5	55	163	125	61	175
Stream Diversions	250	-	-	75	75	-
Rehabilitation Costs - ADF	822	1,077	1,250	772	1,192	1,964
Opex costs	816	3,897	1,528	1,654	1,378	1,998
Shifting costs	60	71	111	102	136	137
Total Construction Costs	5,429	10,276	9,041	7,663	7,924	9,450
Comparison between Alternatives	100%	186%	165%	140%	145%	172%

The ADF forms part of the operations of the Kusile Power Station and will thus not produce a direct revenue stream. Therefore an indirect cost on electricity prices will be felt. The cost of Alternative A to power generation is 0.23 cents/kWh. Alternative GA would increase power generation costs by an additional 0.09 cents/kWh to 0.32 cents/kWh, whereas Alternatives B, C, FA and FG would increase power generation costs by an additional 0.20, 0.15, 0.10 and 0.17 cents/kWh respectively (Table 7-4).

Table 7-4. Comparison of the impacts on electricity prices for the six Alternatives

	Alternative					
	A	B	C	GA	FA	FG
Kusile capacity (MW)	4,800	4,800	4,800	4,800	4,800	4,800
Capacity factor (%)	95%	95%	95%	95%	95%	95%
KWh (Million)	39,946	39,946	39,946	39,946	39,946	39,946
Cents/kWh	0.23	0.43	0.38	0.32	0.33	0.40

When the economic value of ecosystem services is considered the CBA found that the ADF would put aquatic ecosystem services at risk. However on a sub-catchment level of the Olifants WMA the Upper Olifants the potential ecosystem services in monetary value is considerable less than the other alternatives.

Alternative A emerges as the preferred Alternative.

The benefits of Alternative A include:

- Lowest inferred ecosystem cost (i.e. most preferred) Alternative by the following specialists:
    - Wetlands specialist
    - Aquatic ecosystems specialist
    - Groundwater specialist
    - Social specialist
    - Bats
    - Air Quality
    - Soils specialist
    - Traffic specialist
    - Engineering specialist.
- Highest minimisation and offset potential area;
- Least number of dirty water dam controls (one only on the Klipfonteinspruit, more than 6.5 km from the Wilge River) - this limits the risk of water pollution and maximises the ability to mitigate impacts before reaching the Wilge River;
- Lowest cost Alternative to Eskom;
- Lowest cost Alternative to electricity users.

Alternative A has the following negative impacts, which need to be addressed in a mitigation strategy:

- It has 227 ha of wetland area and associated terrestrial habitat that would have to be offset;
- It contains graves that need to be relocated.

8 PROJECT DESCRIPTION

The detailed comparative assessment and sustainability assessment undertaken during the EIR phase concluded that Site A is the most preferred site for the placement of the ADF and associated infrastructure. This chapter only describes the project design and components for the proposed ADF and associated infrastructure on Site A. The engineering concept design report and infrastructure design drawings are provided in Appendix G.

8.1 PROJECT COMPONENTS AND LAYOUT

8.1.1 Site Layout

Site A is positioned south of the power station. It is wedge shaped, starting wide in the north and becoming narrower as it develops southwards.

Due to the site constraints the space is limited which consequently requires the ash facility to start near final height instead of typically starting near ground level and building an approach ramp at a slope of 1[v]:20[h] up to final height. Therefore a substantial starter platform is included in the design. The starter platform will be constructed from ash using a truck and haul operation. The platform will also need to be lined.

Site A is characterised by a valley draining from the south-east to the north-west forming the Holfonteinspruit (Figure 8-1). This valley will continue to lead clean storm water into the site for the duration of operations and therefore requires a combination of contour cut-off drains and clean storm water attenuation dams. A dam and a diversion canal system upstream of the New Largo Phola Conveyor will also be required. A river diversion will further be required for the Klipfonteinspruit, which is located along the northern side of the site.

The detailed conceptual design of the 60 year ash facility at Kusile Power Station consists of the following components:

- A lined starter platform constructed of ash with a storage capacity of 5 years;
- A lined ash disposal facility with a storage capacity of 55 years;
- Clean and contaminated water separation and storage infrastructure including:
  - Pollution control dams (PCDs);
  - Contaminated storm water trench network;
  - Klipfontein river diversion and stilling basin;
  - Clean storm water diversion trenches and berms;
  - Clean storm water contour cut-off drains;
  - Clean storm water holding dams;
  - Clean storm water transfer drains.
- Pipelines:
  - For transporting water between the PCDs and the Power Station;
  - For transporting water for dust suppression and irrigation;

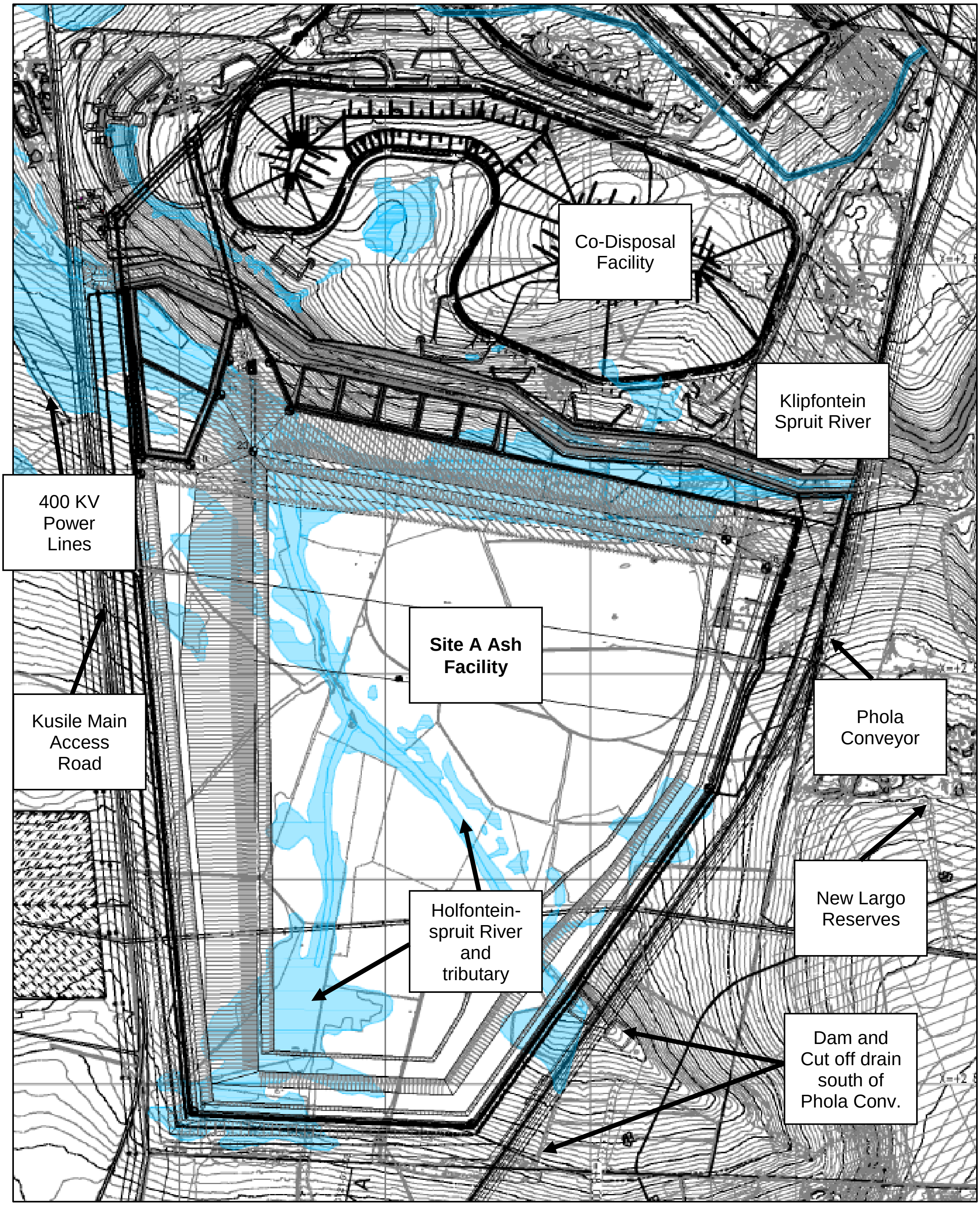


Figure 8-1: Site A Layout

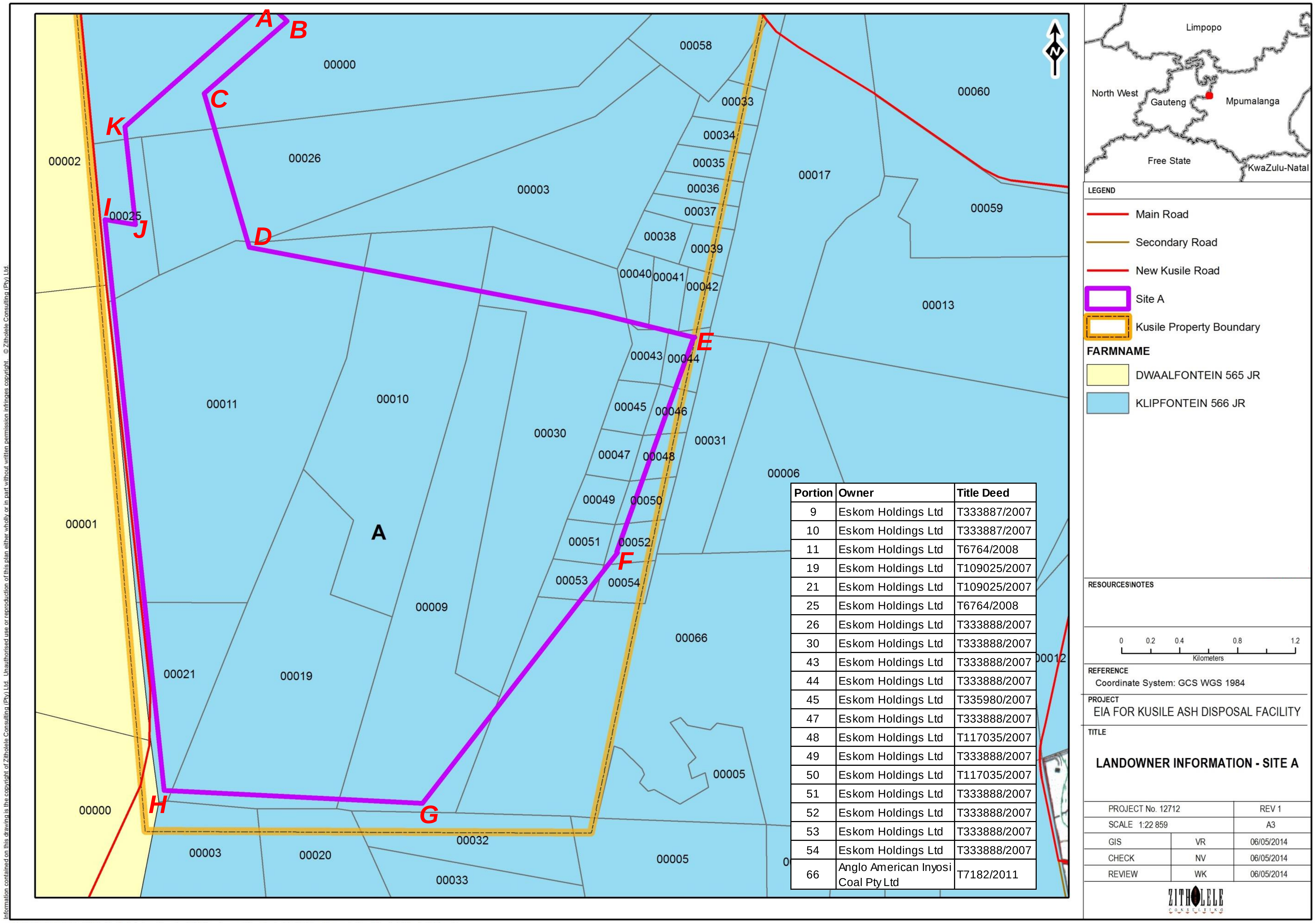
  - For transporting water between the clean water holding dams and the contour drains.
- Access roads around the facility;
- A fence line around the facility;
- Relocation of existing infrastructure including a power line that runs through the site;
- Rehabilitation of the ash facility.

8.2 AFFECTED PROPERTIES AND LAND OWNERS

The extent of Site A is owned entirely by Eskom Holding SOC Limited (Table 8-1, Figure 8-2). Only a small portion located in the south eastern extent of Site A belongs to Anglo American (66/566, Klipfontein). This portion is bordered on its south eastern side by the Phola Conveyor as indicated by the coloured block in Figure 8-2. Just to the north east of the above-mentioned portion of land the Phola Conveyor bisects five smaller portions of land owned by Eskom (portions 48, 50, 52, 53 and 54 of Klipfontein 566 JR). A "land swop" agreement with Anglo American was reached whereby Eskom and Anglo American would "swop" portions of land to ensure all the land within the Eskom site boundary is owned by Eskom. No mineral prospecting or mining right has been registered on any of the properties within the bounds of Site A.

Table 8-1: Portions of Klipfontein 566 directly affected by Site A development footprint, including ownership

Portion	Owner	Title Deed
9	Eskom Holdings Ltd	T333887/2007
10	Eskom Holdings Ltd	T333887/2007
11	Eskom Holdings Ltd	T6764/2008
19	Eskom Holdings Ltd	T109025/2007
21	Eskom Holdings Ltd	T109025/2007
25	Eskom Holdings Ltd	T6764/2008
26	Eskom Holdings Ltd	T333888/2007
30	Eskom Holdings Ltd	T333888/2007
43	Eskom Holdings Ltd	T333888/2007
44	Eskom Holdings Ltd	T333888/2007
45	Eskom Holdings Ltd	T335980/2007
47	Eskom Holdings Ltd	T333888/2007
48	Eskom Holdings Ltd	T117035/2007
49	Eskom Holdings Ltd	T333888/2007
50	Eskom Holdings Ltd	T117035/2007
51	Eskom Holdings Ltd	T333888/2007
52	Eskom Holdings Ltd	T333888/2007
53	Eskom Holdings Ltd	T333888/2007
54	Eskom Holdings Ltd	T333888/2007
66	Anglo American Inyosi Coal Pty Ltd	T7182/2011



Portion	Owner	Title Deed
9	Eskom Holdings Ltd	T333887/2007
10	Eskom Holdings Ltd	T333887/2007
11	Eskom Holdings Ltd	T6764/2008
19	Eskom Holdings Ltd	T109025/2007
21	Eskom Holdings Ltd	T109025/2007
25	Eskom Holdings Ltd	T6764/2008
26	Eskom Holdings Ltd	T333888/2007
30	Eskom Holdings Ltd	T333888/2007
43	Eskom Holdings Ltd	T333888/2007
44	Eskom Holdings Ltd	T333888/2007
45	Eskom Holdings Ltd	T335980/2007
47	Eskom Holdings Ltd	T333888/2007
48	Eskom Holdings Ltd	T117035/2007
49	Eskom Holdings Ltd	T333888/2007
50	Eskom Holdings Ltd	T117035/2007
51	Eskom Holdings Ltd	T333888/2007
52	Eskom Holdings Ltd	T333888/2007
53	Eskom Holdings Ltd	T333888/2007
54	Eskom Holdings Ltd	T333888/2007
66	Anglo American Inyosi Coal Pty Ltd	T7182/2011

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Figure 8-2: Map of landowners affected on Site A

8.3 FOOTPRINT AND LIFESPAN OF FACILITY

The footprint of the starter platform of the ADF is 120.5 ha (1 205 000 m^2). Approximate dimensions are 3 500 m long by 380 m wide. The footprint of the ash facility is 696.6 ha (6 966 300 m^2), with approximate dimensions of 3 350 m long by 2 825 m wide. The footprint of the first 5 years starter platform to be lined is 125.7 ha (1 257 000 m^2), with approximate dimensions of 3 500 m long by 420 m wide.

Coordinates of the corners of the proposed Site A facility is provided in Table 8-2 below. Coordinate markers are indicated in red text in Figure 8-2.

Table 8-2: Coordinates for Site A facility

Corner Marker	Degrees, minutes, seconds	
	Longitude	Latitude
A	28°54'19.63" E	25°55'39.96" S
B	28°54'24.29" E	25°55'44.30" S
C	28°54'05.70" E	25°56'00.46" S
D	28°54'15.79" E	25°56'34.91" S
E	28°55'55.24" E	25°56'54.99" S
F	28°55'38.00" E	25°57'42.97" S
G	28°54'54.54" E	25°58'39.16" S
H	28°53'56.77" E	25°58'36.30" S
I	28°53'43.56" E	25°56'28.69" S
J	28°53'50.35" E	25°56'29.84" S
K	28°53'47.97" E	25°56'07.91" S

The life span of the entire ash disposal facility is 60 years, with the starter platform accounting for approximately 5 years' worth of ash deposition and the rest of the ash facility approximately 55 years.

8.4 HEIGHT, SOURCE AND VOLUME OF WASTE

The ADF for the Kusile Power Station will employ a multi-stacker system, therefore the ash facility will consist of four ash layers:

- Bottom Stacker: Front stack height – 5 m;

  Back stack height – 12 m;
- Top Stacker: Front stack height – Varies from 30 to 94 m (worst case). The average thickness is 51.6 m.

  Back stack height – 12 m.

The bottom stacker will follow ground contours therefore the top surface of the bottom stacker's back stack will mimic the ground topography. Additional sloping and dozing may be required to ensure adequate drainage of this layer.

The top stacker will progress at a slope of 1:20 until final height of the ash facility is reached. It will then progress at a slope of 1:300 until the end of the stack is reached. Therefore the top stacker's front stack height varies from a minimum of 30 m to a maximum of 94 m depending on the topography of the ground level. The thickest part of the front stack occurs where the facility develops over the Holfontein Valley. The back stack layer thickness is constrained by the geometric dimensions of the stacker. The back stack is formed from 14 m high cones with the top two meters being dozed to form a 12 m thick stack.

The thickness of the bottom stacker front stack is dependent on the nature of the site soils. The site soils consist mainly of tillite material which typically has high clay content. Therefore, it can be expected that the strength of the soil will be insufficient to support a high ash stack due to the generation of high excess water pressures. The strength of the in situ soils increases as the excess pore water pressures dissipate due to the applied load from the front stack. The additional strength is required for the higher top stacker's front stack that later follows. At this stage of the design, a 5 m high front stack for the bottom stacker is assumed. The total required storage is calculated in Table 8-3.

Table 8-3: Calculation of the required volume of the ash facility

Description:	Value:	Unit:
Load	150	t/hr/unit
Load Factor	90	%
Availability Factor	90	%
Result	121.5	t/hr/unit
Factor of Safety	1.1	
Final load	133.65	t/hr/unit
Rounded load	135	t/hr/unit
Daily Load per unit	3,240	t/day/unit
Monthly Load per unit	98,550	t/month/unit
Yearly Load per unit	1,182,600	t/year/unit
Total Load per unit (60 year life)	70,956,000	t/60yr/unit
Total Load of Power station	425,736,000	t/60yr/6units
Bulk Density	0.8	t/m^3
Total Volume	532,170,000	m^3

The storage volume available in the ADF must be greater than 532 million m^3. The storage capacity of the designed ash facility is 534 million m^3 therefore it is large enough to store the required ash volume. The storage capacity is split into the following sections:

- 35.8 million m^3 in the Starter Platform;
- 113.6 million m^3 in the Bottom Stacker (Volume Split: 23% of Total);
- 385.3 million m^3 in the Top Stacker (Volume Split: 77% of Total).

8.5 WASTE CLASSIFICATION

The waste classification was carried out in terms of the National Norms and Standards for the assessment of waste for landfill disposal (R635 of 23 August 2013). Ash samples were taken from Kendal Power Station as they are considered the closest approximation of the ash expected at Kusile Power Station. Total extraction analysis was carried out on the ash sample. Australian de-ionised water leach tests were also carried out on the ash and an analysis of the leach solution was conducted.

The ash is classified as a Type 3 waste (low hazard waste). Therefore the ash requires disposal on a landfill with a Class C barrier system. This classification was the result of the leachable concentration of boron and the total concentration of barium and fluoride in the ash.

8.6 ADF INFRASTRUCTURE

8.6.1 Starter Platform

The Starter Platform is designed such that it provides the walkout platforms for the upper and lower tier stackers.

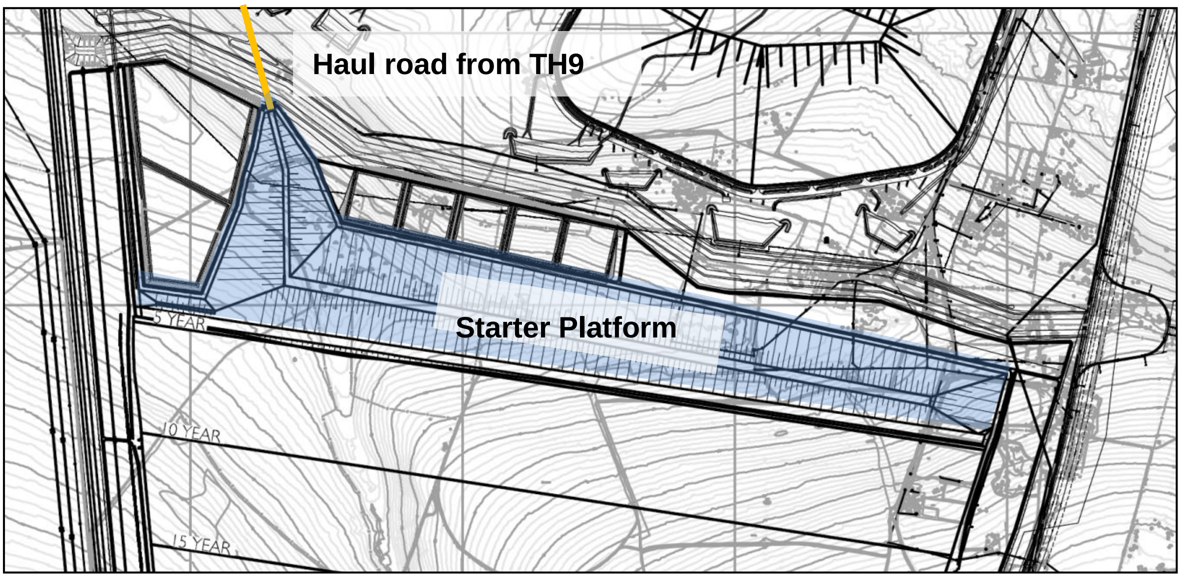

Figure 8-3: Final Starter Platform

The lined Starter Platform has a storage capacity of 5 years and has the following dimensions:

- Length: 3 500 m
- Width: 380 m
- Footprint area: 120.5 ha
- Maximum Height: 73.5 m

- Average Height: 29,7 m
- Volume: 35.8 million m^3
- Side slopes: 1[v]:3[h] on the east, west and north sides, 1[v]:2.5[h] on the southern side due to the advancing face launching from this face.

8.6.2 The Barrier System

The barrier is designed according to the National Norms and Standards for the assessment of waste for landfill disposal (R635 of 23 August 2013). As the ash is classified a Type 3 waste, the barrier has been designed according to the Class C lining specification as shown in Figure 8-4.

The barrier for the facility will be installed every five years coinciding with the commencement of each 5 year development stage. This is to reduce risk of damage due to exposure for long periods of time. As the liner is required to be installed before the ash facility reaches the capacity of the previously lined area, and due to the fact that the liner installation is a lengthy process, careful planning is required to ensure smooth development of the facility.

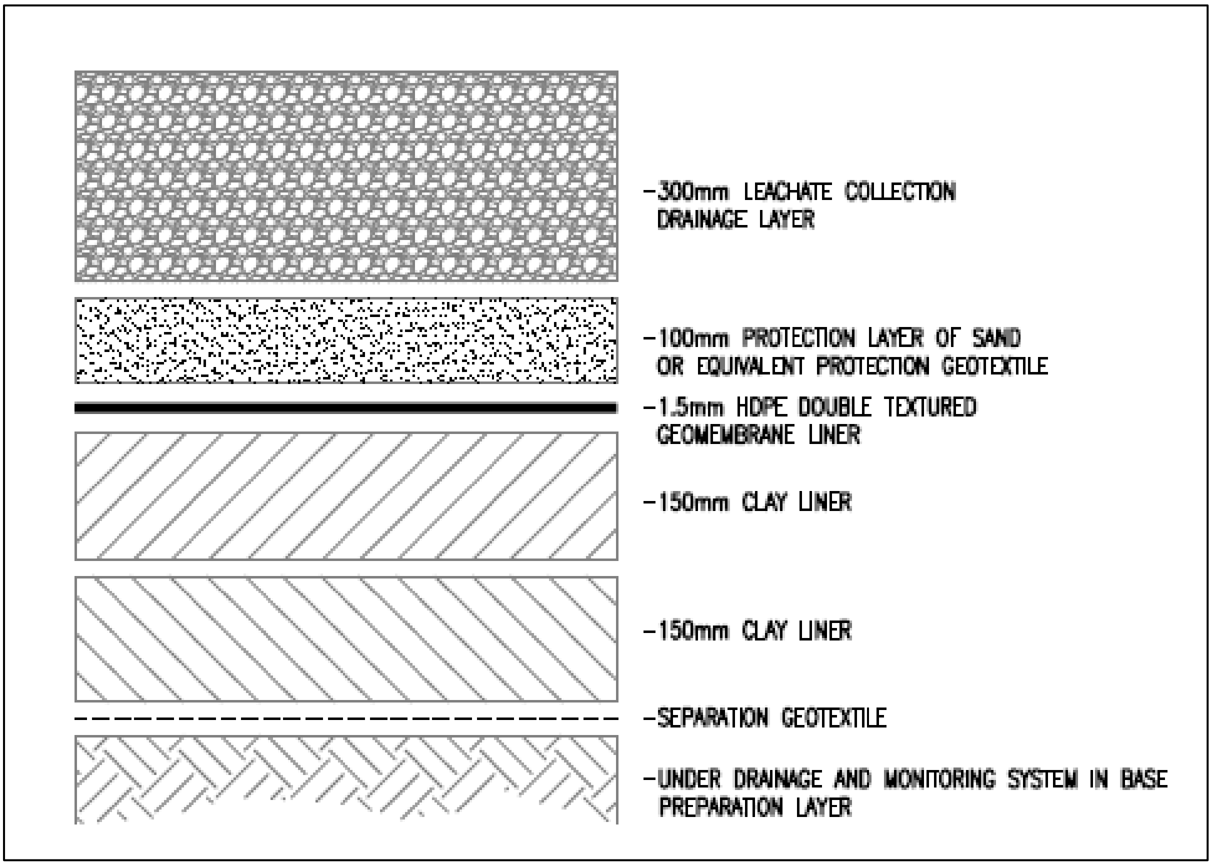

Figure 8-4: Class C Liner Specification in terms of DEA Norms and Standards

Table 8-4: Construction processes under various development periods

	A	B	C	D	E	F	G	H	I	J
1	**Ash facility operation period:**	**Lined Area: (Ha)**	**Required Pollution Control Dams**	**Clean SW contour cut-off drains**	**Clean Storm Water Infrastructure**	**Access Road**	**Contaminated Storm Water Network**	**Rehabilitation**	**Other**	**Redundant Infrastructure**
2	Starter Wall: 0-5 year life	120.5	PCD 1 - 7	Main Clean SW Contour cut-off drain in footprint and east of Phola Conveyor	- Dam D10 - New Largo Dam - Klipfonteinspruit River Diversion incl. stilling basin - Clean water side drains - Clean water diversion berms	- Access Road around starter platform footprint and along fence up to 20 year development line (+15 yr) - Haul Road to Starter Platform	Northern, eastern and western sides.		- Topsoil Stockpile area	
3	5 – 10	127.5		5 -10 yr Clean SW Contour cut-off drain	- Dam D1	Access Road around footprint	Extend east and western sides	Rehabilitate Starter platform Rehabilitate 5 – 10 year development	- Conveyor platforms up to starter platform - Emergency Stockpile Platforms 1 and 2	
4	10 – 15	120.1		10 -15 yr Clean SW Contour cut-off drain	- Dam D2	Access Road around lined footprint	Extend east and western sides	Rehabilitate 10 – 15 year development		- Dam D1
5	15 – 20	67.9		15 -20 yr Clean SW Contour cut-off drain	- Dam D3A and D3B	Access Road around lined footprint	Extend western side	Rehabilitate 15 – 20 year development		- Dam D2
6	20 – 25	55.7		20 -25 yr Clean SW Contour cut-off drain	- Dam D4A and Dam D4B	Access Road around lined footprint and along fence up to 40 year development line (+35 yr)	Extend western side	Rehabilitate 20 – 25 year development		- Dam D3A and D3B
7	25 – 30	37.2		25 -30 yr Clean SW Contour cut-off drain	- Dam D5A and D5B	Access Road around lined footprint	Extend western side	Rehabilitate 25 – 30 year development		- Dam D4A and Dam D4B
8	30 – 35	48.9		30 -35 yr Clean SW Contour cut-off drain	Dam D6A and D6B	Access Road around lined footprint	Extend western side	Rehabilitate 30 – 35 year development		- Dam D5A and D5B
9	35 – 40	55.8		35 -40 yr Clean SW Contour cut-off drain	Dam D7A and D7B	Access Road around lined footprint		Rehabilitate 35 – 40 year development		Dam D6A and D6B
10	40 – 45	51.1		Main Clean SW Contour cut-off Outlet pipe 1.0m Diameter concrete pipe	Dam D8A and D8B	Access Road around lined footprint and along fence up to 60 year development line (+55 yr)		Rehabilitate 40 – 45 year development		Dam D7A and D7B
11	45 – 50	46.5		Main Clean SW Contour cut-off Outlet pipe 1.0m Diameter concrete pipe	Dam D9	Access Road around lined footprint		Rehabilitate 45 – 50 year development		Dam D8A and D8B
12	50 – 55	48.2		Main Clean SW Contour cut-off Outlet pipe 1.0m Diameter concrete pipe		Access Road around lined footprint		Rehabilitate 50– 55 year development		
13	55 – 60	39.8		Clean SW transfer drain		Access Road around lined footprint		Rehabilitate 55 – 60 year development		
14	Decommissioning	0				Access Road and security fence around entire existing facility		Carry out final rehabilitation		- PCD 2 and PCD 4 to 7

Note:

1. Infrastructure requirements for previous periods apply to subsequent periods unless included in Redundant Infrastructure (Column J)

The barrier system includes the following layers from excavation level upwards:

- Substrate preparation layer: The substrate will be ripped and re-compacted to 95% MOD AASHTO with a moisture content of -2 to +2% of optimum moisture content. Subsoil drains will be installed during this period. The detail of the subsoil drains is shown in Figure 8-5.
- Subsoil Drainage Layer: A 100 mm layer of filter sand will be used as a subsoil drainage layer.
- Primary impermeable layer: 2 x 150 mm layers of Tillite clay compacted to 98% Standard Proctor with a moisture content of +1 to +3% of optimum moisture content in order to have a permeability co-efficient (k) of less than $1x10^{-7}$ cm/s.
- Primary geomembrane layer: 1.5 mm HDPE double textured geomembrane layer.
- Leachate collection layer: 300 mm layer of filter sand with HDPE pipe drainage network. The detail of the leachate collection drains is also shown in Figure 8-5. The leachate collection system will be free draining. The average slope of the footprint is 1:30 and ranges from 1:5 in the valleys to 1:100 on the crests. The transmissivity of the filter sand used in the leachate collection system must be checked for adequate flow through the drainage layer to ensure that a hydrostatic pressure head of leachate does not build up on the geomembrane. The spacing of leachate collection pipes must also be confirmed during the detailed design phase to ensure adequate drainage.

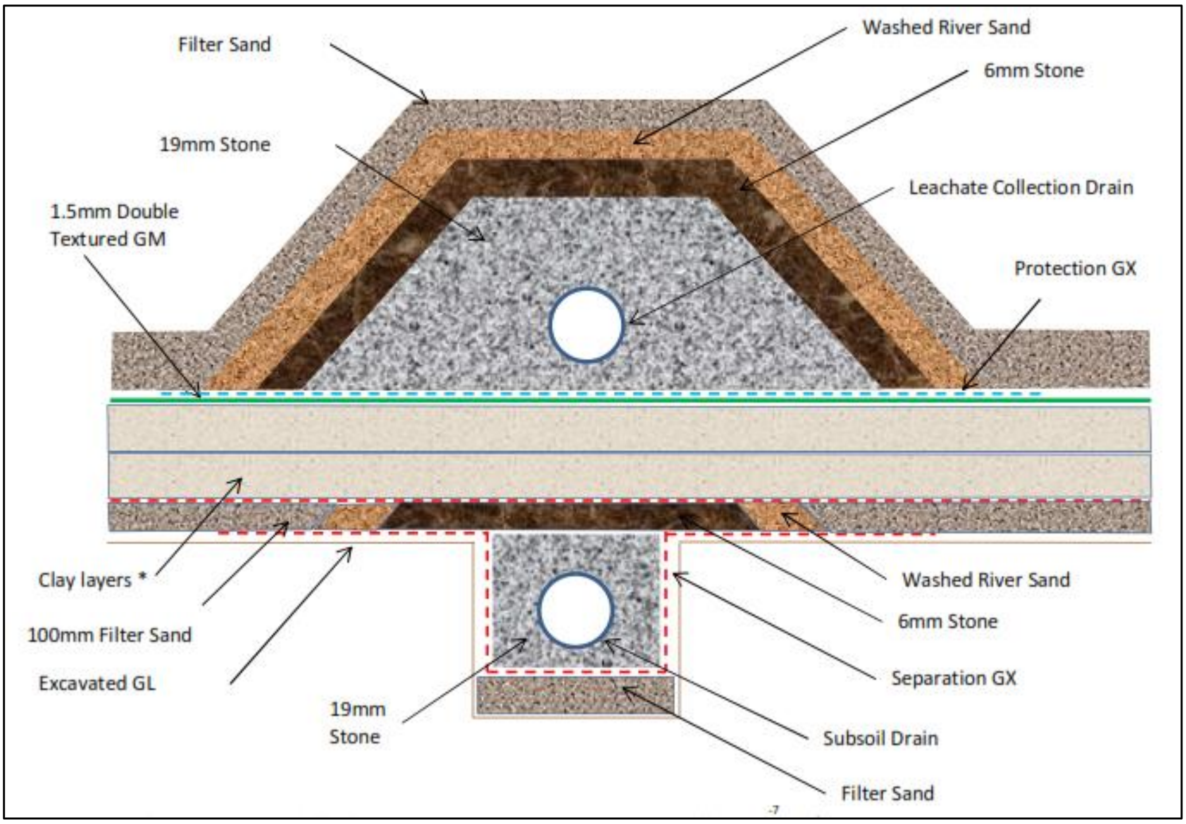

Figure 8-5: Barrier system applied to site conditions showing leachate and sub-soil conditions

The subsoil and leachate collection drains as well as the filter sand layers will be graded such that they act as natural filters for ash and the site material. The geomembrane will require anchoring on the sides of the area to be lined. This necessitates a berm on each side of the area. The berm will also act to divert storm water and retain leachate so that it may be extracted in a controlled manner.

Subsurface flows will be managed through a subsurface collection and drainage system designed underneath the barrier system. This subsurface drainage system will prevent the subsurface water from building up beneath the barrier system, which could cause damage to the barrier system.

The barrier system of the ADF and the PCDs will decrease the potential for leaching to the environment significantly. The ADF has a large buffer capacity meaning that it will take a long time for leachate to generate above the lining system. The lining system will have a leachate collection layer which will help to drain the leachate away before it can form a significant pressure on the lining system. However, it must be noted that lining systems may leak due to defects in the geomembrane that arise in the manufacturing, transporting and construction stages. For this reason, an expected leakage rate is typically calculated to feed into ground water monitoring models, as demonstrated by the ground water specialist study report provided in Appendix F7.

8.6.3 Conveyor Systems and Stackers

Due to the underlying geology not offering sufficient strength to support a front stack of more than 15 m a multi-level stacker setup, similar to the arrangement at Majuba Power Station, will be used.

The bottom stack will consolidate the underlying clay layers, increasing their strength in time to support the Top Stacker's high front stack and 12 m back stack as shown in Figure 8-6.

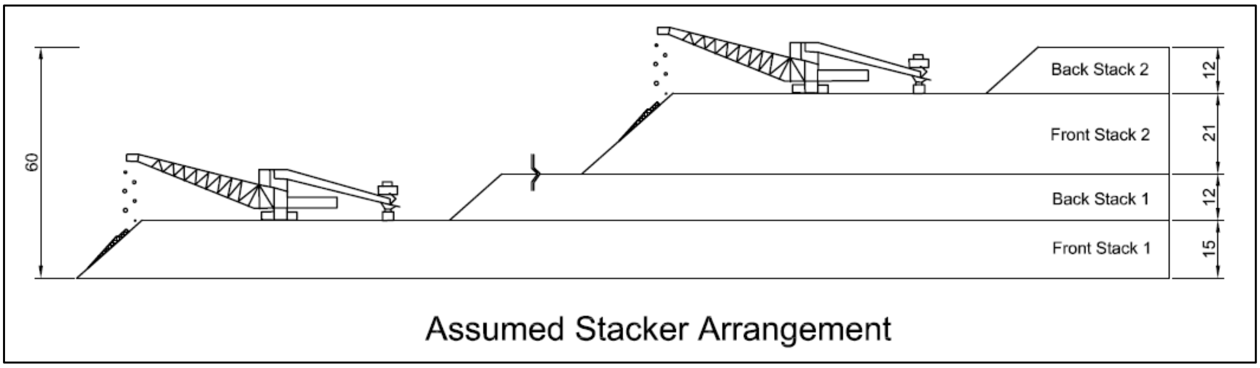

Figure 8-6: Multi Stacker Philosophy, as also applied at Majuba Power Station

Figure 8-7 and Figure 8-8 show the connection of the crawler mounted stacker to the tripper car which runs along tracks on the shiftable conveyor.

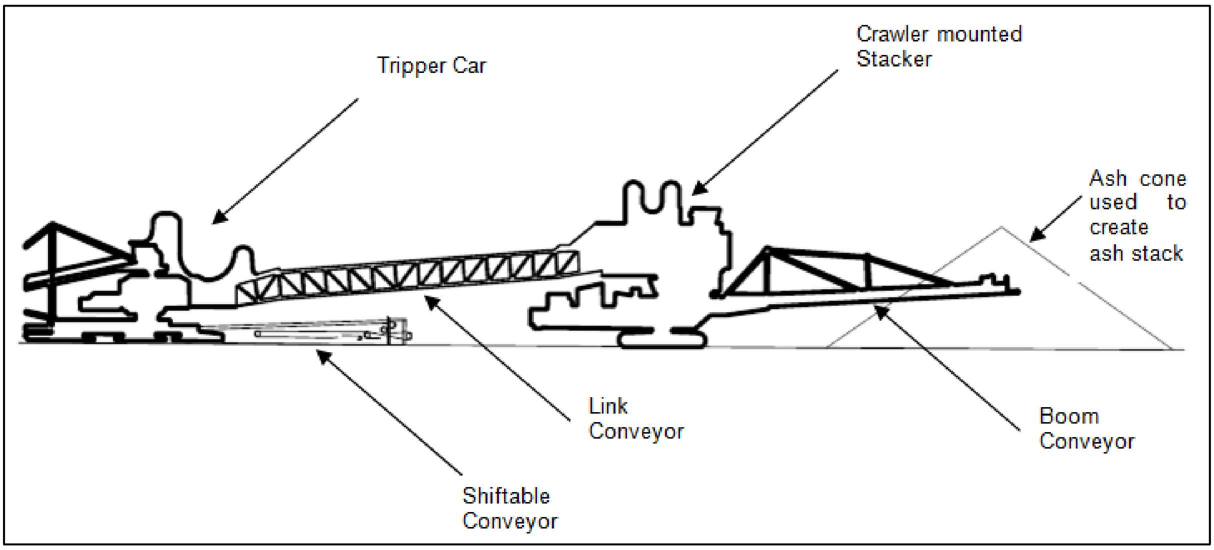

Figure 8-7: Stacker setup

Figure 8-8: Stacker setup at Medupi Power Station

8.6.4 Emergency off loading facility

If one or both stackers are out of commission, ash will temporarily be offloaded onto the emergency ash platform situated after the additional transfer houses required for the overland conveyor.

The overland conveyors are connected to a moving head system which can extend past the transfer point and deposit ash onto the emergency platform. The extended length is supported by a wall which also retains the ash until it can be moved by mobile equipment.

No additional hardening to cater for mechanical track wheels will be included in the design of the slab on the emergency platform. Therefore only plant with conventional tyre wheels should be used. The ash is transferred onto the extendable conveyor with the use of small plant such as a skid steer vehicle (bobcat type loader) or a TLB.

8.7 CLEAN AND DIRTY WATER SEPARATION AND CONTAINMENT INFRASTRUCTURE

8.7.1 General Storm Water Management

Storm water that falls on the ash facility or conveyor platforms will be contaminated and will be kept separate from clean storm water from the catchment. The site will have a network of contaminated storm water collection trenches which will surround the facility and gravity-drain towards seven PCDs located on the northern side of the ash facility. Upstream clean storm water will be diverted around the ash facility via earth diversion berms and trenches, which will allow regrowth of aquatic vegetation. The clean storm water will be diverted into the environment downstream of the facility at pre-development rates.

The contaminated storm water system is designed according to GN 704 which states that the design should cater for a 1 in 50 year storm event and in addition has a 500 mm buffer (freeboard) between it and the clean storm water system. If a large enough storm (greater than 1 in 50 year storm) falls on the site it is possible that there may be spillage into the clean storm water system and onto the soil surface. Where two pollution control dams are located next to each other, the upstream dam will spill into the downstream dam which will in turn spill into the environment depending on the size of the rainfall event.

The storm water design philosophy is as follows:

- The dam sizing is based on the longest historic record of the nearest rainfall station. In the case of this design, the closest station that had the largest reliable data set (94 years) was the Wilge Weather Station (0514618W), positioned 13 km away.
- Evaporation data was taken from the Bronkhorstspruit Dam Evaporation Station.
- Various catchment scenarios are assessed. The worst case catchment scenario is designed for.
- The inflows into the dams considered are: Direct rainfall, contaminated or clean storm water run-off and make-up water from the power station.
- The outflows considered are: Evaporation, water pumped out of the dams, abstraction water for dust suppression and irrigation on the facility.
- The dams are sized to ensure that they could safely contain rain from storm events over a 50 year period with the allowance of one spilling event in that period.
- The run-off co-efficient for clean storm water flowing over undisturbed catchment = 10%.
- The run-off co-efficient for contaminated storm water flowing over the lining system catchment = 13%.
- Clean storm water dams will have a depth of 3.0 m.
- Pump size that will be used is 35 ℓ/s as typically used at other power stations.

8.7.2 Clean Storm Water Infrastructure and Management

The site is characterised by three main valleys:

- The Klipfonteinspruit valley that runs along the northern edge of the facility;
- The Holfonteinspruit valley that runs northwards down the centre of the site;
- The tributary valley that runs towards the northwest.

The last two valleys will be responsible for transporting storm water from the upstream catchments directly into the site. Therefore it will be essential to cut off as much water upstream as possible to reduce the water heading towards the site. There will always be a requirement for a clean water dam south and upstream of the ADF. As the ash facility develops southwards, the existing clean water dam will become redundant and will need to be demolished as it will be within the footprint of the future extension. Before it is demolished, a new dam will be required further upstream to take its place. Figure 8-9 shows the 17 clean storm water dams that will be required over the life of the facility.

The clean storm water dams are designed to continuously pump water to an upstream contour cut-off drain during the construction phase of the ADF. During the decommissioning phase, a trench will be constructed from the last remaining clean water cut-off drain to the nearest contour in order to negate the need for continuous pumping after the ADF is decommissioned. This will ensure the ADF is free draining at all times.

Two 35 ℓ/s pumps will be used at each dam so that a back-up system is in place. The use of pumps reduces the storage volume required so that the dams are smaller. It also reduces the amount of water lost to evaporation. However, it does introduce a dependency on pump systems. The risks of pump failure are used to introduce worst case scenarios. Table 8-5 shows the results of the calculation.

The following scenarios were considered:

- No pump failure (best case scenario);
- Both pumps fail for a period of 12 hours due to a power failure.
- One of the pumps fails and it takes 12 days to correct the failure (Worst case scenario).

Table 8-5: List of clean water dams including sizes and catchments

Description:	Dam Size:	Catchment (ha):
D1	30 000 m^3 (100 x 100 x 3 m)	103
D2	40 000 m^3 (115 x 115 x 3 m)	130
D3a	15 000 m^3 (70 x 70 x 3 m)	72.4
D3b	30 000 m^3 (100 x 100 x 3 m)	104.6
D4a	30 000 m^3 (100 x 100 x 3 m)	99
D4b	25 000 m^3 (90 x 90 x 3 m)	118
D5a	30 000 m^3 (100 x 100 x 3 m)	103
D5b	30 000 m^3 (100 x 100 x 3 m)	100.6

Description:	Dam Size:	Catchment (ha):
D6a	30 000 m^3 (100 x 100 x 3 m)	107.4
D6b	19 200 m^3 (80 x 80 x 3 m)	78.8
D7a	25 000 m^3 (90 x 90 x 3 m)	99.8
D7b	10 800 m^3 (60 x 60 x 3 m)	54.9
D8a	25 000 m^3 (90 x 90 x 3 m)	95
D8b	7 500 m^3 (50 x 50 x 3 m)	32.8
D9	19 200 m^3 (80 x 80 x 3 m)	77
D10	30 000 m^3 (100 x 100 x 3 m)	116.6
New Largo Dam	30 000 m^3 (100 x 100 x 3 m)	100

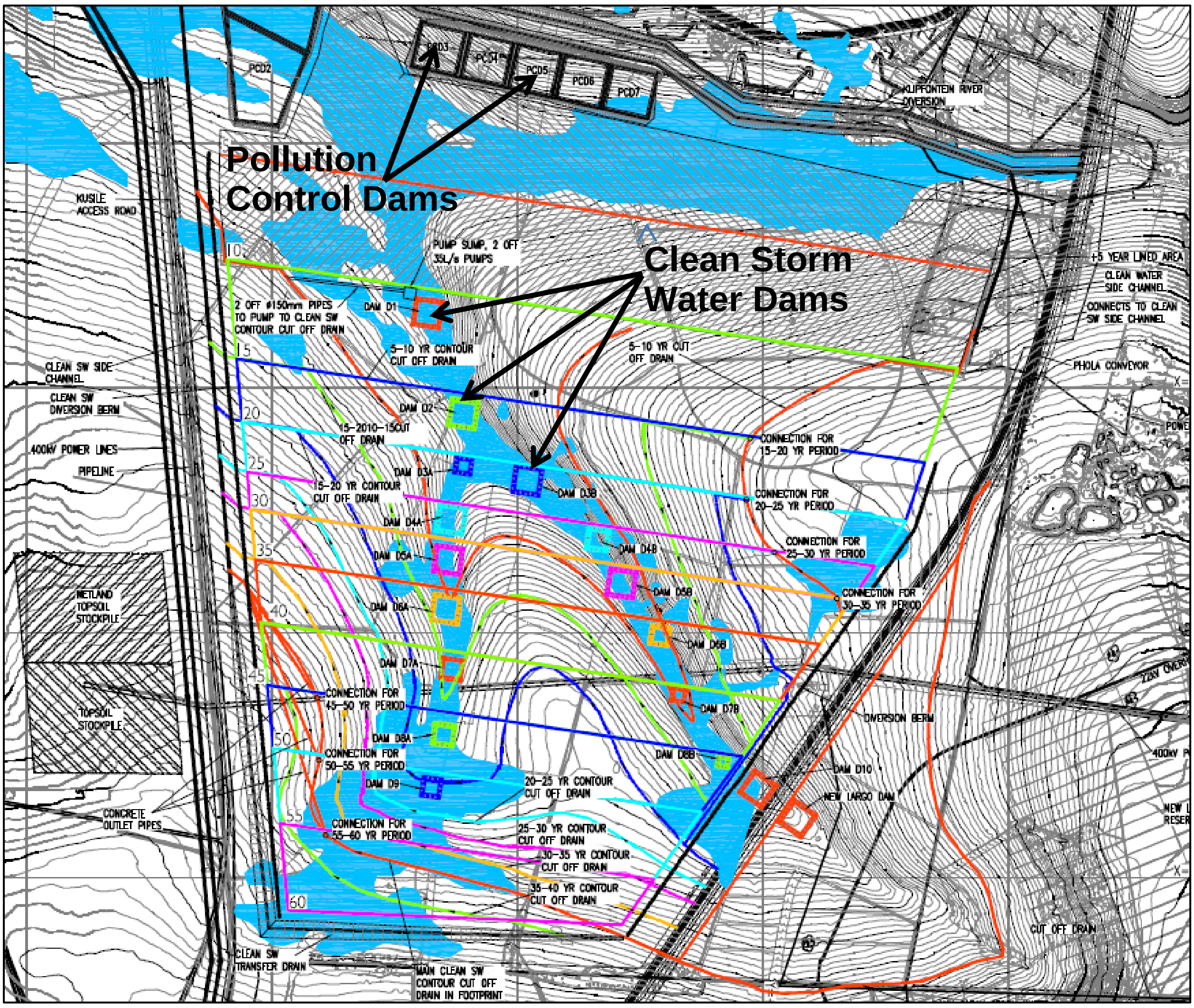

Figure 8-9: Layout of Clean Storm Water Dams and Pollution Control Dams

The removal of topsoil and exposure of soils during the construction of the lined area may lead to an increase in the turbidity of the surface water in the surrounding area. Therefore storm water run-off during construction will need to be managed such that sediment transport is limited. The management system will consist of cut-off trenches which will lead to unlined storm water storage facilities. These facilities will trap the sediment in the run-off by allowing deposition to take place by controlling the discharge of cleaned storm water into the environment.

Clean storm water management will also be required during rehabilitation of the ADF. Clean storm water falling on the rehabilitated area will be intercepted by the storm water berms that are placed above the rehabilitated layer at every shift. These berms lead to a down chute which will transport the water down the side slope to the toe of the facility. There are benches included along the rehabilitated side slope that form storm water collection trenches to collect slope run-off. These trenches also lead into the down chute through inlet boxes. At the bottom of the down chute, energy dissipaters are positioned to reduce the energy of the water. The water then drains into clean storm water collection trenches which will divert the water around the site.

8.7.3 Contaminated Storm Water Management

Storm water falling on the conveyor platforms, ADF or lined area will become contaminated once it is in contact with ash. Conveyor platforms have a cross fall of 2% towards drains situated as described below.

8.7.3.1 Leachate Collection System

From the ADF or lined area, the water is captured in the leachate collection system (LCS) positioned at the top of the liner system. From the LCS, the contaminated water is drained by penstocks that connect to the contaminated storm water trench network.

The contaminated storm water network includes trenches positioned on the eastern and western sides of the ash facility and on the northern side of the starter platform. Contaminated storm water trenches also run adjacent to the extendible conveyors that are located in the conveyor corridor that collect contaminated water falling within the corridor. The above trenches all drain towards the pollution control dams.

8.7.3.2 Pollution Control Dams

The ADF will have seven (7) Pollution control dams (PCDs), all of which are planned for during the construction of the Starter Platform and the first 5 years of lining. The PCDs are placed to receive drainage from the lined areas of the facility through the contaminated storm water trench network. The dams and channels leading to them will have the same lining system as the ash facility. However, the leachate collection layer above the lining system is replaced by a 300 mm ballast layer of site sand stabilized with 8% cement content by mass. The stabilized sand will be placed in geocells on the side slopes of the dams.

The layout of the dams is grouped as shown in Figure 8-9.

Complex 1 (PCD 1 and 2): PCDs 1 and 2 are located west of the conveyor approach ramp and will be the main storage dam complex. PCD 1 will receive the make-up water from the power station and all irrigation and dust suppression water will be pumped from it.

Complex 2 (PCD 3 to 7): PCDs 3 to 7 are located east of the conveyor approach ramp and will form the other dam complex. The pollution control dams are designed for the lined area for the 5 to 10 year ADF development. This forms the worst case scenario as it is the largest lined area over a 5 year period. The catchment for the 5 to 10 year ADF development is 125.7 ha; approximately two thirds of the catchment will drain to Complex 1 and the other third to Complex 2 (Table 8-6).

Table 8-6: Pollution Control Dams Volume and Area Information

Complex:	Pollution Control Dam:	Catchment (worst case): (ha)	Volume: (m^3)	Area at FSL: (m^2)
1	PCD 1	84.3	246 600	149 000
	PCD 2		151 200	92 200
2	PCD 3	41.4	62 400	31 900
	PCD 4		60 700	31 100
	PCD 5		61 300	31 400
	PCD 6		62 400	31 900
	PCD 7		60 200	32 200

8.8 EROSION PREVENTION AND DESILTING

8.8.1 Silt traps and transfer boxes

Storm water flowing over ash and soil tends to entrain silt along the way. Desilting the water before it reaches the pollution control dams is one of the aims of the design of the storm water management system. This is achieved by placing silt traps at the bottom of transfer boxes / inlet boxes.

Even though the above features will mitigate the amount of silt that enters the pollution control dams, there will be some build-up of silt in the dams. Cleaning of the deposition will be required during the dry winter periods or when deposition has reached 25% of the storage volume of the dam. Each dam's final layer is a geosynthetic in-filled with cement stabilized sand. This will provide a strong platform for the desilting process.

8.8.2 Storm water canals and trenches

Due to the entrainment of silt particles into storm water, there is a high risk for erosion on the site. All trenches on the site have been designed with erosion protection except for cut to fill trenches for clean storm water that may be re-graded from time to time. Contaminated trenches are first lined with geomembrane and then with geocells that are in-filled either with concrete or cement stabilized sand depending on the application and period of usage.

Clean storm water trenches that are permanent and will manage high flow rates will be lined with precast concrete blocks (Amorflex). The extent of the blocks will cater for the 1 in 5 year storm event which will be the base load of the flow. The trench will be sized to manage a peak storm event of 1 in 50 years. Temporary clean storm water trenches may be lined with cement stabilized soil or may be unlined depending on the application and period of use.

Designs for storm water canals are provided in Appendix G.

8.9 PROGRESSIVE TOPSOIL MANAGEMENT

Figure 8-10 shows the method of progressive topsoil management. The topsoil of the Starter platform and the first 5 years lined area (5 to 10 year development) is stockpiled for later use near the end of the facility.

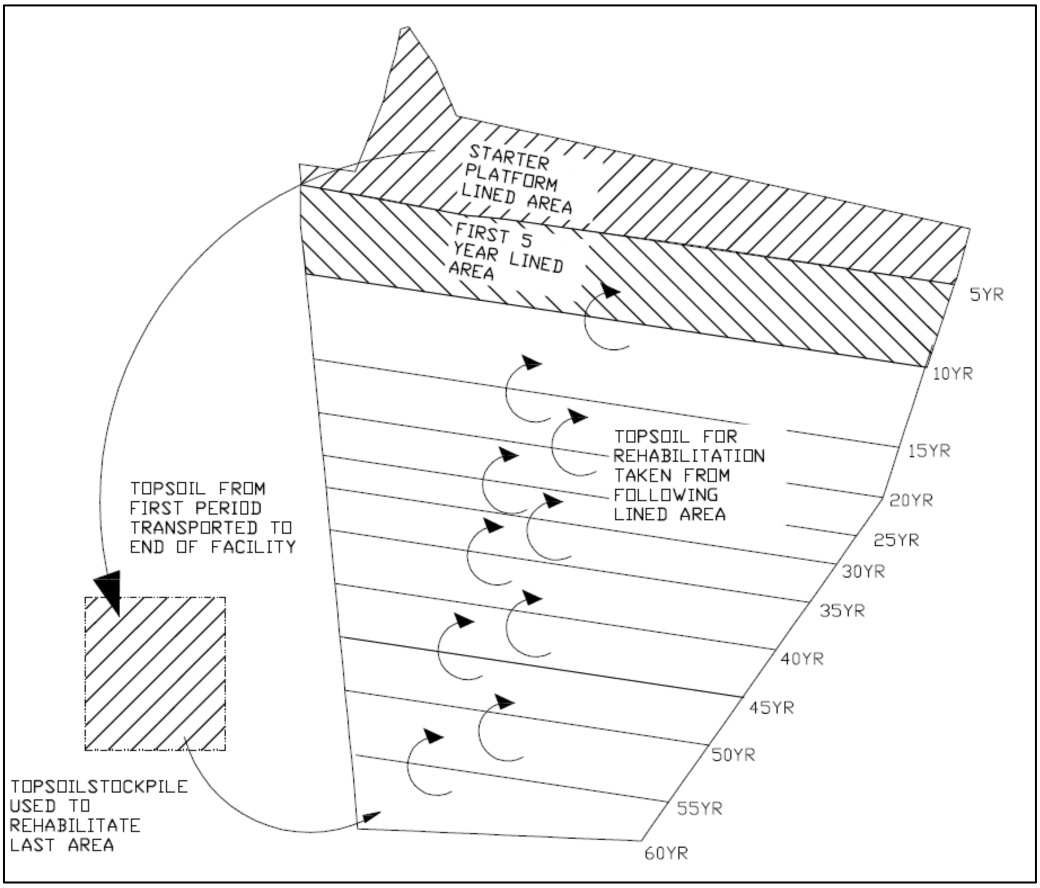

Figure 8-10: Method of progressive topsoil management

The topsoil in the footprint of the 10 to 15 year development is used to rehabilitate the initial development of ash facility. This process then repeats itself until the last area (55 to 60 year development). The topsoil in the stockpile is then used to rehabilitate the last area.

There may be a need for additional topsoil during the rehabilitation of the facility. It is likely that the surface area of the facility will be larger than the footprint of the facility. Also, due to the wedge shape of the facility, preceding lined areas are larger than subsequent areas resulting in a reducing availability of topsoil. For these reasons, there may be a topsoil shortage and later areas will need to be ~~covered~~ sourced from a commercial source of topsoil.

8.10 RIVER DIVERSIONS

River diversions are required where rivers or tributaries intersect the ash facility footprint. The aim of the diversion is to transfer the water around the facility back to the natural drainage path with causing as little impact on the environment as possible. The following river diversions are required:

8.10.1 The Klipfonteinspruit River Diversion

A 90 m wide buffer has been indicated for this diversion which will consist of a trapezoidal shaped canal. The canal will be lined with natural material for erosion protection in order to prevent high flow velocities that will cause erosion downstream.

The river diversion will drain into a large stilling basin which will further reduce flow velocities and allow settling of transported material before the water returns to the natural drainage path. It is envisaged that topsoil that is removed from delineated wetlands within the footprint will be placed at the base of the river diversion to encourage regrowth of similar vegetation.

8.10.2 The Holfonteinspruit River Diversion

This diversion will consist of earth contour cut-off drains and clean water dams. The cut-off drains will intercept water upstream and drain it around the facility along a contour line. Water downstream of the cut-off drain will collect in a clean water dam in the base of the valley in front of the ash facility.

8.11 DUST SUPPRESSION AND IRRIGATION INFRASTRUCTURE

Figure 8-11 shows the dust suppression system in operation at the Matimba Power Station. The ash arrives at the facility with a raised moisture content of approximately 10 % as shown in Figure 8-12. The aim of the dust suppression system is to ensure that the moisture content is maintained to reduce dust blow. The source of the dust suppression and irrigation water will be sourced from the surrounding pollution control dams or the existing Kendal-Kusile water pipeline supplying Kusile Power Station with water.

The rate of irrigation and dust suppression are estimated with reference to the Medupi Ash Facility Design. The operations requirement (Table 8-7) is approximately 900% more volume than the construction requirements as these areas will continuously need to be wetted during operations whereas the area during construction will only require wetting during a single period.

In the event that the dust suppression system fails, the irrigation system can be used for dust suppression. The irrigation system, however are designed to be smaller sprinklers so the system will have to be on for longer periods in order to get the coverage required. Irrigation may also then need to be carried out by water tankers/bowsers.

If both the irrigation and dust suppression systems fail, water tankers/bowsers will need to be used on a daily basis to control dust blow. Sacrificial soil cover will also be used as well as compaction of the ash for areas that will be exposed for long periods of time. If excessive winds are experienced from a specific direction, wind breaks may be installed to reduce dust blow. The irrigation system may be increased if necessary in the event of constant failure of the current system.

Figure 8-11: Dust suppression system at Matimba Power Station

Figure 8-12: Moisture condition (typically 10 %) of ash at arrival at the ash facility (Matimba Power Station)

Table 8-7: Operations Water Requirements

Description:	Operations Water Requirements
No of days of operations (60 yr life)	21,900 days
Exposed Area (requires dust suppression)	2 000 000 m^2
Rehabilitated Area (requires irrigation)	316,000 m^2
Dust Suppression	3,333 m^3/day
Irrigation	1,896 m^3/day
Total Dust Suppression over 60 years	73,000,000 m^3
Total Irrigation over 60 years	41,500,000 m^3

8.12 PIPELINES

The following applications of pipelines are included in the design:

- Two 315 mm HDPE pipelines from a pump house at PCD 01 for dust suppression;
- Two 5" (139.7 mm) diameter steel pipelines from a pump house at PCD 01 for irrigation;
- Two 150 mm diameter pipelines from the pump houses at the clean water dams required throughout the life of the facility.

8.13 INFRASTRUCTURE RELOCATIONS

The following infrastructure relocations will be required:

- ~~An~~ Two 88 KV power lines that runs through the southern half of the ADF site footprint in an east - west direction;
- Two 11kV Largo B Largo B lines in north eastern corner of the site.
- The Co-Disposal Facility's security fence.

Space within the Eskom property investigated exists around the southern boundary (2 x 88 kV) and around the north eastern boundary (11 kV) of site A where the distribution lines can be relocated in order to maintain connectivity. The ADF will develop from north to south within site A, therefore the relocation of the 88kv power lines (Figure 8-13) in the south of the site is only expected during the latter stages of the ADF development. The proposed relocation of the distribution lines are presented in design drawings provided in Appendix G of this FEIR.

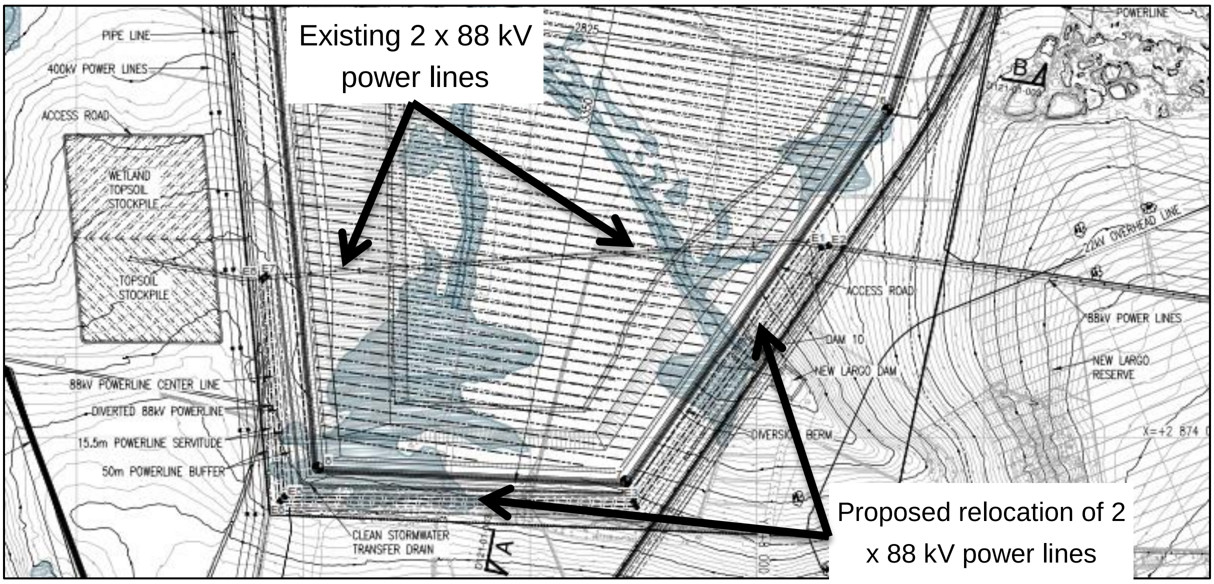

Figure 8-13: Southern footprint of proposed ADF showing the existing and proposed location of the 2 x 88 kV power lines

Relocation of the 11 kV power lines will occur within the property owned by Eskom and will be undertaken before site preparation of the starter platform will commence.

8.14 REHABILITATION

The aim of rehabilitation is to restore vegetation and gentle the slopes of the ash facility to increase stability and decrease dust blow. The facility will also blend in better with its surroundings.

As the ADF develops, rehabilitation occur approximately 2 shifts behind the advancing face ensuring only a relatively small window of ash is exposed to the environment. Ongoing placement of topsoil reduces dust blow and erosion of the ash.

Rehabilitation includes the following activities:

- **Reshaping:** Cut to fill of side slopes from angle of 40° (1[v] to 1.2[h]) to an average angle of 11.3° (1 to 5);
- **Topsoil covering:** Cover ADF surface area with 300mm topsoil; Scarification and fertilization of the topsoil layer; Grassing of topsoil area including pioneer and long term grass seeding; Transplanting of existing and new trees and shrubs; and Irrigation.
- **Installation of storm water measures:** Construction of infrastructure including down chute pipes, outlet channels, energy dissipaters, side slope berm trenches, shift berms and crest berms.
- **Maintenance of rehabilitated area:** Cleaning and repair of existing storm water and rehabilitation infrastructure.

8.15 SITE FACILITIES

The following site facilities will be constructed on site:

- **Site office:** The Site Office is located in the north western corner of the facility. The office includes three offices, one 10 seat meeting room, a kitchenette and a dining hall. Male and female ablutions are also provided.
- **Workshop and Store:** A workshop and store, both 6 x 10 m in size, with vehicle access, are provided. An oil spillage sump outlet to outside containment facilities is included.
- **Vehicle maintenance:** A service bay and wash bay with oil trap facilities.
- **Contractor Yard:** 50 x 50 m yard including one Site Agent Office, kitchenette with attached dining hall and male & female ablutions.

8.16 MOBILE PLANT AND EQUIPMENT

Where access for the stacker is limited, mobile equipment is used to place the ash and shape it according to the geometry shown on the drawings. The ashing system is arranged so that dozing is kept to a minimum while free ash is maximized. Free ash is defined as ash that is placed by the stacker which does not require further dozing.

Due to the ash being placed at the angle of repose, a large amount of shaping is required at the side slopes during rehabilitation. Mobile equipment is also used to shift conveyors and carry out similar tasks.

The following mobile equipment is needed:

- **A dozer:** Required to move ash to positions outside the reach of the stackers, carry out trimming and profiling of the dump surface, side slopes, and conveyor platforms and to move the head and tail stations during conveyor shifts.
- **D6 (or equivalent) dozer:** This dozer will be fitted with a rail shifting head frame which will be used to shift the shiftable conveyors.
- **Grader:** Final levelling and shaping of the platforms, advancing front stack slope, side slopes, back stack and rehabilitation of topsoil on the final surfaces of the ADF. It will also be used for minor cleaning operations on the stacker working platforms as well as for grading of roads and excavation of clean storm water cut-off trenches.
- **Compaction Equipment:** A self-propelled or towed vibrating roller will be used to achieve nominal compaction of the dump surface in the stacker working areas as well as on the shiftable conveyor platforms. Compaction of the advancing front stack slope assists in the shifting operation of the shiftable conveyors.
- **Water bowser:** Dust suppression of working areas, roads and, washing down of the mechanical plant. Water bowsers will also be used for dust suppression of advancing slopes where it is difficult to reach with sprinklers or for specific chemical dust suppression applications.
- **Dump Trucks:** Hauling and placing topsoil and fill material on the ADF.
- **Front End Loader:** Loading dust suppression soil and fill material onto trucks, for general maintenance on and around the ADF.
- **TLB:** Cleaning concrete lined canals, digging holes for anchor plates and general maintenance on and around the ADF.

8.17 ACCESS INFRASTRUCTURE

8.17.1 Access roads

A number of existing dirt roads exist that provides access to fields being cultivated. These dirt roads are indicated in grey in Figure 8-14. New access and maintenance roads proposed for the establishment and operating of the ash disposal facility are indicated in black in Figure 8-14.

Site entry will be through the site office on the north western side of the site near the site office. Leading from the office will be the service roads along the conveyors and the patrol road that follows the fence around the site. At certain points along the patrol road, side roads will branch off toward infrastructure such as storm water trenches or pollution control dams.

There are three conveyor service roads along the Overland Conveyor Platform: one on either side of the two conveyors and one that runs between the conveyors. The service roads along the conveyors lead to the starter and erection platforms and then onto the conveyor corridor on the ash facility.

On the rehabilitated back stacks, access roads are included on the western and eastern edges with access berms every fourth shift. Roads will be used for access to carry out maintenance, inspections, material delivery and construction.

The roads that are included in the design of the ADF and the ash conveyor platforms will be designed according to best practice. Best practice at other ash and waste facilities involves the use of a combination of competent gravel materials (G5 and G7 in TRH04) as a base and wearing course. Due to the low traffic expected on these roads, the cost of higher specified pavements as specified in TRH04, is not warranted.

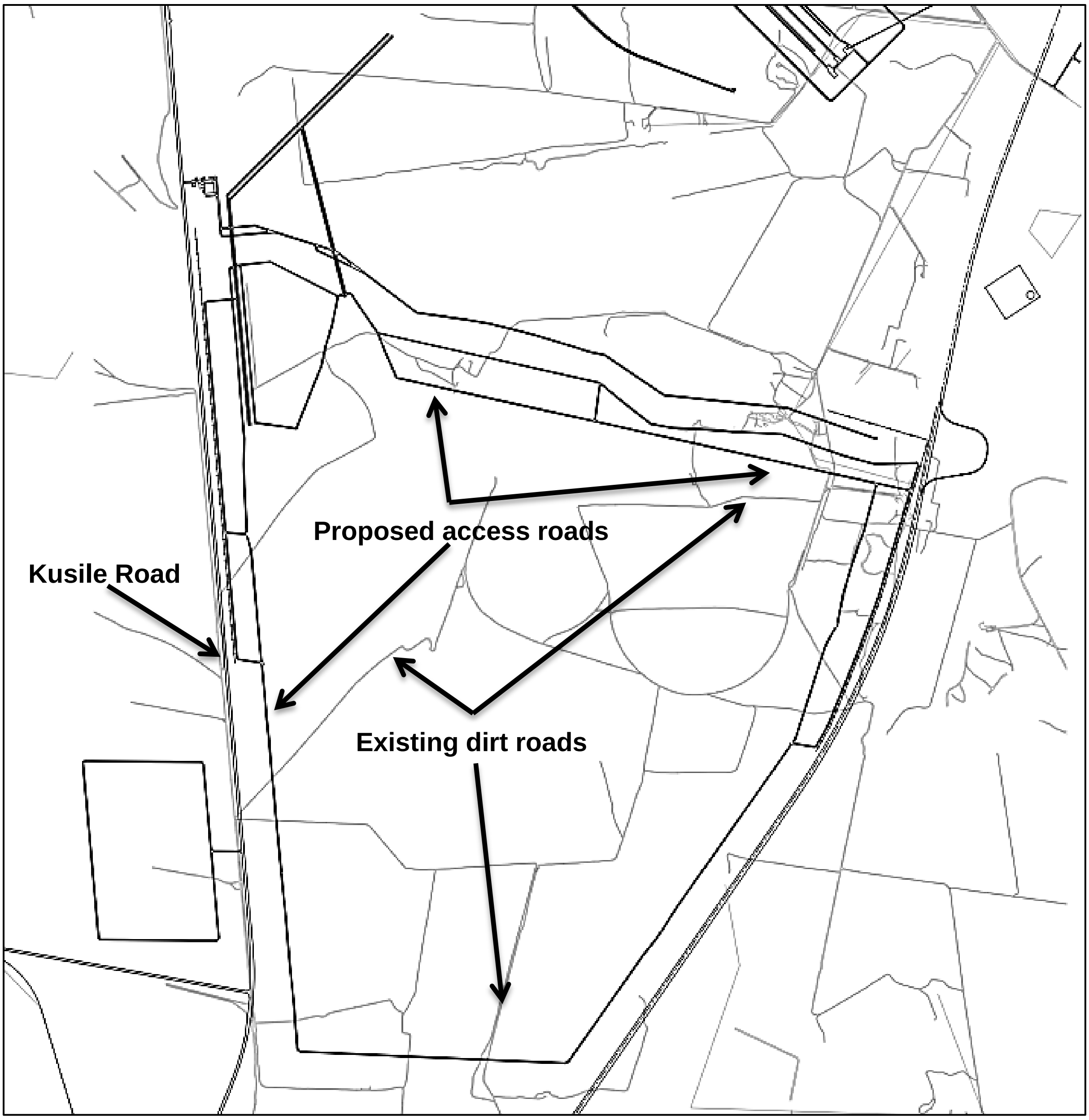

Figure 8-14: Existing and proposed road layout for the site A footprint and adjacent areas

8.17.2 Fencing

The ADF will be fenced off on the western and eastern sides adjacent to the sides of the ADF, leaving room for storm water management. The southern side is fenced off at the 15 year facility development stage. When the ash disposal facility reaches the 15 year mark the fence at this location will be moved further south to allow development of the facility beyond the 15 year mark. The fence on the northern side of the ADF will connect to the fence of the co-disposal facility. Sections of the co-disposal fence may need to be relocated where there is a clash with the 60 year ash facility's infrastructure.

The fence is included in the design to prevent unauthorized access. Signs indicating that there is an ADF on the property and that it is a safety risk area will be displayed.

8.18 AVAILIBILITY OF SERVICES

8.18.1 Potable water

Water will not be extracted from an existing water source but will be obtained from the existing Kendal-Kusile water pipeline that has been constructed to provide Kusile Power Station with potable water.

8.18.2 Sewage

The construction site will be services through the use of chemical toilets obtained through a reputable service provider for the duration of the construction phase. The service provider shall be responsible for the service and maintenance of all chemical toilets. Sewage will be removed from site on a regular basis and will be disposed of in a licenced hazardous waste facility. The service provider will also provide disposal certificates to the proponent as proof of this.

8.18.3 Refuse removal

General and construction waste shall be removed from site be a reputable service provider for the duration of the construction phase. The service e provider shall dispose of the waste at a registered and licenced waste disposal facility and shall submit disposal certificates for the disposed waste to the proponent.

8.18.4 Electricity

Electrical infrastructure will be installed along the conveyor corridor and to the construction site camp. Electricity required to operate the conveyor system and any other ADF related infrastructure will be obtained from the Kusile Power Station itself once generation of electricity has started.

8.19 ASH AS A RESOURCE

There are various alternative uses for ash including combining it with cement in concrete and using it as a filler in plastic production. If at any point during the operation of the facility there are commercial interests to use ash as a resource, access to specific areas of the facility will be made available.

Co-ordination between the collection parties and the facility operation personnel must exist so that no damage to lined areas or disturbance of rehabilitated areas occurs and that collection is carried out in a safe manner.

9 DESCRIPTION OF DEVELOPMENT ACTIVITIES

The pre-construction, construction, operation and closure/decommissioning activities of this project are discussed below according to the following phases: Pre-construction; Construction; Operation, Rehabilitation; Closure and Post-Closure of the Facility.

9.1 THE PRECONSTRUCTION PHASE

9.1.1 Feasibility Stage

During the site screening stage, 12 possible sites were identified. These are Site A, B, C, D1 & D2, E, F, G, H1, H2, H3 and I. A matrix that combined technical, environmental and social criteria was used to compare the feasibility of all the sites. The result of the Site Screening exercise is that above-average sites were taken forward into the detailed comparative assessment stage. These are Sites A, B, C, F, G. The result of the comparative assessment is that Site A is the most preferred alternative and therefore this detailed concept is carried out on Site A.

9.1.2 Design Stage

This stage includes the formulation of the detailed design. The detailed concept design was carried out as part of the EIA. The detailed design is developed from the concept design. Engineering drawings are developed from the concept design such that the project can go out to tender and the facility can be constructed and operated from the drawings. The detailed design is outside the scope of the EIA.

9.1.3 Decision making and public notification

Once the impact assessment phase is complete the Final Environmental Impact Report together with the detail concept design and Environmental Management Programme will be submitted to the Department of Environmental Affairs, who is the competent authority in this case, for decision. After a decision is reached the proponent and Environmental Assessment Practitioner will be notified. The EAP in turn will notify all I&APs of the decision.

9.1.4 Land Purchases and Negotiation (if positive authorisation is received)

All the land portions affected by the preferred site alternative are owned by Eskom Holdings SOC Limited. If any of the other site alternatives as discussed in the DEIR are authorised detailed negotiations with affected landowners to purchase their properties or servitude rights will commence. Detailed land purchase negotiations will only commence if a positive environmental authorisation is obtained.

9.1.5 Appointment of Contractor

After the detailed design is complete, the project will be put out to tender. This will be followed by a tender adjudication and contract negotiations. After all internal tendering processes have been satisfied (and land acquisitions in the case of the authorisation of one of the other alternative sites), Eskom will appoint the construction contractor.

9.1.6 Pre-construction conditions associated with the EA

If Environmental Authorisation is grated for the proposed ADF development the EA will generally state a number of preconstruction activities that will need to be completed before construction can commence. These generally include a walk-down by a heritage, avifauna and botanical specialist to identify heritage resources that must be preserved or removed, and the identification of sensitive birds and vegetation.

9.2 THE CONSTRUCTION PHASE

9.2.1 Installation of fences and access control

The construction area and contractor's site camp will be secured with a fence installed at the outset of construction phase.

9.2.2 Site preparation and clearance for contractor's camp

An area will be cleared for the siting of a contractor's camp. The position of these potential contractors camps are usually determined and delineated in the site-specific EMPr submitted to DEA prior to construction. The location is guided by the ease of access, central proximity, and currently disturbed status of area. Preparation of this area will include vegetation clearing, compaction, installation of bunded areas for hydrocarbon storage, establishment of temporary offices / storage facilities (such as containers or park homes), chemical toilets (portable / conservancy tanks), potable water storage, and fences and access control. This area will be rehabilitated as per the EMPr requirements post construction.

9.2.3 Erection of camp sites for the contractors' workforce

Contractors will not house their workforce on site.

9.2.4 Vegetation clearing to facilitate access and construction activities

Vegetation must be cleared to facilitate access, construction and safe operation. Where protected indigenous vegetation needs to be removed appropriate permits and licenses must be obtained from the relevant provincial or national authority. Search and rescue activities may be required for any protected species if found on site during clearing. Plant and tree species that tend to transplant well should be transplanted on site during rehabilitation.

9.2.5 Establishing of access roads

Once the contractor is established on site the access roads to the construction site will be established. Each road alignment will first be walked to ensure that site sensitivities are accounted for and avoided / planned for wherever encountered. Each road will then be cleared of vegetation, graded, and where necessary a nominal wearing course of gravel may be imported and/or the road may be compacted for added stability. This will be determined during the detailed engineering phase of the project. All materials used in the development of access roads will be inert and non-carbonaceous material. The road will be developed taking into account proper storm water management measures, including upslope cut-off drains, and/or mitre drains where required.

9.2.6 Site services

Portable chemical toilets will be used during the construction phase, and a reserve water tank will supply potable water requirements at the construction camp as required.

9.2.7 Relocation of existing electrical services

In order for the ash disposal facility to be constructed the existing 11 kV and 88 kV power lines that traverse the site will need to be relocated. Relocation will occur within the Eskom owned property (See appendix G). First new power lines will be constructed, and then a switch will be made between the existing identified power lines and the new power lines. Thereafter the existing lines will be decommissioned. The power line construction will consist of the following activities:

- **Corridor walk-down by relevant specialists**: To ensure that all site specific sensitivities are avoided for location of the pylon. During this process the exact co-ordinates of the proposed pylons will be established.
- **Vegetation clearance:** A 31 m (15.5 m on either side of the power line) servitude is required for the proposed 88kV power line, tall trees will be cleared along the entire length of the servitude. The vegetation will also be maintained by Eskom in the operational phase of the project.
- **Pylon footings:** During construction the route will be surveyed, pegged and the soil nominations undertaken for each of the potential pylon foundations. The first step is the excavation of the pylon foundations, the reinforcing thereof and finally the concreting of the foundations. The equipment required to excavate the foundations can be manual labour, a TLB or in the case of hard rock – a drill rig will be required. The concrete will have to be transported via concrete trucks to the required locations.
- **Steelwork structures:** After the foundations and footings have been installed the construction team will transport the various steel parts of the towers to the site and start erection of the pylons. The pylons will be erected in segments. This process again requires a lot of manual labour and often mobile cranes are used to assist with the erection of the towers.

- **Stringing:** Once the towers are erected the stringing of the conductor cable/s commences, from tower to tower and the line is tensioned as per the requirements.
- **Switching the feed:** Once the power line has been erected the feed will be switched from the current line to the new facility.

Once stringing and tensioning is complete the line is considered constructed, where after it will be tested prior to being commissioned.

9.2.8 Construction of the ADF infrastructure

The construction of the Klipfontein River Diversion, starter platform and conveyor access ramp (Phase 1)

This stage is estimated to take 18 months and will be required to be completed before ash is delivered to the facility. This stage will consist of the following activities:

9.2.8.1 The construction of the Klipfontein River Diversion including the stilling basin

The Klipfontein Spruit River Diversion is the first section of infrastructure that needs to be constructed. The diversion will prevent further water entering the Starter Platform footprint which will allow construction of the footprint to commence as well as allow the material to dry. The Klipfontein River Diversion is represented in Figure 9-1, with the full engineering design provided in Appendix G.

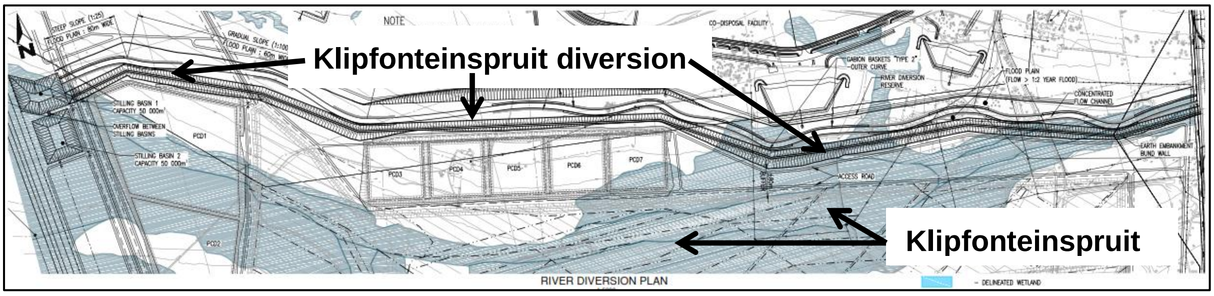

Figure 9-1: Layout view of the proposed Klipfontein River Diversion

9.2.8.2 Construction of the first 5 year lined area (Phase 2)

This stage is estimated to take 2 years and will be required to be completed before ash is delivered to the facility via the conveyor system. Phase 2 will consist of the following activities:

1. Construction of conveyor platforms to the facility including access roads and storm water canals along the conveyor;
2. Installation of the terrace and lining system for the first 5 years of operation;
3. Construction of clean Storm Water Dam D1 and clean storm water contour cut-off trench;
4. Establishment of two emergency stockpile platforms;

5. Construction of access roads and security fence up to the 20 year development line.

9.2.8.3 A haul road to the starter platform from Transfer House 9

A haul road between the Starter Platform and Transfer House 9 will be constructed as part of the site preparations. The haul road will need to cross the Klipfonteinspruit River Diversion and requires its own storm water management infrastructure such as trenches for contaminated runoff. The haul road will be converted to an Overland Conveyor Platform for the operations of Phase 2.

9.2.8.4 Development of the Starter Platform

The Starter Platform will be constructed using mobile equipment (trucks) for the initial 5 years of operations. After 5 years, the infrastructure for two stackers will be completed and the remainder of the facility will be constructed with the stackers.

The Starter Platform will be constructed in two stages so that the first stage is available for ash placement before the second stage is completed.

a) Construction of the terrace and lining system for the starter platform.

Assuming the first stage is limited to 600 000 m^2 and using a liner installation production rate estimate of 5 000 m^2 per day the construction period will be 120 days or 4 months. However, a certain amount of earthworks is required before the liner installation can commence. A fair assumption is that the earthworks will also take 6 months to complete. Therefore Stage 1 is estimated to take 10 months to construct.

b) Construction of pollution control dams 1 to 7 for the starter platform.

Before the stage can be commissioned at least one pollution control dam will need to be constructed. Using the size of PCD 1 (approximately 150 000 m^2) an additional 3 months would be required. Therefore, the total construction time to commission the first stage is 13 months.

The remaining construction period, including the remaining 600,000 m^2 liner installation for the Starter Platform and the 6 remaining dams of combined liner area 280 000 m^2, results in a duration of approximately 8 months. Allowing 8 additional months for earthworks, gives a total of 16 months.

Therefore if a staged approach is taken, the first stage will be 15 months and the second 16 months resulting in a total of 29 months or just less than 2.5 years. The programme for this activity will need to be optimised as current indications are that this phase must be completed within 18 months.

All these dates and durations are based on normal weather conditions and expected / assumed geotechnical conditions.

c) Placement of ash

Approximately 24 300 m^3 of ash will need to be placed per day. Assuming Articulated Dump Trucks are used (ADTs) which can carry approximately 13 m^3 of ash per load, 1870 loads will be required per day or 78 loads per hour. Over the initial stage area of 600 000 m^2, 150 000 m^3 of ash will be required to place a layer 0.25 m thick. Considering the deposition rate, it will take approximately 6 days to place one layer.

Sixteen months after construction of the first stage, the second stage of the Starter Platform will be available for placing ash. The deposition rate will then be split between the two stages resulting in a 0.25 m thick layer taking 12 days to place. In order to get to an average height of 29.7 m, a total of approximately 120 lifts will be required. At 12 days per lift, the Starter Platform will take 1 440 days or 4 years to construct.

d) Compaction of ash

Compaction of the ash is required to ensure stability of the platform. The platform must be:

- Constructed in horizontal layers over the full area;
- Constructed from the bottom of the liner terrace upwards;
- Constructed in layers not exceeding 250 mm thick (uncompacted).

Compaction will be according to an initial field compaction trial that determines a suitable "method specification" for all future compaction. A weekly routine test will be undertaken to cross check the ideal number of roller passes.

9.2.8.5 Contaminated Storm water network around footprint

The contaminated storm water network must be constructed before large scale clear and grub activities commence. This is to ensure that storm water run-off from exposed soil is controlled and prevented from entering the environment. This run-off will likely have a large amount of suspended soil particles which will cause the turbidity of local streams to increase.

Instead of allowing the turbid storm water into the environment, it will be diverted to a settling pond which will likely be one of the partly constructed pollution control dams (a lining system will not be required at this time). The turbid water will be allowed to settle and the larger soil particles will deposit on the dam floor. Clear water will be tested to ensure the water quality is of an acceptable nature, and will then be removed from the top of the dam by either controlled overflowing through a spillway or by pumping water from the surface.

Colloidal particles will likely not settle under their own self weight. Options for dealing with colloidal particles are the following:

- Installing silt bags whereby turbid water is pumped through a water permeable fabric bag resting on a bed of washed aggregate;
- Using PAMs (Polyacrylamides) which are a large range of flocculants in liquid, powder and solid form to chemically bind sediment particles together and settle out. These need to be used at recommended levels to prevent aquatic organisms from being affected.

9.2.8.6 Establishment of a Topsoil Stockpile area.

The topsoil stockpile area must be established southwest of the Site A ADF footprint in close vicinity to the last lined area (year 55 to 60 area) before the removal of topsoil commences.

Construction Water Requirements

The area of the total lined footprint is used in the calculation of construction water requirements. The figure provided is for the facility over a 60 year life. At this level of detail it is sufficient to assume that this figure is used uniformly over the life of the facility.

The water will need to be sourced from the Raw Water Reservoir at the power station or the pipeline from Kendal Power Station until any of the dams is constructed in which case water will be sourced from local dams. Water will not be sourced from ground water.

Table 9-1: Construction Water Requirements

Description:	Construction Water Requirements
Area (ha)	817.4
Depth (m)	0.45
Volume (m^3)	3,678,300
Mass of soil (t)	6,621,000
2% Moisture Content increase (m^3)	132,420

9.2.9 Rehabilitation of disturbed areas

Once construction is completed, remediation of affected areas will be undertaken. The ECO / WMCO appointed to monitor the construction phase will delineate all areas requiring rehabilitation activities and will be responsible for signing off that these areas have been suitably rehabilitated as per the methods identified in the EMPr and the Method Statement from the Contractor. The following areas have been identified at this juncture as areas that will require rehabilitation post construction:

- The contractors hard park / construction camp / lay down area (in the event some areas will not be used during the operations phase construction period);

- Any access roads not remaining for the operational phase maintenance and servicing of infrastructure;
- The water pipeline surface area and servitude;
- The dismantled power line servitude including old tower positions and service roads; and
- Any other infrastructure deemed unnecessary at any phase of the development.

The methods for rehabilitation will be confirmed on site, based on the extent and type of impact, and will be in compliance with the approved EMPr for the project. It is envisaged that rehabilitation activities will include at a minimum:

- Profiling of the terrain to ensure that it is free draining, and ties into the existing terrain without causing erosion;
- Soil amelioration and improvement will be undertaken to promote establishment of a sustainable vegetation layer;
- Seeding of the area will be undertaken with an pre-defined seed mix to ensure that a sustainable vegetation cover is established;
- Irrigation of rehabilitated area, usually in the first two years, during dry spells to ensure vegetation cover is properly established is common; and
- Alien invasive control is practiced to ensure that the area is maintained in a weed free condition.

9.3 THE OPERATIONS PHASE

9.3.1 Development of the ADF and operation of the conveyor systems and stackers

Conveyors are used to transport the ash from the power station to the ADF. This is achieved in the following manner:

1. At the power station, the ash is deposited onto an overland conveyor at a transfer house.
2. The overland conveyor transports the ash to a transfer house at the ADF.
3. The transfer house at the facility either deposits the ash onto an extendable conveyor which leads onto the ADF or onto a cross conveyor which will transport the ash to the transfer house of a second ash facility if required.
4. The extendable conveyor transports the ash from the transfer house to the starter platform where the shiftable conveyor is set up in the first shift position.
5. The stacker will do one complete cycle of placing ash in front of the shiftable conveyor followed by placing ash in the back stack behind the conveyor.
6. Once the first ashing cycle is complete, the shiftable conveyors will be shifted onto the newly placed ash.
7. The extendable conveyors will be extended past the starter platform and onto the placed ash and the next shift's ashing cycle will commence.
8. On-going rehabilitation of completed areas of the ADF and topsoil placement.
9. This stage will continue for the life of the power station – 60 years.

9.3.2 The construction of the remaining footprint in 5 year lined area intervals

Phase 3 consists of the construction of the following:

1. Installation of the terrace and lining system for each 5 year development stage;
2. Construction of Clean Storm Water Dams and contour cut-off dams required for each development stage;
3. Construction of access roads and security fences when required as per development stage.

9.3.3 The ash facilities growth plan

The Kusile PS 60 year ADF growth plan is based on the volume and tonnage information shown in Table 8-3. It is also based on the assumption that all 6 units are operational when the 60 year ash facility is commissioned.

Table 9-2 provides a summary of the accumulative volume stored over the lifetime of the facility.

Table 9-2: Growth Plan Summary for 5 year lined areas

Period:	Accumulated Ash Storage: (million m^3):	Lined Area per period: (Ha)	Accumulated Lined Area: (Ha)
Starter Platform	35.8	120.5	120.5
5 to 10 year	81.5	125.7	246.2
10 to 15 year	122.0	120.1	366.3
15 to 20 year	172.5	67.9	434.2
20 to 25 year	210.5	55.7	489.9
25 to 30 year	260.6	37.2	527.1
30 to35 year	301.8	48.9	576
35 to 40 year	349.8	55.8	631.8
40 to 45 year	388.8	51.1	682.9
45 to 50 year	437.2	46.5	729.4
50 to 55 year	478.9	48.2	777.6
55 to 60 year	534.8	39.8	817.4

The following table indicates the dates at which the percentage splits change throughout the lifetime of the facility.

Table 9-3: Percentage splits for stacker over life of facility

Life:	Percentage Split	
0 – 3 years	100% truck and haul operation (Development of Starter Platform	
3 – 5 years	50% Truck and haul operation	50% Bottom Stacker
5 – 18 years	55 % Top Stacker	45 % Bottom Stacker
18 – 55.5 years	82 % Top Stacker	18 % Bottom Stacker
55.5 – 60 years	90 % Top Stacker	10 % Bottom Stacker

Although the growth plan indicates that the starter platform will take four years to complete it is envisioned that there will be a cross over period where the bottom stacker may start ashing before the starter platform is complete. This will extend the life of the starter platform to 5 years as shown in Table 9-3.

Graphs of the proposed growth plan of the ADF can be viewed in the Detailed Concept Design report in Appendix G.

9.3.4 The shifting procedure

The shift procedure involves the moving of the shiftable conveyor from the current position to new the shiftable conveyor position, which will be a distance of 50 m approximately parallel to the current position.

Movement of the conveyor is made possible by the inclusion of tracks at the base of each conveyor unit. However, the conveyor cannot be moved in one continuous motion. It requires a “snaking” movement whereby a dozer is used to pull one unit into position at a time. Therefore the conveyor is “shifted” from one side to the other.

9.4 THE DECOMMISSIONING PHASE

Decommissioning will include the following:

- Rehabilitating final areas of the ash stack;
- Decommissioning the stackers and the conveyors;
- Decommissioning pollution control dams no longer used;
- Constructing required access roads for continuous maintenance and monitoring.

9.4.1 Rehabilitation

Rehabilitation will take place concurrently as the ash stack develops. The extent of rehabilitation will be 2 shifts (approximately 100m) behind the advancing face of the top stack.

Rehabilitation includes the following activities which are further discussed below:

9.4.1.1 Reshaping of the western slope

Due to the nature of operations of the ash facility, the ash is stacked at its angle of repose or 1[v]:1.2[h] or 40° as shown in Figure 9-2. This occurs on the western side as well as the advancing face developing southwards. The western side will be reshaped immediately after the ash is placed as the conveyor corridors do not allow for later reshaping. This is illustrated in Figure 9-3.

The steep angle of the slope has long term stability risk and therefore the eastern side slope of the facility needs to be reshaped to a more gentle slope of 1[v]:5[h]. Reshaping involves a cut to fill process whereby bulldozers are used to cut down the steeper crest to create an extended toe (see Closure and Rehabilitation Plan in Appendix H).

Figure 9-2: Typical stacking ash at angle of repose (as seen at Kendal Power Station)

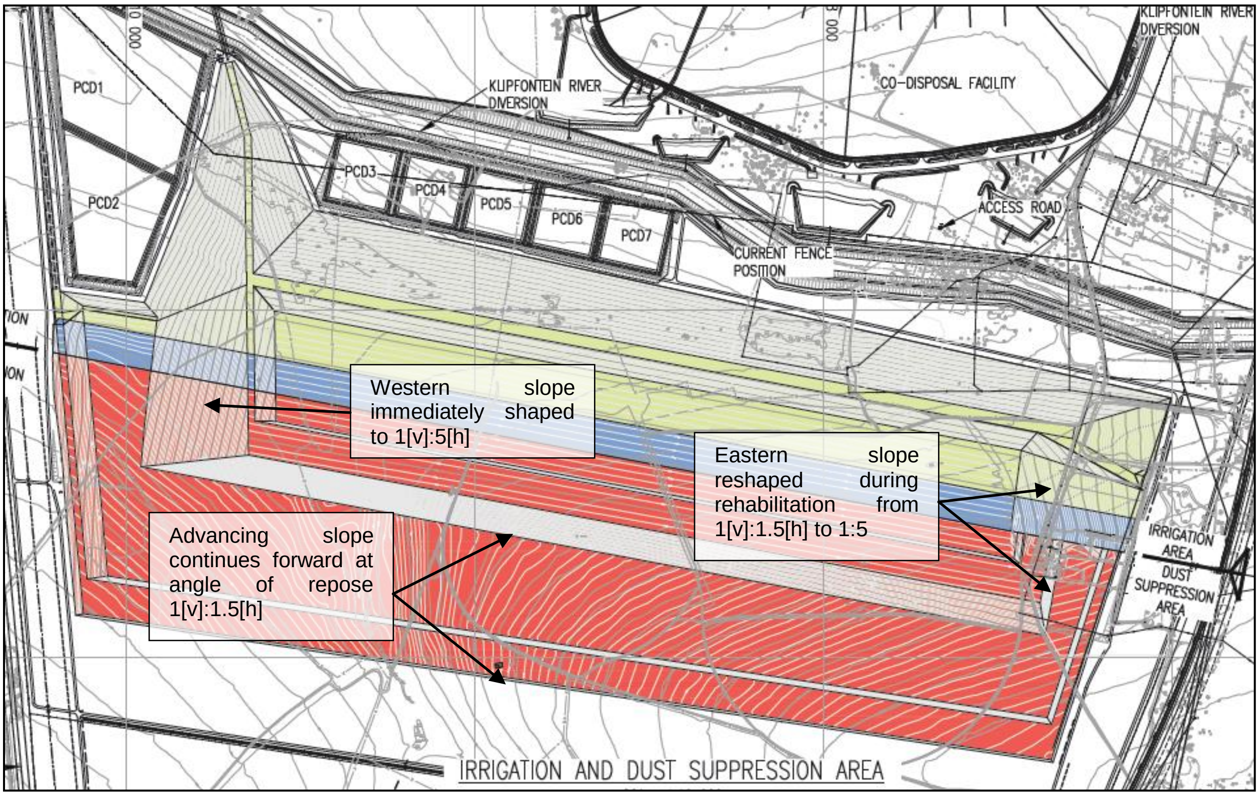

Figure 9-3: Reshaping on eastern side of facility

9.4.1.2 Placement of topsoil layers on exposed ADF surface

This process includes placing two 150 mm layers of topsoil above the reshaped ash. The topsoil is then scarified and fertilized in preparation for grassing. The grassing seed mix will include pioneer and long term grass seeds. New trees and shrubs, or those that previously existed in the facility footprint, will be transplanted where possible to the topsoil layer. An irrigation system will be installed for the ADF to ensure rapid establishment of seed mix and recovery of transplanted species.

9.4.1.3 Installation of Storm water measures

Storm water measures include the construction of infrastructure such as down chutes, outlet channels, energy dissipaters, side slope berm trenches, shift berms and crest berms. These measures are discussed in more detail in section 9.2.8.

9.4.1.4 Equipment required for rehabilitation

The following mobile equipment is needed for rehabilitation:

- **A bulldozer:** A dozer will be required to move ash to positions outside the reach of the stackers, carry out trimming and profiling of the ash stack surface and side slopes.

- **Grader:** A grader will be used to do final levelling and shaping on rehabilitated areas where topsoil has been placed.
- **Dump Trucks:** Dump trucks will be used for hauling and placing topsoil and fill material on the ash stack.
- **Front End Loader:** Front end loaders will be used for loading topsoil onto trucks.

9.4.1.5 Handover of rehabilitated areas

As ash handling operations are carried out separately from previously rehabilitated and established areas, it is feasible to hand responsibility for these areas over to Eskom. To avoid any conflict over these matters a procedure must be set up whereby both Eskom and the ash facility construction personnel agree to the handing over of a particular area.

The areas in question should be surveyed and inspected prior to their acceptance by Eskom and full records kept as handover of new areas progresses. A physical separation such as a low specification fence can be used to indicate areas handed over. A standard form must be compiled and filled in, to record the details of the handover.

9.4.2 Decommissioning the stackers and the conveyors;

Decommissioning of the stackers will be undertaken in reverse order to the assembly procedure.

9.4.3 Decommissioning pollution control dams no longer used;

The decommissioning of the pollution control dams includes the following:

- PCD 4, 5, 6 and 7 will be decommissioned at the end of the ash facility's life of 60 years;
- The geomembrane and ballast layer of the lining system, along with any silt deposition, will be removed and taken to an appropriate landfill;
- Soil layers under the lining system will be tested for contamination, if necessary, and removed;
- The embankments will be dozed into the basin and additional fill material will need to be sourced if required in order to ensure that the final landform is free draining;
- A layer of topsoil will be placed over the footprint of the dam, which will be hydroseeded after placement.

9.5 POST-CLOSURE PLANNING

The development of the ash disposal facility over a long term period of 60 years allows for reassessment of power generation and ash disposal technologies. The ash disposal facility will be developed in five year blocks allowing time for the development of new technologies or methods that can utilise a larger proportion of generated ash.

Current planning proposes the decommissioning and closure of the ash disposal facility at the end of the power station life which is estimated to be 60 years from first ash received by the ash disposal facility. Rehabilitation of the ADF will be continuous throughout the life of the ADF with rehabilitation of the final section of the ADF occurring during closure of the facility.

Although it is much too early to speculate whether the power station life will be extended beyond the proposed life, the extension of the power station life will require the development of an additional ash disposal facility. The proposed preferred alternative will occupy an already optimised footprint with little room for expansion at the proposed location. The preferred alternative is limited by the New Largo Colliery to the east, the Kusile Power Station and co-disposal facility to the north, Kusile Road to the west, and the N12 and New Largo Colliery to the south.

The New Largo Colliery to the east of the ADF may present an opportunity to investigate the feasibility of disposing the ash into the mining voids left by the mining activities. Currently doubts about the feasibility of such an option at the New Largo Colliery exist, however further research on this may identify an economically, technically and environmentally feasible option to dispose of ash in the mining voids in an environmentally responsible manner. In the event that further investigation proves the viability of such an option, switching to the disposal of ash in mining voids can be undertaken at the end of the particular phase the ADF development is in. Further research into the large scale economic uses of ash must also be investigated.

9.6 MONITORING AND MAINTAINANCE

9.6.1 Inspection Frequency

The following inspections should be carried out:

- Fortnightly
- Monthly
- Yearly
- 5-yearly

The fortnightly and monthly inspections are to be carried out by Eskom staff, whilst the yearly inspections are to be carried out by a professionally registered civil engineer.

Monitoring should occur at the following frequency:

Table 9-4: Monitoring Frequency

Description:	Frequency:
Rainfall	Daily
Volume and constituents of water in pollution control dams and clean water storage dams	Monthly
Pumping systems are operational	Weekly
Borehole network	Monthly
Seepage at toe of ash facility	Continuous (minimum daily)
Exposed liner damage, penetrations and anchor trenches	Monthly
Liner temperatures Ash sampling for hydration constituents	Continuous (minimum weekly) Bi-annually
Leakage into detection sumps	Continuous (minimum weekly)
Repair work (Including date and nature of repair)	When Required
Damage (Including date and nature of damage)	When Required

9.6.2 General maintenance

Maintenance will take place throughout the entire facility. Checklists will be used to ensure that the facility is being developed according to the design and specification, by highlighting areas that may need remedial works as required.

Maintenance work must be well planned and cost effective. For some cases, a more costly alternative can be used if it is proved that the solution will be durable as opposed to short-lived less expensive alternatives.

9.6.3 Maintenance Frequency

Maintenance frequency will be based on the monitoring frequency approved for the proposed development. After monitoring has taken place items that require maintenance will be highlighted and should be maintained as soon as possible.

9.6.4 Barrier system

The barrier system is designed so that the geomembrane is minimally exposed. Where liner is exposed it should be carefully inspected for mechanical liner damage and for marked deterioration caused by exposure. Small crack patterns in the HDPE could indicate environmental stress cracking. Should this occur the advice of a specialist should be sought.

The liner anchor trenches should be inspected for signs of stress on the liner as well as the compaction of the fill material. Should the backfill to these trenches be insufficient, additional material is to be brought in and compacted. All anchors / penetrations of the lining system are to be inspected for failure and for stress on the liner.

Should damage to the geomembrane of the lining system occur it will need to be repaired by a specialist contractor. Where the geomembrane has become exposed due to the removal of its cover material, the cover material should be replaced as to prevent prolonged exposure or damage.

9.6.5 Liner temperature monitoring

The barrier system will have a temperature monitoring system installed to take continuous readings of the temperature at the lining system. The monitoring system will include instrumentation such as thermo-couples. Ad hoc measurements can also be taken using a handheld electric thermometer.

The ash is to be sampled and tested for chemical constituents (mainly free lime (CaO) and Sulphates (SO_3) to assess the possibility of hydration and temperature build-up occurring.

9.6.6 Leachate detection and collection

Records of leakage volumes pumped from the sump must be inspected as well as the pumping system, flow meters and sampling points. Pumping systems that have failed must be repaired or replaced.

9.6.7 Pollution control dams

The water in the dams is to be tested for its constituents. Long grass on the side of a dam leads to rodent habitation and will increase the risk of fire. Grass within 2 m of the crest of the dam will need to be removed. Trees' roots may cause piping in the dam embankment. All trees within 2 m of the toe of the embankment must be removed. The outlet of each dam must be kept clear of vegetation or other blockage material.

Bare patches on the sides of dam embankments must be reseeded. Pollution control dams may be filled with deposition over time, thus reducing their capacity. The geomembrane of the dam lining system is protected by a cement stabilised soil layer which will allow access into the dam for removal of the deposition.

9.6.8 Clean Water Storage Dams

The dam spillways must be monitored to ensure that there are no blockages. The operation of the pumping systems that are used to drain the dams to the upstream contour drains are to be monitored. If the systems fail, the dams may become full and there will be a risk of spilling. Pumping systems that have failed must be repaired or replaced.

9.6.9 Ash facility

The toe of the ash facility must be continuously checked for seepage. If major seepage is evident, the cause of seepage must be investigated. If it is due to over wetting by irrigation or dust suppression systems these must be adjusted to ensure delivery of correct water volumes.

If the cause is due to extensive rainfall, the advancing face must be specifically monitored until the seepage has dissipated through the barrier system drainage layers.

If the cause is due to drainage system failure, the area of failure should be investigated for options to increase the drainage capacity. Gullies on the ash body caused by erosion must be filled with ash and the cause remedied before worsening. The ash facility must also be inspected for subsidence, wall movement and undercutting.

9.6.10 Slope stability

Slopes must be continually checked for signs of slope failure such as the development of tension cracks at the crest and bulging of the side slope. No water should be allowed to pond at the toe of the ash facility as this could lead to a reduction in the strength of the ash and failure could occur.

9.6.11 Storm water management

Storm water trenches will be inspected for erosion and surface damage. The position of occurrence will be noted. Storm water trenches and berms must always be kept clear of material that can reduce conductivity such as deposited material or material that may cause a blockage such as branches or litter. Pipes are to be kept clear of blockages. Water planned for diversion to the environment must be tested regularly for its constituents and turbidity before release.

9.6.12 Rehabilitated areas

Exposure of the ash through the topsoil may occur due to storm water erosion or burrowing animals. These exposed areas must be covered by topsoil when discovered as soon as possible to prevent further contamination of storm water. Erosion gullies that may have formed must be refilled with topsoil immediately and to avoid further contamination of rehabilitated areas.

Once rehabilitation / remediation activities have been completed the area will be audited by the ECO / WMCO and a close out audit produced. The audit report will be submitted to the DEA for review and approval.

9.6.13 Dust suppression

All excessive dust entrainment occurrences must be measured and monitored using dust monitors.

9.6.14 Erosion control

All erosion damage will be repaired and affected areas returned to their original state. All topsoil erosion must be reclaimed.

9.6.15 Access roads

All access roads will be inspected for depressions, potholes and erosion. The position of all depressions shall be indicated on the inspection form. Standing water or ponding ~~will be~~ must not be allowed and occurrence shall be noted and remedied.

9.6.16 Borehole network

The borehole network must be monitored on a monthly basis. Damaged boreholes will need to repaired or reinstalled.

9.6.17 Tests and Analyses

Sampling points are included in the leakage detection systems of the ash facility and the pollution control dams. Samples are also to be taken from the borehole network. The samples taken are to be sent to a laboratory to test for the following constituents:

Table 9-5: Constituents to be taken for tests and analysis

pH	Sulphate as SO_4
Electrical conductivity	Sodium as Na
Total Dissolved Solids	Potassium as K
Total Alkalinity as $CaCO_3$	Calcium as C
Nitrate as N	Magnesium as Mg
Chloride as Cl	Turbidity

9.6.18 Record keeping

The records of the following events are to be kept:

- Leakage volumes and constituents on the ash facility and the pollution control dams;
- Constituents of bore hole sampling;
- Constituents of clean water diversion systems;
- Leaching volumes measured at the toe of the facility and constituents of samples;
- Liner temperatures.

10 ENVIRONMENTAL IMPACT STATEMENT

The impact assessment methodology used in the compilation of the Environmental Impact Statement (EIS) is described in section 3.2.2 of the EIR.

10.1 CONSTRUCTION PHASE

10.1.1 Air quality

Status quo

The current sources of particulate emissions in the vicinity include mining, other power stations and agriculture. The Kusile Power Station falls within the Highveld Priority Area, near to the eMalahleni Hot Spot. The eMalahleni Hot Spot is an area of already poor air quality where the NAAQS for daily PM10 concentrations are frequently exceeded. The status quo air quality is of MODERATE-HIGH significance at a *district* scale. The impacts of the status quo are *very-likely* in the long-term and result in a **MODERATE-HIGH** impact risk.

Project impact (unmitigated)

Impact on air quality during the construction phase will not impact the ambient air quality more than the status quo situation.

Cumulative impact

The cumulative impact will not exceed the status quo ambient air quality.

Mitigation measures

Mitigation measures to ensure elimination or at least minimisation of dust associated with construction activities will include:

- Vegetation clearance should be undertaken only when construction activities necessitates removal of vegetation and site preparation;
- Regular wetting of the exposed areas cleared during site preparation and vegetation clearing; and
- Stabilisation and / or rehabilitation of the exposed areas no longer in use must be undertaken as soon as possible.

Residual impact

The residual impact on air quality during construction is expected not to exceed the status quo impact. The impacts are *very likely* to be of MODERATE-HIGH significance at a *district* scale over the long-term, resulting in **MODERATE-HIGH** impact risk. However, the impact of dust outfall on adjacent land is **LOW**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-1 below.

Table 10-1: Construction phase impact assessment matrix: Air Quality

Rated By:	Dr T Bird	Site A						
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	Phase							
AirQual01	CONSTRUCTION							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	Definite	4 MODH	5 DIS	4 LONG	4 VLIKE	-3.8 MODH
Project Impact 1	Impacted area where dust-fall >400 mg.m^{-2}.day^{-1}	Negative	Probable	2 LOW	3 ADJ	3 MED	2 UNLIKE	-1.2 LOW
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	Probable	4 MODH	5 DIS	4 LONG	4 VLIKE	-3.8 MODH
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	Probable	4 MODH	5 DIS	4 LONG	4 VLIKE	-3.8 MODH

10.1.2 Geology

Status quo

The geology underlying site A is almost exclusively tillite, however a small portion of the south eastern part of the site contains Arenite (sandstone). At present the geology of site A is not impacted.

Project impact (unmitigated)

During construction of the ash disposal facility and associated infrastructure the terrain will be profiled using conventional construction methods and equipment. This will require cut and fill operations using conventional plant equipment. Such “cut and fill” operations will likely affect only shallow geological strata (typically less than ~10m deep). The project impact will include removal of shallow geological strata and excavation of tillite to act as clay material for use in the barrier system.

The combined weighted project impact to geology (prior to mitigation) will definitely be of a LOW negative significance, affecting the *development site*. The impact will be permanent and will *occur*. The impact risk class is thus **MODERATE-HIGH**.

Cumulative impact

The cumulative impact of the ADF on the geology during construction will not exceed that of the project impact above. Therefore, the combined weighted project impact to geology (prior to mitigation) will definitely be of a LOW negative significance, affecting the *development site*. The impact will be permanent and will *occur*. The impact risk class is thus **MODERATE-HIGH**.

Mitigation measures

There are no mitigation measures that can be implemented to reduce the significance of geological impacts.

Residual impact

As no mitigation measures are possible the residual impact will be the same as the cumulative impact above i.e. project impact to geology will definitely be of a LOW negative significance, affecting the *development site*. The impact will be permanent and will *occur*. The impact risk class is thus **MODERATE-HIGH**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-2 below.

Table 10-2: Construction phase impact assessment matrix: Geology

Rated By:	M Vosloo	Site A						
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	Phase							
Geol01	CONSTRUCTION							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	Definite	0 NO				0 NO
Project Impact 1	Impacts on geological formations	Negative	Probable	2 LOW	2 DEV	5 PERM	5 OCCUR	-3.3 MODH
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	Probable	2 LOW	2 DEV	5 PERM	5 OCCUR	-3.3 MODH
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	Probable	2 LOW	2 DEV	5 PERM	5 OCCUR	-3.3 MODH

10.1.3 Topography

Status quo

The topography of the region is a gently to moderately undulating landscape of the Highveld plateau. The topography of the area encompassed by site A is draining in a north westerly direction. At present the topography of site A is not impacted.

Project impact (unmitigated)

During construction of the proposed ADF and its associated infrastructure (incl. PCDs, conveyor and roads) the terrain will be profiled using conventional construction methods and equipment. Profiling of the terrain will be permanent, and will affect surface water drainage patterns beyond the life of the facility.

The combined weighted project impact to topography (prior to mitigation) will probably be of a LOW negative significance, affecting the *development site*. The impact will be permanent and is going to *occur*. The impact risk class is thus **MODERATE-HIGH**.

Cumulative impact

The cumulative impact of the ADF on the topography during construction will not exceed that of the project impact above. Open cast mining activities to the north-east and east of the study area also have further impacts to the topography in the region; and this should be considered when assessing cumulative impacts. Predicted future runoff from the modified topography resulting from the ADF has been modelled to be 2 % less than current runoff. It is therefore anticipated that the cumulative impact will not exceed that of the project impact.

Therefore, the combined weighted project impact to topography will definitely be of a LOW negative significance, affecting the *development site*. The impact will be permanent and will *occur*. The impact risk class is thus **MODERATE-HIGH**.

Mitigation measures

- Install a clean water cut-off system that at a minimum, ensures that:
  - clean water cut-off canals are installed such that they tie into the adjacent terrain;
  - a free draining profile is established on all clean areas, and that storm water is allowed to move unhindered off the site;
  - the clean water cut-off system is designed as close to the facilities as possible to maximise the clean water leaving the site;
  - the clean water cut off system is installed prior to other construction activities are undertaken on the ADF or conveyor;
- Ensure a profile is established that contains all dirty water within the facility footprint; and
- Ensure that any areas impacted during the construction phase are rehabilitated as soon as practically possible.

Residual impact

With mitigation in place, the project impact to topography will definitely be of a VERY LOW negative significance, affecting the *development site*. The impact will be permanent and will *occur*. The impact risk class is thus **MODERATE-LOW**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-3.

Table 10-3: Construction phase impact assessment matrix: Topography

Rated By:	M Vosloo	Site A						
	IMPACT DESCRIPTION	Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	*Phase*							
Topo01	***CONSTRUCTION***							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	0 NO				**0** **NO**
Project Impact 1	Impacts on topography	Negative	**Probable**	2 LOW	2 DEV	5 PERM	5 OCCUR	**-3.3** **MODH**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	2 LOW	2 DEV	5 PERM	5 OCCUR	**-3.3** **MODH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	1 VLOW	2 DEV	5 PERM	5 OCCUR	**-2.9** **MODL**

10.1.4 Soils and land capability

Status quo

The geomorphological characteristics of the soils in the study area are influenced by the negative water balance and semi-arid environment, with the effects of evaporites and the development of laterites being highlighted as aspects of importance to the ecological status, and conditions that will influence the capability of the land. Soil groupings on site A include sandy and silty loams, sandy and silty clay loams, rocky sandy loams and wet soils, which are moderately easily worked but generally have a poor organic content matter. Site A has areas of cultivated pastures and commercial cropping, however with limited arable potential and moderate grazing potential.

The status quo is therefore characterised by agricultural impacts with soils that require commercial additives to increase arable and grazing potential. The status quo impact to soils and land capability is thus probably of a MODERATE-HIGH negative significance, affecting the *local* area. The impact is long term and is *occurring*. The impact risk class is thus **HIGH**.

Project impact (unmitigated)

The project impact relate to the loss of utilisable resource (sterilization and erosion), or compaction, contamination or salinisation. During the construction phase, construction activities will only impact a portion (~10 %) of the soil resource. The agricultural activities are perceived to be of great economic benefit to the local economy and land owners and contribute to the ecosystem services.

The construction for the ADF and its support activities will, if un-managed and without mitigation has a definite, MODERATE-HIGH negative significance that will affect the *development site and its immediate surroundings* and will be permanent. The impact is going to *occur*. The impact risk class is thus **HIGH.**

Cumulative impact

The cumulative impact on soils relates to a deterioration of the soil quality through agriculture resulting in the current status quo, as well as a loss of arable and grazing quality soil permanently due to the placement of the ADF.

The combined weighted project impact to soils and land capability will probably be of a MODERATE-HIGH negative significance, affecting the *development site and its immediate surroundings*. The impact will be long term and will *occur*. The impact risk class is thus **HIGH**.

Mitigation measures

The reduction in the risk rating of the impact can be achieved by:

- Limiting the area of impact to as small a footprint as possible, inclusive of the resource (soils) stockpiles and the length of servitudes, access and haulage ways and conveyancing systems wherever possible;
- Construction of the facility and associated infrastructure over the less sensitive soil groups;
- The development and inclusion of soil management as part of the general housekeeping operations, and the independent auditing of this management;
- Concurrent rehabilitation of all affected sites that are not required for the operation;
- The rehabilitation of temporary structures and footprint areas used during the feasibility investigation (geotechnical pits, trenching etc.) and the construction phase;
- Effective soil stripping during the less windy months when the soils are less susceptible to erosion;
- Separation of the utilisable soils and ferricrete base materials from each other and from the soft overburden;
- Effective cladding of the berms and soil, ferricrete stockpiles/heaps with vegetation or large rock fragments, and the minimising of the height of storage facilities to 15 m and soil berms to 1,5 m wherever possible;
- Restriction of vehicle movement over unprotected or sensitive areas, this will reduce compaction;
- Soil amelioration (cultivation) to enhance the oxygenation and growing capability (germination) of natural regeneration and/or seed within the stockpiled soils (maintain the soils viability during storage) and areas of concurrent rehabilitation.

Residual impact

The above management procedures will probably reduce the negative significance rating and resultant risk impact to a MODERATE-LOW rating that will be confined to the *development site and its immediate (500m) surroundings* in the medium term. Based on the historical actions of the proponent these actions are very likely to occur.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-4.

Table 10-4: Construction phase impact assessment matrix: Soils and land capability

Rated By:	Earth Science Solutions (IJ)	Ash Dump - Site A						
	IMPACT DESCRIPTION	Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	Impact Risk
Code	*Phase*							
	CONSTRUCTION							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	3 MODL	3 ADJ	4 LONG	5 OCCUR	**-3.7 MODH**
Project Impact 1	Loss of soil utilisation potential due to perminant nature of the proposed Ash Dump Facility	Negative	**Definite**	5 HIGH	3 ADJ	5 PERM	5 OCCUR	**-4.8 HIGH**
Project Impact 2	Loss of vegetative cover and topsoil protection - possibility of erosion, the perminant loss of resource downslope and the impact of sedimentary load on the streams and river systems.	Negative	**Definite**	4 MODH	2 DEV	4 LONG	5 OCCUR	**-3.7 MODH**
Project Impact 3	Loss of soil resource and its utilization potential and the possible contamination of the soil resource by waste product, hydrocarbon spils and/or dirty water	Negative	**Probable**	4 MODH	2 DEV	3 MED	4 VLIKE	**-2.7 MODL**
Project Impact 4	Loss of soil resource and its utilisation potential due to compaction over unprotected soil.	Negative	**Probable**	3 MODL	2 DEV	4 LONG	4 VLIKE	**-2.7 MODL**
Project Impact 5	Loss of soil nutrient status and resultant reduction in land capability potential due to denitrification and leaching from stripping and storage	Negative	**Probable**	4 MODH	2 DEV	4 LONG	4 VLIKE	**-2.9 MODL**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	4 MODH	3 ADJ	4 LONG	5 OCCUR	**-4.1 HIGH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	3 MODL	3 ADJ	3 MED	4 VLIKE	**-2.7 MODL**

10.1.5 Surface water

Status quo

Surface water resources within Site A are the Holspruit and Klipfonteinspruit. There is also a tributary that drains Kusile Power Station and flows directly into Klipfonteinspruit. The footprint of the Site A is currently utilised extensively for agriculture, mostly cultivation, though some livestock grazing is also known to occur. These activities have had limited impact on the streams in the area with some impacts on water quality from agricultural run-off. A wetland is located at the headwaters of Klipfonteinspruit. The water quality results at the sample sites for the area show high levels of fluoride (F), sulphate (SO_4), conductivity (EC) and total dissolved solids (TDS), exceeding the RWQOs. This is very possible due to the limited mining activity upstream of these points and the Kusile co-disposal facility in close proximity. The proposed New Largo mine is upstream of the Klipfonteinspruit. However water quality downstream of the Klipfonteinspruit shows an improved water quality indicating the functionality of the wetland. A number of farm road crossings have also lead to reduction of flow in the streams.

The status quo impact to surface water is thus probably of a VERY LOW negative significance, occurring at *isolated sites*. The impact is incidental and will *likely* occur. The impact risk class is thus **VERY LOW**.

Project impact (unmitigated)

Potential impacts anticipated to occur during the construction phase include loss or disturbance to streams, increased sediment transport into water resources, increased erosion, water quality deterioration in adjacent water resources, and altered flows. Loss of flow at the outlet of catchment B20F due to destruction of streams within the footprint of Site A is expected to be an average reduction of 1,6% of the base flow. Only the footprint required for the first 5 years of ash deposition will be cleared and prepared during the construction phase so the loss of water resources is expected to be greatest during the operational phase.

Construction activities are also likely to increase the disturbance footprint beyond the boundaries of the actual development footprint through temporary stockpiles, laydown areas, construction camps and uncontrolled driving of machinery leading to increased flow velocities off the site, increasing the risk of erosion with sediments potentially transported down the water resources and deposited in the Wilge River.

The combined weighted project impact to water resources (prior to mitigation) will definitely be of a MODERATE-HIGH negative significance, affecting the *local area*. The impact will act in the medium term and is *very likely to occur*. The impact risk class is thus **MODERATE-HIGH**.

Cumulative impact

The agricultural activities on site have had a limited impact on the water resources quality, while farm dam construction has resulted in some flow alteration. The Kusile Power Station construction has had an impact on the water quality while the proposed New Largo Mine is also likely to result in further water quality deterioration.

The baseline impacts are considered to be low and additional project impact (if no mitigation measures are implemented) will increase the significance of the existing baseline impacts, the cumulative unmitigated impact will probably be of a MODERATE-HIGH negative significance, affecting the *study area* in extent. The impact is *very likely* and will be medium term. The impact risk class is thus **MODERATE-HIGH**.

Mitigation measures (during construction)

- Optimise design of the ADF to minimise the size of the footprint;
- Minimise area of vegetation clearing;
- Where practically possible, undertake the clearing of vegetation during the dry season to minimise erosion;
- Comply with GN704 in relation to storm water measures so that sediment transport off site is minimised and clean water is diverted around the cleared area;
- A storm water management plan should be in place prior to construction being initiated;
- Install sediment traps as part of the storm water management plan where necessary and especially upstream of discharge points where erosion protection measures and energy dissipaters should be in place;
- Clean spills as quickly as possible;
- Store and handle potentially polluting substances and waste in designated, bunded facilities;
- Waste should be regularly removed from the construction site by suitably equipped and qualified operators and disposed of in approved facilities;
- Locate temporary waste and hazardous substance storage facilities out of the 1 : 100 flood lines;
- Locate temporary sanitation facilities out of the 1 : 100 year flood lines;
- Design infrastructure for river crossings adequately to prevent spillages; and
- Implement a water quality monitoring programme.

Residual impact

The residual impact of the construction of the ADF will include the permanent loss of water resources (flow), as well as a potential decline in water quality. Most of these impacts are expected to be mostly restricted to the local scale, however the potential deterioration of water quality within the Wilge River will increase the extent of the impacts.

After mitigation the impacts to the water resources will probably be of a MODERATE-LOW negative significance, affecting the *adjacent area* in extent. The impact is *likely* and will be permanent. The impact risk class is however still **LOW**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-5.

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Table 10-5: Construction phase impact assessment matrix: Surface water

Rated By:	*L Boyd / T Coleman*	Site A						
IMPACT DESCRIPTION		Direction of Impact	**Degree of Certainty**	Magnitude	Spatial	Temporal	Probability	**Impact Risk**
Code	*Phase*							
SurfWat01	***CONSTRUCTION***							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	1 VLOW	1 ISO	1 INCID	3 LIKE	**-0.7** **VLOW**
Project Impact 1	Water quality deterioration	Negative	**Probable**	4 MODH	4 LOC	4 LONG	4 VLIKE	**-3.5** **MODH**
Project Impact 2	Flow alteration			1 VLOW	4 LOC	3 MED	2 UNLIKE	**-1.2** **LOW**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	4 MODH	4 LOC	3 MED	4 VLIKE	**-3.2** **MODH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	3 MODL	3 ADJ	3 MED	3 LIKE	**-2** **LOW**

10.1.6 Groundwater

Status quo

If no ash is disposed on Site A, the different man-made activities and natural processes that lead to the established baseline groundwater conditions will prevail. Contaminant transport from upstream of the Klipfonteinspruit would probably continue downstream if no remediation action is taken. The water elevations would also probably continue to decrease. The analysis of the monitoring data (water levels) at Kusile power station shows an average annual decrease of 0.77m. The model simulation results in a maximum drawdown of 2.5 m over 3 years.

Impacts to the groundwater resources status quo will definitely be of a MODERATE-HIGH negative significance, affecting the *local area* in extent. The impact will occur and will be medium term. The impact risk class is however still **HIGH**.

Project impact (unmitigated)

Impacts have been considered and quantified during the construction phase on site A include increasing of infiltration rates, decreasing of the soils buffering capacity, deterioration of groundwater quality due to construction waste, deterioration of groundwater quality due to hydrocarbon spills, and altered flow systems that may be associated with probable groundwater dewatering and stream diversion.

The total estimated maximum depth of excavation for the construction of the ADF and associated facilities is approximately 5 mbgl. Considering such depth of excavation, it is probable that excavations intersect groundwater seepage at 1.9 mbgl at Site A. This implies that some groundwater dewatering will take place during construction.

Overall project impacts to the groundwater resources will range between VERY LOW to MODERATE-LOW negative significance, affecting the *local and adjacent area* in extent.

Cumulative impact

The main cumulative impacts of concern in Site A are the impacts from New Largo. Necessary groundwater dewatering would probably be implemented, which might create a cone of groundwater depression around the open pit at New Largo. The groundwater flow regime would therefore be altered, and flow between Site A and New Largo would probably be reversed toward the New Largo. This would help in containing any pollution associated with open cast mining, at New Largo, but will result in the spreading of the pollution from the 60 years ADF towards the south of Site A. At the 60 years horizon, New Largo dewatering will result in a plume expansion of an extra 800 m (further than without dewatering) at the south of site A. This would involve an extra 2.4 km^2 polluted area at the south of site A.

In the case where operation of New Largo is not considered, the historical underground mining impacts (acidic water) would still prevail since it is included in the site background groundwater quality and such impacts cannot be neglected. But the spreading (due to New Largo) dewatering of the pollution plume from the 60 years ADF towards the south of site A, would be avoided.

Cumulative impacts to the groundwater resources will probably be of a MODERATE-HIGH negative significance, affecting the *local area* in extent. The impact is *very likely* *to occur* and will occur in the medium term. The impact risk class is therefore **MODERATE-HIGH**.

Mitigation measures

- Any waste and spills (especially during construction and closure) need to be cleaned up immediately according to the departmental minimum requirements;
- Groundwater monitoring network should be installed before commencement of any construction activities on site;
- The monitoring network should be updated per project phase according approved methodologies, and maybe, in agreement with the DWS;
- Authorities need to be notified in the event of a spill or leachate during construction and closure;
- In the case of any groundwater dewatering, or pumping of contaminated groundwater, pumped water should be re-injected into the aquifer system at downstream of the site. If the groundwater is contaminated, treatment needs to take place to ensure that the quality of the re-injected water complies with the groundwater quality reserve as required by DWS;
- During design phase, the ADF and all pollution control facilities (dams, trenches) must be designed with the appropriate liner system and comply with the departmental minimum requirements (1998/2012) with cuspate leak detection;
- The design of the contaminated water trenches and dams should ensure their long term integrity;

- The ADF and all pollution control facilities (dams, trenches) must be designed to have a minimum freeboard above full supply level, at such manner that they can always handle 1:50 year flood-event on top of its mean operation level; and
- Storage area for hydrocarbons or any toxic construction material should be bonded according to departmental minimum requirement.

Residual impact

After the application of the mitigation measures, the groundwater risk impacts would be reduced as described in the mitigation section. The reduced impact risks together with the base line (status quo) impacts risk will constitute the residual risk impacts.

Residual impacts to the groundwater resources will probably be of a LOW negative significance, affecting the *development site and adjacent area* in extent. The impact would be limited to isolated incidences and would be *unlikely to occur*. The impact risk class is therefore **VERY LOW**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-6.

Table 10-6: Construction phase impact assessment matrix: Groundwater

Rated By:	*P Ahokpossi*	Site A						
	IMPACT DESCRIPTION	Direction of Impact	**Degree of Certainty**	Magnitude	Spatial	Temporal	Probability	**Impact Risk**
Code	*Phase*							
GroundW01	***CONSTRUCTION***							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	4 MODH	4 LOC	3 MED	5 OCCUR	**-4.1 HIGH**
Project Impact 1	Increase in infiltration rates	Positive	**Possible**	3 MODL	1 ISO	2 SHORT	2 UNLIKE	**-0.9 VLOW**
Project Impact 2	Decrease in soil buffering capacity to absorb contaminents from surface water	Negative	**Definite**	2 LOW	1 ISO	2 SHORT	3 LIKE	**-1.1 LOW**
Project Impact 3	Deterioration of groundwater quality due to constrution waste	Negative	**Probable**	4 MODH	4 LOC	3 MED	3 LIKE	**-2.4 MODL**
Project Impact 4	Deterioration of groundwater quality due to hydrocarbon spills from storage	Negative	**Probable**	2 LOW	4 LOC	3 MED	2 UNLIKE	**-1.3 LOW**
Project Impact 5	Altered flow systems that may be associated with probable groundwater dewatering and stream diversion	Negative	**Unsure**	2 LOW	3 ADJ	2 SHORT	2 UNLIKE	**-1 VLOW**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	4 MODH	4 LOC	3 MED	4 VLIKE	**-3.2 MODH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	2 LOW	3 ADJ	2 SHORT	3 LIKE	**-1.5 LOW**

10.1.7 Terrestrial ecology

Status quo

Site A is situated in close proximity to Kusile Power Station and is mostly characterised by cultivated land under maize production. Natural habitat occurs in the form of the moist grass and sedge community associated with on-site wetlands, and the adjacent dry mixed grasslands. These areas are important habitat for fauna and flora, some of which maybe Red Data/protected species. These natural areas are part of a larger habitat network that connects with the Wilge River riparian area.

The Kusile Power Station site is located immediately north of Site A, while the proposed New Largo Colliery is located to the east of the station. The site is thus largely surrounded by transformed or highly disturbed land. The proposed conveyor corridor link from Site A to Kusile Power Station is relatively short and will run adjacent to the existing tarred road and the Kusile co-disposal facility.

Status quo impacts to terrestrial ecology will definitely be of a HIGH negative significance, affecting the *development site* in extent. The impact *will occur* and over the long term. The impact risk class is therefore **HIGH**.

Project impact (unmitigated)

As construction of the proposed ADF progresses, natural habitat within the development footprint of the chosen site alternative will be subject to vegetation clearing and earth works causing direct habitat loss and fragmentation. The construction of the conveyor between Kusile Power Station and the selected site will also lead to habitat loss and habitat fragmentation. These impacts will commence during the construction phase and will persist throughout the entire life of the facility. Habitat loss and habitat fragmentation are thus the principle environmental impacts of concern and will affect Site A.

Project impacts to terrestrial ecology will range from MODERATE-LOW to SEVERE negative significance, affecting the *development site and adjacent area* in extent. The impacts are *very likely to occur* or *will occur* and will be permanent in some cases. The impact risk class therefore range from **MODERATE-LOW to VERY HIGH**.

Cumulative impact

Large portions of land immediately surrounding Site A are already transformed or will be transformed in the near future. Kusile Power station and its associated facilities have transformed the land to the north, while the proposed New Largo above-ground mining operation will transform the land to the east of Site A.

Cumulative impacts to terrestrial ecology will be a SEVERE negative significance, affecting the *local area* in extent. The impacts *will occur* and will be permanent. The impact risk class is therefore **VERY HIGH**.

Mitigation measures

- Vegetation clearing should be restricted to the proposed development footprints only, with no unnecessary clearing permitted outside of these areas;
- Areas to be cleared should be marked/taped-off to prevent unnecessary clearing outside of these demarcated sites;
- A nursery should be established to house species of conservation significance removed during site clearing. Alternatively conservation significant species should be taken to an existing nursery to temporarily house the plants. Only species known to successfully relocate should be moved;
- Removed topsoil should be stockpiled and used to rehabilitate disturbed areas. Topsoil should ideally not be stockpiled for greater than 12 months and stockpiles should not exceed two metres in height;
- It is recommended that an environmental control officer (ECO) or Waste Management Control Officer (WMCO) be appointed during construction to oversee the vegetation clearing process;
- A suitable rehabilitation programme should be developed and implemented in all disturbed areas post-construction. The ECO or WMCO should be responsible for overseeing the rehabilitation programme;
- It is recommended that monitoring of rehabilitated areas be undertaken to ensure successful stabilisation and revegetation of disturbed areas;
- Where possible, proposed linear infrastructure should be aligned with existing linear infrastructure or routed through already transformed / degraded areas;
- To prevent the obstruction of fauna dispersal and movement patterns, culverts should be installed at regular intervals along conveyor routes, fences and access roads to allow easy access across the barrier;
- An exotic species control programme, including monitoring, must be developed and implemented to reduce the encroachment of exotic invasive species;
- It is recommended that the ECO or WMCO be responsible for monitoring the nature and extent of on-site exotic, invasive plants;
- Prior to construction, all areas designated for vegetation clearing should be clearly marked and surveyed for Red Data/protected flora and fauna species. It is advised that an ECO be appointed to oversee this process;
- Where possible, development footprints should be sited so as to exclude areas where Red Data/protected flora occur; and
- In the event that Red Data/protected flora are identified within the designated construction footprints and require relocation, rescue permits must be obtained from the provincial or relevant authority, and a suitable ex-situ, and/or in-situ conservation plan developed.

Residual impact

Residual impacts to the terrestrial ecology will probably be of a VERY HIGH negative significance, affecting the *local area* in extent. The impact will be permanent and *will occur*. The impact risk class is therefore **VERY HIGH**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-7.

Table 10-7: Construction phase impact assessment matrix: Terrestrial Ecology

Rated By:	A Zinn	Site A						
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	Phase							
TerrEcol01	CONSTRUCTION							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	Definite	5 HIGH	2 DEV	4 LONG	5 OCCUR	-4.1 HIGH
Project Impact 1	Habitat loss and degradation through vegetation clearing	Positive	Possible	7 SEV	2 DEV	5 PERM	5 OCCUR	-5.2 VHIGH
Project Impact 2	Habitat fragmentation through loss of habitat and erection of artificial barriers	Negative	Definite	6 VHIGH	4 LOC	4 LONG	4 VLIKE	-4.1 HIGH
Project Impact 3	Increase in erosion and possible sedimentation of drainage features	Negative	Probable	4 MODH	4 LOC	4 LONG	4 VLIKE	-3.5 MODH
Project Impact 4	Increased dust generation	Negative	Probable	4 MODH	4 LOC	3 MED	5 OCCUR	-4.1 HIGH
Project Impact 5	Increased exotic and/or declared Category 1, 2 & 3 invader species	Negative	Unsure	3 MODL	3 ADJ	4 LONG	4 VLIKE	-2.9 MODL
Project Impact 6	Killing or injuring of fauna in the study area			3 MODL	3 ADJ	2 SHORT	4 VLIKE	-2.4 MODL
Project Impact 7	Loss of species of conservation importance			4 MODH	2 DEV	2 SHORT	4 VLIKE	2.4 MODL
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	Probable	7 SEV	4 LOC	5 PERM	5 OCCUR	-5.9 VHIGH
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	Probable	6 VHIGH	4 LOC	5 PERM	5 OCCUR	-5.5 VHIGH

10.1.8 Aquatic Ecology

Status quo

The main current impacts to surface water include agriculture (primarily livestock grazing with crop production prevailing to the west of the Wilge River) and construction activities related to the Kusile Power Station. Mining-related water quality impacts were evident within the Klipfonteinspruit.

Status quo impacts to aquatic ecology will probably be of a MODERATE-LOW negative significance, affecting the *local area* in extent. The impact *will very likely occur* over the short term. The impact risk class is therefore **MODERATE-LOW**.

Project impact (unmitigated)

The major impacts associated with site A will be water quality as well as design, construction and management of diversions and storm water infrastructure, in order to retain some aquatic diversity and species richness. Impacts due to the conveyor are likely to be relatively minor, restricted to two wetland crossings, and mainly confined to the operational phase. At a catchment level, only quaternary catchment (B20F) and one watercourse will be impacted upon, making it easier to mitigate impacts on site and contain spills.

The combined weighted project impact to aquatic ecosystems (prior to mitigation) during the construction phase will probably be of a VERY HIGH negative significance, at the *local* scale. The impact will act in the long term and will *definitely occur*. The impact risk class is thus **VERY HIGH**. Impact risk classes for individual project impacts can be seen in Table 10-8.

Cumulative impact

The development of site A will place additional stress on the Klipfonteinspruit, in terms of water quality and habitat integrity. This decline in water quality, however, is unlikely to significantly impact on the already depauperate aquatic biota within the Klipfonteinspruit. However, where water of poor quality reaches the Wilge River there are likely to be significant impacts, including the potential loss of sensitive fish and aquatic macroinvertebrate species. The Wilge River is currently relatively unimpacted by mining activities (which includes coal-fired power stations). As such, any impacts to the river will set a precedent that may facilitate the approval of future mining applications within the catchment. The Wilge River is also a tributary of the seriously impacted Olifants River. Impacts to the Wilge River will thus exacerbate impacts to the Olifants River system, potentially pushing these impacts beyond a critical level. Major pollution events (e.g. major spills or structural collapses) could potentially be carried as far as Mozambique, with international implications.

The baseline impacts are considered to be substantial, and additional project impact (if no mitigation measures are implement) will increase the significance of the existing baseline impacts, the cumulative unmitigated impact will probably be of a VERY HIGH negative significance, at the *provincial to national scale*. The impact is *going to happen* and will be permanent. The impact risk class is thus **VERY HIGH**.

Mitigation measures

Mitigation measures include:

- The ADF and other relevant infrastructure must be appropriately lined;
- Wetland areas, together with their buffers, should be cordoned off and considered no-go areas as far as possible;

- Soil stockpiles and toilet facilities should be placed outside of wetland areas. All construction staff should be informed on the sensitivity of the wetlands;
- It is essential that the development footprint be optimised and minimised so as to minimise the loss of wetland areas;
- The Klipfonteinspruit and Holfonteinspruit will have to be diverted around the development footprint, to avoid contamination of clean water. These diversions should be designed well in advance and should consider the following:
  - Diverted flows should be engineered to mimic the natural flows as far as possible by using uneven surfaces, flow retardant structures and sinuous flow patterns. Substrates should consist of crushed rock, reno mattresses or wetland vegetation. The use of concrete should be strictly avoided;
  - Design and management of diversions should aim to retard flows and to facilitate lateral connectivity (with marginal and riparian habitats) as well as longitudinal connectivity;
  - The design of the diversion should aim to maintain wetland functions, specifically flow attenuation and water quality improvement;
  - Habitat continuity - maintenance of habitat and migration corridors for fish, frogs and aquatic macroinvertebrates (e.g. fish ladders, fringing vegetation, pool habitats). A series of crushed rock weirs will facilitate this;
  - Maintenance of riparian corridors for fauna;
  - Optimal habitat heterogeneity;
  - The side slopes should be seeded with indigenous grasses. The slope of the side slopes should be gradual to minimise erosion and encourage colonisation by indigenous grasses;
  - Alien vegetation (e.g. black wattle), which is likely to colonise the side slopes, will need to be controlled.
  - Erosion protection and flow retardation measures should be applied at the diversion outlet to prevent erosion in downstream reaches;
- The position and design of stream crossings should include the following factors:
  - Follow existing roads as far as possible;
  - Crossings should ideally be perpendicular to streams to minimise the footprint;
  - Conveyors and pedicels should span the wetland and its buffer zone and should be clear of major flood levels (at least 1:100 year events) so as to prevent contamination of water during floods;
  - The conveyor should be enclosed at wetland crossings, including buffer zones, and should have adequate capacity to contain major spills;
  - Transfers should be located outside of wetland areas;
  - Dirty storm water dams and trenches at conveyor crossings should be designed to prevent spills or leaks of contaminated water and no dirty water should be discharged directly into wetland areas;
  - Ensure easy access for maintenance or clean ups;
  - The time period during which flow is modified due to construction should be kept as short as possible;

  - All wetland/riparian areas disturbed during construction should be rehabilitated immediately upon completion of construction;
- The design of the storm water management system should take into account the quality of water leaving the site, retention/treatment of dirty water, and volumes and velocities of water leaving the site;
- Construction should take place in the dry season to avoid erosion from exposed soils and stockpiles;
- Areas to be cleared should be kept to a minimum at any one time;
- No vegetation clearing or topsoil removal may take place within the 32 m buffer surrounding wetlands;
- Install sediment traps and storm water berms as soon as possible during the construction process;
- All surface runoff should be directed to a sediment trap. Silt traps should be regularly inspected and cleaned to ensure optimal functionality;
- Energy dissipaters and erosion protection measures should be incorporated at points of discharge which should be located outside of wetland areas;
- Storm water berms should be appropriately sloped and stabilised (e.g. revegetated) to prevent collapses;
- Dust suppression should aim to minimise dustfall into wetland areas; and
- A monitoring plan, including biomonitoring, should be compiled and implemented. Monitoring/biomonitoring data must be compared with baseline levels. Where target endpoints are not met, recommendations should translate directly into follow-up actions that are documented and audited.

Residual impact

The residual impact of the development is likely to include loss of wetland areas and declines in water quality and habitat suitability and/or availability. These impacts are likely to be, for the most part, restricted to the local scale. However, it is anticipated that water quality in the Wilge River will decline, even with mitigation. In addition, there is a significant risk that large-scale spills will impact on water quality further afield within the Olifants River system, potentially extending as far as Mozambique.

After mitigation the impacts to aquatic ecosystems will probably be of a MODERATELY-LOW negative significance, affecting the *district* area in extent. The impact is *going to happen* and will be permanent. The impact risk class is thus **MODERATE-HIGH**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-8.

Table 10-8: Construction phase impact assessment matrix: Aquatic Ecology

Rated By:	N Sharratt	Site A						
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	Phase							
AquaEcol01	CONSTRUCTION							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	3 MODL	4 LOC	2 SHORT	4 VLIKE	**-2.7 MODL**
Project Impact 1	Habitat loss due to sedimentation	Positive	**Probable**	5 HIGH	4 LOC	3 MED	5 OCCUR	**-4.4 HIGH**
Project Impact 2	Habitat loss due to serosion	Negative	**Probable**	7 SEV	3 ADJ	4 LONG	5 OCCUR	**-5.2 VHIGH**
Project Impact 3	Decline in water quality due to spills/leaks	Negative	**Definite**	5 HIGH	4 LOC	3 MED	5 OCCUR	**-4.4 HIGH**
Project Impact 4	Destruction of wetlands	Negative	**Definite**	6 VHIGH	2 DEV	5 PERM	5 OCCUR	**-4.8 HIGH**
Project Impact 5	Loss of sensitive species and biodiversity due to declines in water quality and habitats	Negative	**Possible**	4 MODH	4 LOC	5 PERM	3 LIKE	**-2.9 MODL**
Project Impact 6	Impacts to overall integrity of ecologically sensitive and important downstream ecosystems	Negative	**Probable**	3 MODL	5 DIS	5 PERM	5 OCCUR	**-4.8 HIGH**
Project Impact 7	Impacts to habitats and biodiversity due to conveyor crossings of the Klipfonteinspruit and	Negative	**Definite**	4 MODH	4 LOC	3 MED	5 OCCUR	**-4.1 HIGH**
Project Impact 8	Impacts to downstream reaches due to diversion of the Klipfonteinspruit	Negative	**Probable**	4 MODH	4 LOC	2 SHORT	4 VLIKE	**-2.9 MODL**
Project Impact 9	Impacts due to conveyor crossings of the Klipfonteinspruit to downstream ecosystems and biota	Negative	**Definite**	3 MODL	4 LOC	2 SHORT	4 VLIKE	**-2.7 MODL**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	6 VHIGH	4 LOC	4 LONG	5 OCCUR	**-5.2 VHIGH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	3 MODL	4 LOC	3 MED	5 OCCUR	**-3.7 MODH**

10.1.9 Wetlands

Status quo

The footprint of the proposed 60 year ash dam is currently utilised extensively for agriculture, mostly cultivation, though some livestock grazing is also known to occur. These activities have impacted on the wetlands, specifically where cultivation extends into the temporary zones of the wetlands and has resulted in the completed transformation of vegetation. Considerable areas of wetland habitat that are not currently cultivated have also been cultivated at some stage in the past and are characterised by secondary vegetation. Only small areas of natural vegetation remain within the hillslope seepage wetlands. Impacts to water quality are likely to have materialised from agricultural runoff, while some limited mining activity is also already taking place within the upper catchment of the Klipfonteinspruit. Currently the Klipfonteinspruit is severely incised and flows are concentrated within the incised channel.

Status quo impacts wetlands is of a MODERATE-LOW negative significance, affecting the *development area* in extent. The impact *has occurred* over the long term. The impact risk class is therefore **MODERATE-HIGH**.

Project impact (unmitigated)

Impacts expected to materialise during the construction phase include:

- Loss of wetland habitat;
- Disturbance to wetland habitat;

- Increased sediment transport into wetlands;
- Increased erosion within adjacent wetlands;
- Water quality deterioration in adjacent wetlands and water resources;
- Loss of Red Data and protected species;
- Increase in alien vegetation; and
- Altered flows within wetlands crossed by the conveyor.

Wetland habitat falling within the footprint of the ADF, conveyor and Pollution Control Dams will be lost. Earth works relating to the construction of these facilities will sterilise the wetland habitats within the construction footprint. In total, the extent of wetland habitat directly affected exceeds 225 hectares. However, not all wetlands will be lost during the construction phase. For the ADF, only the footprint required for the first 5 years of ash deposition will be cleared and prepared during the construction phase. Construction activities are also likely to increase the disturbance footprint beyond the boundaries of the actual development footprint through temporary stockpiles, laydown areas, construction camps, uncontrolled driving of machinery etc. Such activities will result in the loss of vegetation cover within the affected areas and increase the risk of erosion.

A diversion of the Klipfonteinspruit wetland will be required around the ash dam footprint. The stream diversion could result in discharge of concentrated flow into the downstream wetlands thus increasing the erosion risk in this wetland, and could in itself be at risk of erosion, especially in the period immediately following the completion of construction along the diversion and prior to the full establishment of vegetation. The design of the river diversion however allows for a broad system with gentle side slopes that will be earthen and vegetated, i.e. allowing for the establishment of wetland habitat within the diversion. The river diversion will be terraced to allow for low flows to be conveyed within the so-called ‘concentrated flow’ area, with flood flows overtopping this ‘concentrated flow’ area and spilling onto the ‘floodplain’ either side of the ‘concentrated flow’ area.

As part of the proposed ash dam development a conveyor from the power station to the ash dam will be required. This conveyor will cross a number of wetlands. Conveyor crossings have the potential to impact on flow characteristics of the affected wetlands through the concentration of flows and the impoundment of flows upstream of the crossing.

The combined weighted project impact to wetlands (prior to mitigation) will definitely be of a VERY HIGH negative significance, affecting the *local area*. The impact will act in the long term and *will occur*. The impact risk class is thus **VERY HIGH**.

<u>Cumulative impact</u>

The agricultural activities on site have resulted in wetland habitat degradation, though most of the wetlands still exist and are at least partially functional compared to their reference condition and functions they were likely to support. Other activities within the direct area that have resulted in wetland loss include the Kusile Power Station and the 10 year co-disposal facility, while future proposed activities such as the New Largo Mine are likely to result in further wetland loss within the affected sub-catchments.

The baseline impacts are considered to be substantial, and additional project impact (if no mitigation measures are implemented) will increase the significance of the existing baseline impacts. The cumulative unmitigated impact will probably be of a VERY HIGH negative significance, affecting the *district area* in extent. The impact <u>*is going to happen*</u> and will be <u>permanent</u>. The impact risk class is thus **VERY HIGH**.

<u>Mitigation measures</u>

1) Loss of wetland habitat

- Optimise design of ash dam to minimise size of footprint, e.g. increase the height of the ash dam, to minimise loss of wetland habitat;
- Ensure that the selected site has sufficient material in situ as required for rehabilitation and for the proposed liner, to prevent additional disturbed areas;
- Avoid additional wetland loss by limiting construction activities to as small an area as possible, ideally within the footprint of the proposed ash dam;
- Fence off all wetland areas falling outside the direct footprint of activities to limit impacts to these wetlands;
- Clearly demarcate the required construction servitude in the field and limit all construction activities to the demarcated area;
- Include environmental awareness aspects into the site induction program to ensure all staff are aware of the location and importance of wetland habitats in the vicinity of the construction site;
- Establish emergency response measures and a clearly defined chain of communication to rapidly deal with any unforeseen impacts to wetlands, e.g. spills;
- No stockpiling of material may take place within the wetland areas and temporary construction camps and infrastructure should also be located at least 100 m away from wetland areas falling outside the development footprint;
- Regular cleaning up of the wetland areas should be undertaken to remove litter; and
- Undertake a wetland offset study to investigate the possibility of mitigating the loss of wetland habitat on site A through the rehabilitation and protection of wetlands elsewhere. A wetlands management strategy has been developed as part of the mitigation strategy foe loss of wetlands and is described below.

The Wetlands Offset Management Strategy includes:

Eskom Kusile has recently developed a Draft Wetlands Management Strategy. This strategy identifies various wetland rehabilitation options. These options rely on a landscape approach of the B20F quaternary catchment, which includes sensitive and threatened habitats, species and vegetation units, comprising riparian zones, wetlands and terrestrial grasslands. It takes cognisance of the fact that both riparian zones and wetlands exist within a matrix of other landscape units and are not divorced from them, often relying on the integrity, intactness and functionality of these units for their own functionality and status.

Five major components within the B20F quaternary catchment that provide options for an overall strategy for wetland management has been identified (Figure 10-1). A detailed offset management plan is currently being developed.

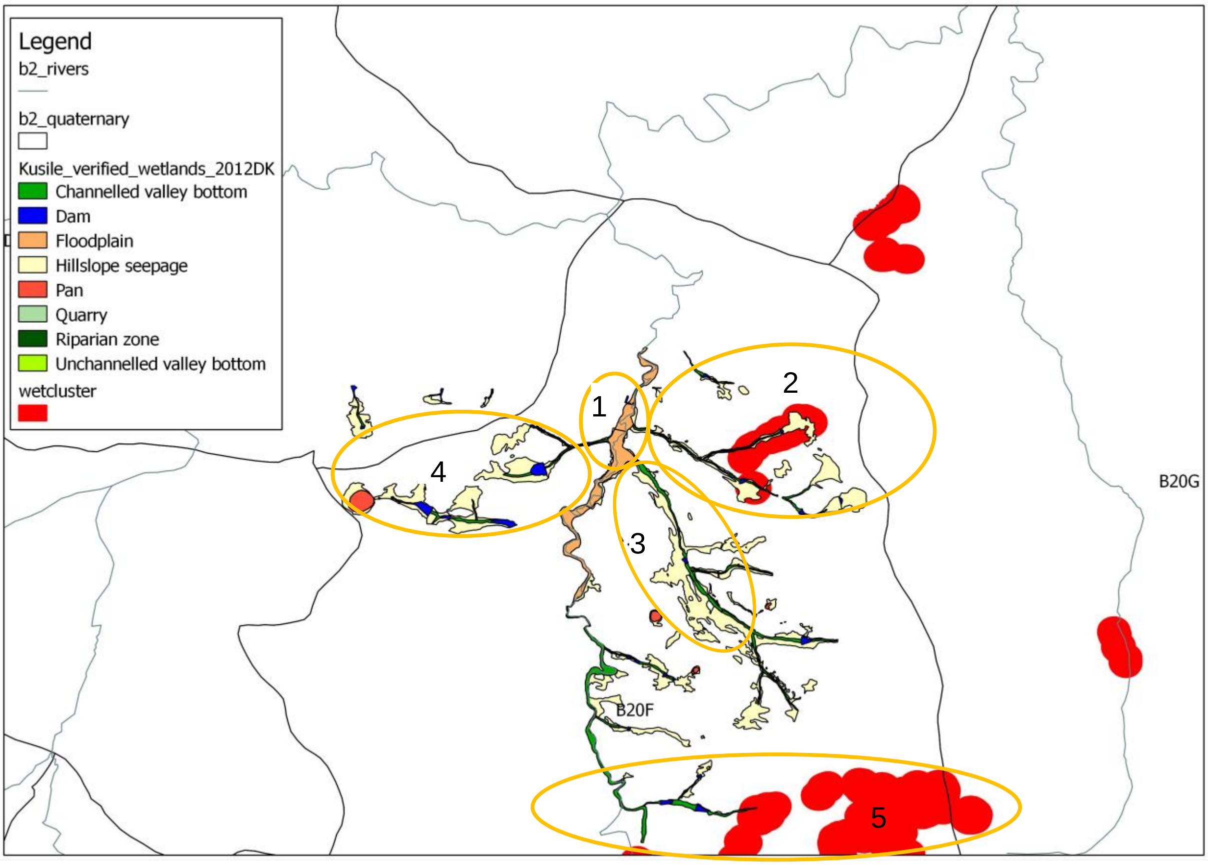

Figure 10-1: Landscape overview of the B20F quaternary catchment indicating 5 major components (A to E) to a proposed overall wetland management strategy

Component 1 is the Wilge River. This portion of the Wilge River is 44.2 km within the quaternary and has only 43 % natural landcover within 500 m of the channel.

Component 2 is dominated by hillslope seepage and channelled valley-bottom wetlands. A significant portion of these wetlands falls within Area C (146 ha), with the remainder, extensive in area, occurring between Alternative C and Kusile power station itself.

Component 3 is dominated by hillslope seepage wetlands with some channelled valley-bottom wetlands and a small portion of floodplain wetlands at the confluence with the Wilge River. The majority of these are category “C” wetlands with some “A” and “D”.

Component 4 is dominated by hillslope seepage wetlands with some channelled valley-bottom wetlands and a pan. Approximately 50% of the wetlands in this area are category “D” wetlands, with some “C” and a large proportion of “B” wetlands.

Component 5 comprises several wetland clusters noted for national importance. They fall outside of the original area assessed but occur within the quaternary catchment. Most of cluster 5 would appear to fall within the New Largo footprint.

A proposed strategy for overall wetland rehabilitation of the B20F quaternary within a landscape context is outlined below, and is intended to serve as sufficient wetland offset requirements. The steps indicated below are not intended to be prescriptive at this stage, nor are they exhaustive but merely provide a conceptual framework that will require more detailed planning and development. In all cases rehabilitation is intended to improve the overall PES of wetlands, especially where category “C” and “D” wetlands occur:

1. Rehabilitation of the Wilge River and associated floodplain wetlands (Component 1). The PES can be improved and a category “B” may be achievable if alien plants are removed and agricultural encroachment is curtailed by moving crops out of floodplain wetlands. If land is owned or purchased, terrestrial rehabilitation of grasslands is also possible which will enhance overall ecosystem resilience. The rehabilitation potential of the Wilge River is high.
2. Rehabilitation of wetlands outlined in Component 2, especially those associated with the NFEPA wetland cluster, those that occur within Alternative C (an option for the 60 Year ADF) and those already impacted by activities associated with Kusile. The area lends itself to the development of a nature reserve within which both terrestrial and wetland habitats are rehabilitated, with the added possibility of incorporating local communities into the reserve management/ownership. Rehabilitation potential is high and would involve inter alia reducing cattle or replacing with natural grazers, reducing dams (in both number and size i.e. reduce dam wall height), removing artificial levees, developing effective storm water runoff management and removing alien woody species (particularly Blue gums and Poplars). The main drainage line of Component 2 (parallel to southern boundary of Component 3) is also heavily impacted by Kusile in terms of turbidity, though this is not yet reflected in the aquatic ecology as much as for the Klipfonteinspruit. However, additional interventions to deal with altered flows and turbidity (e.g. small retention dams or upgrade of existing dams) might also be considered for the upper reaches of this drainage line.
3. Some of the wetlands in component 3 will be lost in Alternative 1 and it is proposed that a portion of wetlands closest to the new ADF be “sacrificed” to protect downstream habitats. This would entail utilising an upstream portion of the wetlands to mitigate impacts by installing a series of small retention dams that would trap sediments,

improve water quality and disperse runoff. The area required for the retention dams, as well as the capacity of the retention dams, will need to be determined through detailed hydrological modelling. The result would be some portion of upstream wetlands essentially becoming artificial in nature, but retaining desired ecological functions and at the same time protecting and improving downstream ecostatus. The majority of wetlands in the area however are to undergo rehabilitation. A significant portion of the wetlands in Component 3 is associated with agricultural activities in Alternative F where irrigation and artificial runoff is high (and polluted), and disturbance activities promote alien weed success essentially ensuring an efficient refuge of alien weeds that encroach into the wetlands. Rehabilitation of terrestrial grasslands in this area, while not an activity directly associated with wetlands, will effectively enhance the ecostatus of wetlands within a grassland matrix by reducing the source of alien plant species, erosion and elevated runoff. Wetlands in this area also have the potential for the development of a conservation area, and could easily be joined to Component 2. Specific rehabilitation activities could include the removal of the existing breached dam wall near the Wilge River and restoration of the floodplain, the removal of alien plant species, the restoration of upland grasslands (which are also a threatened vegetation unit type).

4. Rehabilitation of wetlands outlined in Component 4, especially those that occur within Alternative B. Rehabilitation of wetlands in this area will be more difficult to achieve since the major impact is related to agricultural encroachment and irrigation and would more than likely require the purchase of land to operationalise.
5. This may not be a viable option but would entail investigating the possibility of improving wetland ecostatus of several NFEPA wetland clusters outlined in Component 5.

2) Disturbance to wetland habitat

- Avoid additional wetland disturbances by limiting construction activities to as small an area as possible, ideally within the footprint of the proposed ADF;
- Fence off all wetland areas falling outside the direct footprint of activities to limit impacts to these wetlands;
- Clearly demarcate the required construction servitude in the field and limit all construction activities to the demarcated area;
- Include environmental awareness aspects into the site induction program to ensure all staff are aware of the location and importance of wetland habitats in the vicinity of the construction site;
- Establish emergency response measures and a clearly defined chain of communication to rapidly deal with any unforeseen impacts to wetlands, e.g. spills;
- No stockpiling of material may take place within the wetland areas and temporary construction camps and infrastructure should also be located at least 100 m away from wetland areas falling outside the development footprint; and
- Regular cleaning up of the wetland areas should be undertaken to remove litter.

3) Increased sediment transport into wetlands

- Minimise area of vegetation clearing;

- Phase vegetation clearing activities as far as possible to limit the area exposed at any one time;
- Where practically possible, the major earthworks should be undertaken during the dry season (roughly from April to August) to limit erosion due to rainfall runoff;
- Install sediment barriers and/or low berms along the downslope edge of cleared areas to trap sediments on site. Design of sediment barriers should be such that expected flow velocities will not damage the barriers or impair their function. Regular cleaning and maintenance of the barriers should be undertaken;
- Design and implement a construction storm water management plan that aims to minimise the concentration of flow and increase in flow velocity, as well as minimising sediment transport off site;
- Install the construction storm water management system prior to the onset of vegetation clearing activities on the ash dam footprint;
- Install sediment traps as part of the storm water management plan where necessary upstream of discharge points;
- Divert clean water outside the facility footprint around the cleared area and install erosion protection measures and energy dissipaters at points of discharge;
- Cleared areas outside direct development footprint should be re-vegetated via hydro-seeding as soon as possible; and
- A vegetation and erosion monitoring plan should be established for all rehabilitated sites with clearly defined measures to respond to erosion damage or unsuccessful revegetation.

4) Increased erosion within adjacent wetlands

- Implement a construction storm water management plan prior to the onset of vegetation clearing activities on site;
- Storm water and clean water discharge points should be protected against erosion;
- Discharge points should incorporate energy dissipaters and erosion protection;
- Concentrated, high velocity flows should be avoided;
- During the construction phase, all discharge points should incorporate sediment barriers or sediment traps designed to cope with the flow velocities and volumes at the point of discharge;
- All discharge points should be regularly inspected for signs of erosion, sediment deposition or obstructions;
- The gradient of the stream diversions should be kept as low as possible. The diversion itself should be broad with gently sloping side slopes, and should incorporate rip rap steps (rock-packed steps) at regular intervals to protect against erosion and to allow for the required fall in the stream diversions;
- A stilling basin should be incorporated at the end of the diversion to act as attenuation structure;
- Following construction activities the entire diversion floor should be landscaped to remove all obstacles and ruts that could lead to the formation of preferential flow paths;
- Re-vegetation of the stream diversion floor should proceed naturally and establish rapidly if sufficient flow through the wetland is available. Should exceptionally low flows

be encountered due to drought conditions, seeding of the diversion might be required to ensure rapid vegetation establishment. Regular, monthly monitoring of the stream diversion will thus be required until vegetation cover has been established across the full stream diversion; and

- More terrestrial areas such as the side slopes of the stream diversions will not re-vegetate naturally and should be seeded with a suitable mix of indigenous highveld grasses.

5) Water quality deterioration in adjacent wetlands and water resources

- Store and handle potentially polluting substances and waste in designated, bunded facilities;
- Waste should be regularly removed from the construction site by suitably equipped and qualified operators and disposed of in approved facilities;
- Locate temporary waste and hazardous substance storage facilities a minimum of 100m from any wetland edge;
- Keep sufficient quantities of spill clean-up materials on site;
- Clearly define roles and responsibilities of all personnel during spillage events;
- Keep a detailed log on site of all spills;
- Locate ablution facilities at least 100 m from the edge of wetland areas outside the direct development footprint; and
- No washing of machinery or equipment within wetlands areas adjacent to the development sites should be allowed.

6) Loss of Red Data and protected species

- Appoint suitably qualified professionals to undertake search and rescue operations for Red Data plant species prior to vegetation clearing activities; and
- Include Red Data species and suitable habitat in offset considerations.

7) Increase in alien vegetation

- Compile and implement an alien vegetation management plan for the entire affected area;
- Regular surveys for alien vegetation should be undertaken and populations of alien species controlled. Where possible, the populations should be removed and impacted areas rehabilitated; and
- All removal of alien vegetation must be undertaken under supervision of suitably trained and qualified individuals.

8) Altered flows within wetlands crossed by the conveyor

- Crossing infrastructure should aim to minimise concentration of flows, as well as impoundment of flows upslope of crossings;
- The active channel of all wetlands should be crossed by a clear span bridge, with no pedestals located within the active channels;

- Where culverts are utilised to cross seepage wetlands or weakly channelled systems, sufficient culverts should be utilised to ensure wetting of the full wetland front downslope of the crossing; and
- Gantries should be installed at all wetland crossings.

<u>Residual impact</u>

The residual impact of the construction of the ADF will include the permanent loss of wetland habitat, as well as declines in water quality and degradation of downstream wetland habitat. Most of these impacts are expected to be mostly restricted to the local scale, though the possible deterioration of water quality within the Wilge River will increase the extent of the impacts.

The residual impact to wetlands beyond the closure phase of the project will be reduced through mitigation measures but not to within baseline conditions. After mitigation the impacts to wetlands will probably be of a MODERATE-LOW negative significance, affecting the *adjacent area* in extent. The impact *<u>is going to happen</u>* and will be <u>permanent</u>. The impact risk class is thus **HIGH**.

<u>Impact Matrix</u>

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-9.

Table 10-9: Construction phase impact assessment matrix: Wetlands

Rated By:				Site A				
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	Impact Risk
Code	*Phase*							
	CONSTRUCTION							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative		3 MODL	2 DEV	4 LONG	5 OCCUR	-3.3 MODH
Project Impact 1	Loss of wetland habitat	Negative	Definite	6 VHIGH	3 ADJ	5 PERM	5 OCCUR	-5.2 VHIGH
Project Impact 2	Disturbance to wetland habitat	Negative	Probable	3 MODL	2 DEV	2 SHORT	4 VLIKE	-2.1 MODL
Project Impact 3	Increased sediment transport into wetlands	Negative	Definite	4 MODH	3 ADJ	2 SHORT	5 OCCUR	-3.3 MODH
Project Impact 4	Increased erosion within adjacent wetlands	Negative	Probable	4 MODH	3 ADJ	4 LONG	4 VLIKE	-3.2 MODH
Project Impact 5	Water quality deterioration within adjacent wetlands & water resources	Negative	Possible	4 MODH	4 LOC	2 SHORT	3 LIKE	-2.2 MODL
Project Impact 6	Loss of Red Data species and protected species	Negative	Probable	4 MODH	2 DEV	5 PERM	5 OCCUR	-4.1 HIGH
Project Impact 7	Increase in alien vegetation	Negative	Probable	4 MODH	2 DEV	4 LONG	4 VLIKE	-2.9 MODL
Project Impact 8	Alterred flows within wetlands crossed by the conveyor	Negative	Probable	3 MODL	3 ADJ	5 PERM	5 OCCUR	-4.1 HIGH
Project Impact 9								
Project Impact 10								
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	Probable	6 VHIGH	5 DIS	5 PERM	5 OCCUR	-5.9 VHIGH
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	Probable	3 MODL	3 ADJ	5 PERM	5 OCCUR	-4.1 HIGH

10.1.10 Avifauna

Status quo

The current land use is characterised by agriculture, therefore the existing on-site impact relates to agricultural practices. An ash disposal facility for the Kusile Power Station has been approved on the northern boundary of site A. Furthermore, the proposed New Largo coal mine will be located immediately to the east of site A. Both these activities, including other commercial ventures in the area such as Topigs, combined with the existing agriculture, will in all probability have a negative impact on site A as they are located 'upstream' in the catchments which feed into the wetland habitat on site A.

Status quo impacts on avifauna will definitely be of a VERY HIGH negative significance, affecting the *local area* in extent. The impact is *very likely to occur* over the long term. The impact risk class is therefore **HIGH**.

Project impact (unmitigated)

During the construction, operational and closure phase of the ash disposal facility the remaining natural habitat surrounding the wetlands on the site will be transformed and fragmented which will result in a reduced species diversity and abundance of birds. These impacts will occur as a result of disturbance, vegetation clearing and excavation. Other impacts that may affect avifauna are collisions and electrocutions with powerlines that will be deviated around the ash disposal facility.

The combined weighted impact on avifauna will definitely be of a HIGH negative significance affecting the *local area*. The impact will be permanent and *is going to happen*. The impact risk class during construction is thus **VERY HIGH**.

Cumulative impact

The existing and anticipated future impacts as outlined in the above status quo section combined with the impacts as a result of construction, operation and closure of the 60 year ash disposal facility will definitely have a VERY HIGH cumulative impact. This impact will affect the bird population in the *local area*. The impact *is going to happen* and will be permanent. The impact risk class is thus **VERY HIGH**.

Mitigation measures

- Establish suitable off site mitigation and offsets where needed i.e. conserve and improve suitable alternative grassland and wetland habitat in the region in order to improve and provide additional suitable habitat for impacted avifaunal species. Off-set mitigation should ideally be concentrated in one specific area (e.g. on site C or a suitable alternate locality);

- Contribute towards existing grassland and wetland conservation initiatives already active in the region;
- The proposed recommendations of the Terrestrial Ecology and Wetland Specialist Study for the Environmental Management Programme should be strictly applied to minimise the impact on the natural environment, specifically on the remaining wetlands and natural grasslands, as this is the most important bird habitat types in the study area.
- Maximum use should be made of existing infrastructure (e.g. access roads) to minimise the further fragmentation of natural grassland and wetland areas.
- Undertake a site walk-down to identify sensitive bird areas adjacent to the ADF footprint.
- Install bird flappers where necessary along sections of the deviated 88kV power lines.

Residual impact

The residual impact to avifauna beyond the closure phase of the project will be reduced through mitigation measures but not to within baseline conditions. After mitigation the impacts to avifauna will definitely be of a HIGH negative significance, affecting the *local area* in extent. The impact *is going to happen* and will be long term. The impact risk class is thus **HIGH**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-10.

Table 10-10: Construction phase impact assessment matrix: Avifauna

				Site A				
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	Impact Risk
Code	*Phase*							
	CONSTRUCTION							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	6	4	4	4	**-4.1**
				VHIGH	LOC	LONG	VLIKE	**HIGH**
Project Impact 1	Reduction in species diversity and abundance due to habitat transformation and fragmentation.	Negative	**Probable**	5	4	5	5	**-5.2**
				HIGH	LOC	PERM	OCCUR	**VHIGH**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	6	4	5	5	**-5.5**
				VHIGH	LOC	PERM	OCCUR	**VHIGH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	5	4	4	5	**-4.8**
				HIGH	LOC	LONG	OCCUR	**HIGH**

10.1.11 Bats

Status quo

The current land use is characterised by agriculture, therefore the existing on-site impact relates to agricultural practices. An ash disposal facility for the Kusile Power Station has been approved on the northern boundary of site A. Furthermore, the proposed New Largo coal mine will be located immediately to the east of site A. Although no artificial roosting sites was identified within or adjacent to site A, it does feature existing wetland areas that may serve as feeding grounds for bats. Given the range bats can travel to other feeding grounds, the loss of the wetlands in terms of bat feeding habits may not be significant.

Status quo impacts on bats will definitely be of a LOW negative significance, affecting the *development area* in extent. The impact *will occur* and will be permanent. The impact risk class is therefore **MODERATE-HIGH**.

Project impact (unmitigated)

Project impacts on bats will include the loss of bat feeding habitat and roosting sites. The construction of the ADF will sterilise the existing vegetation units on site, including the wetlands associated with the Holfonteinspruit and Klipfonteinspruit, which serves at feeding grounds for bats.

Project impacts on bats will be of a LOW negative significance, affecting the *development and adjacent area* in extent. The impact *will occur* and will be permanent. The impact risk class is therefore **MODERATE-HIGH**.

Cumulative impact

Cumulative impact resulting from the status quo impacts and project impacts will have the same conclusion as impacts resulting solely from project impacts related to construction of the ADF. Airspace over the fields and natural vegetation in site A will be replaced by the starter platform of the ADF. Displacement of the bats from the area will thus also occur gradually as construction and operational phase continues.

Cumulative impacts on bats will be of a LOW negative significance, affecting the *development and adjacent area* in extent. The impact *will occur* and will be permanent. The impact risk class is therefore **MODERATE-HIGH**.

Mitigation measures

- Pro-actively entice bats away from selected ADF site (Area A) by:
  - Providing artificial daytime roosts > 5 km away from construction site;
  - Providing hibernation opportunities in the form of artificial caves > 5 km away from construction site;
  - Increase aerial prey densities by means of progressive conservation of natural resources (grasslands, water surfaces);
  - Artificially create dusk swarming of areal insects with the use of lights
  - Avoiding ecological poisoning; and
  - Monitor environmental health by bi-annually census bat activity.
- Prevent or minimise environmental pollution of the receiving environment through implementation of all mitigation measures identified by specialist during this study.

Residual impact

The site and ensuing development will progressively be transformed into a hostile area for bats. However, even though the presence of bats at the location of the preferred site A will cease, resident bats will roost and forage at nearby locations.

Residual impacts on bats will be of a LOW negative significance, affecting the *development and adjacent area* in extent. The impact *will occur* and will be permanent. The impact risk class is therefore **MODERATE-HIGH**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-11.

Table 10-11: Construction phase impact assessment matrix: Bats

Rated By:	Dr I Rautenbach			Site A				
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	Phase							
Bats01	CONSTRUCTION							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	Definite	2 LOW	2 DEV	5 PERM	5 OCCUR	-3.3 MODH
Project Impact 1	Impact on bats	Negative	Probable	2 LOW	3 ADJ	5 PERM	5 OCCUR	-3.7 MODH
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	Probable	2 LOW	3 ADJ	5 PERM	5 OCCUR	-3.7 MODH
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	Probable	2 LOW	3 ADJ	5 PERM	5 OCCUR	-3.7 MODH

10.1.12 Noise

Status quo

The most notable sources of intrusive noise in the vicinity of site Sites A include Kusile Power Station and national/regional roads.

The impact of Kusile Power Station's construction phase on Site A is considered LOW in magnitude, limited to the *study area*, of medium duration (i.e. will last for the duration of the power station's operation) and will *definitely occur*, resulting in a negative **MODERATE** impact risk.

Project impact (unmitigated)

The most significant noise sources during construction include movement and offloading of trucks carrying ash to the starter platform, site preparation and construction activities.

During the construction and closure phases of the ash disposal facility, noise impacts are considered LOW in magnitude, limited to the *isolated areas* of construction, short in duration and *likely to occur*, resulting in a negative **LOW** impact risk.

Operational phase impacts are considered low in magnitude, limited to the study area, of medium duration (project life) and likely to occur, resulting in a negative low impact risk.

Cumulative impact

During the construction and closure phases of the ash disposal facility, cumulative noise impacts are considered LOW in magnitude, limited to the *isolated areas* of construction, short in duration and *likely to occur*, resulting in a negative **LOW** impact risk.

Operational phase impacts are considered low in magnitude, limited to the study area, of medium duration (project life) and likely to occur, resulting in a negative low impact risk.

Mitigation measures

Effective noise management and mitigation measures can be summarised as:

- Regular maintenance of all construction equipment, conveyors and conveyor elements, and stacker equipment to minimise noise generation;
- Restricting all construction, closure and maintenance activities to day-time since impacts are most significant at night;
- Monitoring noise levels at noise sensitive receptors within 1 km from of the construction site or from the border of the site;
- To minimise noise generation, vendors can be required to guarantee optimised equipment design noise levels;
- During the planning and design stages of the project, possibly related noise aspects should always be kept in mind. The enclosure of major sources of noise, such transfer houses, must be included in the design process, since they represent basic good engineering practice;
- All vibrating equipment must be installed on vibration isolating mountings;
- By enclosing the tipper discharge and lowering the conveyor drop height, noise emissions may be reduced. Mechanical and electrical design also influences the amount of noise from stacking operations;
- Where possible, relocate noise sources to less sensitive areas to take advantage of distance and shielding;
- Site permanent facilities away from community areas if possible; and
- Develop a mechanism to monitor noise levels, record and respond to complaints and mitigate impacts.

Residual impact

During the construction and closure phases of the ash disposal facility, residual noise impacts are considered LOW in magnitude, limited to the *isolated areas* of construction, short in duration and *could occur*, resulting in a negative **VERY LOW** impact risk.

Operational phase impacts are considered LOW in magnitude, limited to the *study area*, of medium duration (project life) and *could occur*, resulting in a negative **LOW** impact risk.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-12.

Table 10-12: Construction phase impact assessment matrix: Noise

Rated By:	N von Reiche			Site A				
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	Phase							
Noise01	CONSTRUCTION							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	Definite	2 LOW	2 DEV	3 MED	5 OCCUR	-2.6 MODL
Project Impact 1	Environmental noise impacts as a result of the project	Negative	Probable	2 LOW	1 ISO	2 SHORT	4 VLIKE	-1.5 LOW
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	Probable	2 LOW	1 ISO	2 SHORT	4 VLIKE	-1.5 LOW
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	Probable	2 LOW	1 ISO	2 SHORT	3 LIKE	-1.1 LOW

10.1.13 Visual

Status quo

The proposed project is located in a landscape of moderate value that, by the time of the implementation of the Project, already includes negative visual elements.

Project impact (unmitigated)

Construction activities will contrast minimally with the patterns or elements that define the structure of the landscape. Construction activities would however result in a moderate change in landscape characteristics over an extensive area resulting in moderate changes to key views.

Cumulative impact

Construction activities will add to the cumulative negative effect on the visual quality of the landscape.

Mitigation measures

- Dust suppression techniques should be in place at all times during the construction phase;
- As much vegetation as possible should be kept during site clearance;
- Rehabilitate / restore exposed areas as soon as possible after construction activities are complete;
- Avoid high pole top security lighting along the periphery of the project area and use only lights that are activated on illegal entry to the project area; and
- Light public movement areas (pathways and roads) with low level 'bollard' type lights and avoid post top lighting.

Residual impact

Although mitigation measures will be implemented due to the landscape character and height of structures, residents and travellers will still be able to see the construction activities. Mitigation will only partially obstruct views.

During the construction phase of the ash disposal facility, residual visual impacts are considered MODERATE-LOW in magnitude, limited to the *local* area of construction. The impact will be permanent, and is *going to happen* resulting in a negative **HIGH** impact risk.

Impact Matrix

The impacts identified and discussed above have been rated and presented below in Table 10-13.

Table 10-13: Construction phase impact assessment matrix: Visual

Rated By:	*M Cilliers / M Vosloo*	Site A						
IMPACT DESCRIPTION		Direction of Impact	**Degree of Certainty**	Magnitude	Spatial	Temporal	Probability	**Impact Risk**
Code	*Phase*							
Visual01	***CONSTRUCTION***							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	3 MODL	3 ADJ	3 MED	3 LIKE	**-2** **LOW**
Project Impact 1	Visual impact on residents within and travellers through the study area	Positive	**Probable**	3 MODL	4 LOC	5 PERM	5 OCCUR	**-4.4** **HIGH**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	3 MODL	4 LOC	5 PERM	5 OCCUR	**-4.4** **HIGH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	3 MODL	4 LOC	5 PERM	5 OCCUR	**-4.4** **HIGH**

10.1.14 Heritage

Status quo

Four cemeteries, consisting of 47 graves in total, were identified within the footprint of site A. The cemeteries contain African farmworker graves. The remains of a recent farmhouse and farm workers housing were also identified.

Impacts identified are natural (burrowing animals and vegetation) and impacts mainly the cemeteries and graves within the area, while the demolishing and subsequent scavenging of building material has led to the destruction of houses and outbuildings on farmsteads.

The combined weighted base line impact to heritage resources will definitely be of a VERY LOW negative significance, affecting *isolated sites*. The impact will be incidental and *likely to occur*. The impact risk class is thus **VERY LOW**.

Project impact (unmitigated)

During the construction of the ADF, access roads, pipelines, trenches / channels, distribution lines re-routing, and installation of the barrier system impacts will occur to the identified and chance find heritage resources. These impacts will occur as a result of construction activities such as topsoil stripping, excavations and vegetation clearing. The most notable impacts will be on the existing cemeteries and the palaeontological sensitive substrata in the south western section of the study area.

The combined weighted project impact to cemeteries and palaeontological resources (prior to mitigation) will definitely be of a HIGH negative significance, affecting *isolated sites*. The impact will be permanent and is *going to happen*. The impact risk class is thus **MODERATE-HIGH** to **HIGH**.

Cumulative impact

The baseline impacts are considered to be VERY LOW, and additional project impact (if no mitigation measures are implement) will increase the significance of the existing baseline impacts, the cumulative unmitigated impact will definitely be of a HIGH negative significance, *isolated sites* in extent. The impact is *going to happen* and will be permanent. The impact risk class is thus **HIGH**.

Mitigation measures

1. Cemeteries:

It is recommended that in the event that the cemeteries cannot be incorporated into the development, the graves be relocated after a full grave relocation process that includes comprehensive social consultation. The grave relocation process must include:

- A detailed social consultation process, that will trace the next-of-kin and obtain their consent for the relocation of the graves, which will be at least 60 days in length;
- Site notices indicating the intent of the relocation;
- Newspaper Notice indicating the intent of the relocation;
- A permit from the local authority;
- A permit from the Provincial Department of Health;
- A permit from the South African Heritage Resources Agency, if the graves are older than 60 years, or unidentified and thus presumed older than 60 years;
- An exhumation process that keeps the dignity of the remains and family intact;
- The whole process must be done by a reputable company that is well versed in relocations; and
- The exhumation process must be conducted in such a manner as to safeguard the legal rights of the families as well as that of the development company.

2. Palaeontology

If the excavations uncover the Vryheid Formation bedrock:

- A Palaeontologist is appointed as part of the Environmental Construction Team for identified high palaeontological sensitive areas;
- A palaeontological rescue and/or destruction permit is obtained by the Palaeontologist;
- The Palaeontologist accompanies the surveyor and foundation teams during the initial excavation phases to rescue any fossil bearing material from the construction footprint; and
- Compile a Phase 2 report to the Heritage Authority responsible after palaeontological construction inputs.

<u>Residual impact</u>

The impact to heritage resources will be permanent as heritage resources cannot be restored. The proposed mitigation measures will enable the documentation of any palaeontology found and the preservation of human remains through the relocation to cemeteries as requested by the next-of-kin.

The residual impact on heritage resources during the construction phase of the project will be reduced through mitigation measures but not to within baseline conditions. After mitigation the impacts to heritage resources will probably be of a LOW negative significance, affecting the *isolated sites*. The impact is <u>*going to happen*</u> and will be <u>permanent</u>. The impact risk class is thus **MODERATE-LOW**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-14.

Table 10-14: Construction phase impact assessment matrix: Heritage

Rated By:	*W Fourie*	Site A						
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	*Phase*							
Heritage01	***CONSTRUCTION***							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	1 VLOW	1 ISO	1 INCID	3 LIKE	**-0.7 VLOW**
Project Impact 1	Cemeteries	Positive	**Probable**	5 HIGH	1 ISO	5 PERM	5 OCCUR	**-4.1 HIGH**
Project Impact 2	Palaeontology	Negative	**Probable**	5 HIGH	1 ISO	5 PERM	4 VLIKE	**-3.2 MODH**
Project Impact 3	Historical Structures	Negative	**Definite**	1 VLOW	1 ISO	5 PERM	4 VLIKE	**-2.1 MODL**
Project Impact 4	Stone Age Site	Negative	**Definite**	1 VLOW	1 ISO	5 PERM	2 UNLIKE	**-1 VLOW**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	6 VHIGH	1 ISO	5 PERM	5 OCCUR	**-4.4 HIGH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	2 LOW	1 ISO	5 PERM	5 OCCUR	**-2.9 MODL**

10.1.15 Social

Status quo

The area is currently experiencing an in-migration of people as a result of new developments such as the Kusile power station, the New Largo mine and other developments in the area. Impacts that are currently experienced as a result of the in-migration of people is pressure on physical infrastructure (especially in Phola), an increase in crime and a change in the quality of the living environment, such as an increase in dust, noise and traffic. The commercial farmers have indicated that dust has an impact on the quality of their crops as well as their livestock.

The Bravo Cooperative as well as some farmers has reported that the noise from the construction of the Kusile power station is such a nuisance at night that it keeps them awake. The commercial farmers also have concerns about the quality of their water. Currently their water is of a fairly good quality, but they have concerns about the future.

The sense of place of the area is changing as a result of all the industrial developments in the area, which has also resulted in a change in the aesthetic quality of the area. The urban communities as well as the farming community are concerned about the impact of dust on their health in terms of diseases like asthma and sinusitis.

A general feeling among farmers whose properties has been involved in EIAs or ultimately infrastructure developments is that they experience uncertainty about the future as they are unsure of how to proceed amidst the all the proposed developments. They are mostly in a position where it would be very difficult for them to sell their land, as other farmers are also not keen to farm in an area with an increase in mining and power stations.

Project impact (unmitigated)

For the affected land owners and their farm workers, the project may lead to a disruption in the local economic system once the project is approved. Site A previously formed part of a commercial farming unit, however, Eskom has purchased the land portions which now form part of the Eskom Kusile Power Station collective.

Word of the project may lead to an in-migration of opportunistic jobseekers to the area, leading to pressure on physical and social infrastructure, an increased presence of strangers in the area, as well as an increase in crime.

An increase in HIV/AIDS, STD's and deviant social behaviour like alcohol abuse and unwanted pregnancies are traditionally associated with an influx of people, and it is likely that this will be the case during the construction phase of the project as well.

Construction of the project will lead to an increase in dust in the area, noise and an increase in traffic. An increase in dust will have an impact on livestock, crops as well as the health and well-being of humans. The aesthetic quality and sense of place of the area will change as a result of the visual presence of the ash disposal facility. Community members are of the opinion that many impacts cannot be mitigated effectively and that mitigation measures are not consistently applied, using current projects in the area as frame of reference.

An increase in uncertainty and a loss of autonomy is already experienced in the farming community as a result of the project, especially among those who had land that was considered for the other alternatives.

The construction phase will lead to an increase in the number of available temporary job opportunities in the area. People from the Bravo Cooperative expect to benefit from the job opportunities, as do people from Phola. Residents from Phola felt that they were excluded from jobs during the construction of the Kusile power station although they were the nearest community because they were in a different municipal area.

Cumulative impact

It is almost impossible to ascribe a portion of a social impact to a specific project, but it is estimated that the bulk of the existing negative impacts in the area occur as a result of current mining activities in the area, as well as the construction of the Kusile power station and the New Largo mine. The baseline impacts are considered to already being substantial and the additional project impact without mitigation measures will definitely be of a MODERATELY-LOW negative significance affecting the area on a *district level* (more than 5 km from the project site). Some of the impacts have already *occurred* and most of the impacts may extend beyond the life of the operation. The impact risk class is **HIGH**. It must be noted that social impacts are not linear in nature and thus cannot cancel out one another.

When expressing an opinion about a groups of impacts like this, one must be guided by the impacts with the most severe effect and use them as a guideline.

Mitigation measures

The following mitigation measures are suggested:

- Enter in a discussion with the affected land owners to come up with a solution in line with international standards to compensate them for the loss of property and to assist them to recreate their livelihoods, as well as the livelihoods of the dependent farm workers. If possible, swop land for other land of similar quality in the area that may already belong to Eskom, but is not used;
- Ensure that the recommendations of the relevant bio-physical studies (noise, air quality, etc.) are followed to minimise impacts. Farmers suggested planting trees to absorb some of the noise and visual impact;
- Create a grievance mechanism to ensure nuisances can be reported and dealt with quickly;
- Make sure workers wear identification cards and vehicles can easily be identified;
- Create/join a community policing forum for the area with buy-in from neighbours and local police;
- Meet with local municipality to discuss the potential impact of the proposed project on their service delivery;
- Erect signage to warn road users about construction traffic. Follow recommendations of the traffic impact assessment;
- Create an employment policy and communicate it to the stakeholders. Employ local people where possible;
- Compile a stakeholder communication strategy and appoint a community liaison officer;
- Put a complaints procedure/grievance mechanism in place;
- Compile a communication strategy to regularly communicate with land owners affected by alternatives and keep them up to date with developments;
- Implement a drug and alcohol management policy for employees; and
- Implement health and safety programme, including training, on site.

Residual impact

Most of the impacts mentioned cannot be reversed through mitigation measures, but through effective mitigation measures, their impacts can be managed. It is very important that mitigation measures must be implemented consistently and according to the ways prescribed. The identified impacts will still be there, but to a lesser extent. With mitigation, the impacts will possibly be of a LOW negative significance, with effects experienced on a *local* level. The impact is *very likely to happen* and may extend beyond the life of the operation. The impact risk is thus **MODERATE-LOW**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-15.

Table 10-15: Construction phase impact assessment matrix: Social

Rated By:	S-M Aucamp	Site A						
	IMPACT DESCRIPTION	Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	Phase							
Social01	CONSTRUCTION							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	1 VLOW	1 ISO	1 INCID	3 LIKE	**-0.7 VLOW**
Project Impact 1	Relocation/resettlement of business unit required	Negative	**Definite**	3 MODL	3 ADJ	5 PERM	5 OCCUR	**-4.1 HIGH**
Project Impact 2	Breaking up of economic units	Negative	**Definite**	7 SEV	3 ADJ	4 LONG	5 OCCUR	**-5.2 VHIGH**
Project Impact 3	Impacts of construction activities (dust, traffic, noise) on livelihoods	Negative	**Probable**	5 HIGH	3 ADJ	3 MED	5 OCCUR	**-4.1 HIGH**
Project Impact 4	Threats to safety and security - increase in crime, intruders on properties, HIV/AIDS, deviant social behaviour	Negative	**Probable**	4 MODH	5 DIS	3 MED	4 VLIKE	**-3.5 MODH**
Project Impact 5	Change in sense of place	Negative	**Definite**	3 MODL	5 DIS	5 PERM	4 VLIKE	**-3.8 MODH**
Project Impact 6	Job creation	Positive	**Definite**	3 MODL	5 DIS	2 SHORT	3 LIKE	**-2.2 MODL**
Project Impact 7	Influx of people	Negative	**Probable**	4 MODH	5 DIS	3 MED	4 VLIKE	**-3.5 MODH**
Project Impact 8	Pressure on existing services	Negative	**Probable**	4 MODH	5 DIS	3 MED	4 VLIKE	**-3.5 MODH**
Project Impact 9	Increase in traffic	Negative	**Definite**	3 MODL	4 LOC	2 SHORT	4 VLIKE	**-2.7 MODL**
Project Impact 10	Uncertainty	Negative	**Definite**	5 HIGH	4 LOC	2 SHORT	5 OCCUR	**-4.1 HIGH**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	3 MODL	5 DIS	4 LONG	5 OCCUR	**-4.4 HIGH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	2 LOW	4 LOC	4 LONG	4 VLIKE	**-2.9 MODL**

10.1.16 Traffic

Status quo

Site A can be easily accessed off existing roads. The existing traffic recorded is much higher than anywhere else between the Kusile construction access and the Kusile Road & R545 intersection due to Kusile Power Station construction activities. The impact will be arrested with the mitigation measure proposed.

The overall status quo impact's significance is LOW, the spatial scale is limited to areas *adjacent to the site*, duration is short term and the impact is *likely to occur*. The impact risk is thus **LOW**.

Project impact (unmitigated)

This traffic relates directly to the traffic expected during the construction of the liner or foundation of the ash disposal facility that will take place over a period of 24 months (2 years). The construction traffic will dissipate shortly after completion of construction of the liner or foundation.

The background traffic on the roads adjacent to Site A is low to average and the trip generation is not expected to result in additional delays at intersections. This development will have very low impact risk on the road network and surrounding intersections.

Clay material is available on site, which means the impact due to earth moving will be limited to the development footprint. The transportation of staff to and from site will have minimum impact on the road network.

The project impact significance is VERY LOW. The spatial scale will be limited to the *development footprint and adjacent to the site*. The duration will be short term and is *unlikely to occur*. The impact risk is thus **VERY LOW**.

Cumulative impact

The cumulative impact takes into account the close proximity and association of site A to Kusile Road. The cumulative rating further takes cognisance of the Kusile Power Station and the proposed New Largo traffic and mitigation measures proposed in their respective reports.

The project impact significance is MODERATE-LOW. The spatial scale will be limited to the *development footprint and adjacent to the site*. The duration will be short term and is *unlikely to occur*. The impact risk is thus **LOW**.

Mitigation measures

9. Pointsmen to be deployed at both the Kusile Power Station and New Largo Mine Access during the construction phase to control the traffic so that the traffic from both developments can be afforded some gaps on Kusile Road.

Residual impact

The proposed mitigation will improve the flow at intersections affected by the developments within the study area. The significance of the impact after mitigation will be LOW, spatial scale will be limited to intersections *adjacent to site*, the impact will be limited to isolated incidents. The impact is *unlikely to occur* with the proposed mitigation implemented. The degree of certainty is probable and the impact risk is low. The impact risk is thus **VERY LOW**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-16.

Table 10-16: Construction phase impact assessment matrix: Traffic

Rated By:	N Miya / A Brislin			Site A				
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	Phase							
Traffic01	CONSTRUCTION							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	Definite	2 LOW	3 ADJ	2 SHORT	3 LIKE	-1.5 LOW
Project Impact 1	Additional delays at intersections due to additional traffic generated by the development	Negative	Probable	2 LOW	3 ADJ	2 SHORT	2 UNLIKE	-1 VLOW
Project Impact 2	Condition of the Roads or Accessibilty	Negative	Definite	1 VLOW	3 ADJ	2 SHORT	2 UNLIKE	-0.9 VLOW
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	Probable	3 MODL	3 ADJ	2 SHORT	3 LIKE	-1.8 LOW
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	Probable	2 LOW	3 ADJ	1 INCID	2 UNLIKE	-0.9 VLOW

10.2 OPERATIONAL PHASE

10.2.1 Air quality

Status quo

The current sources of particulate emissions in the vicinity include mining, other power stations and agriculture. The Kusile Power Station falls within the Highveld Priority Area, near to the eMalahleni Hot Spot. The eMalahleni Hot Spot is an area of already poor air quality where the NAAQS for daily PM10 concentrations are frequently exceeded. The status quo air quality is of MODERATE-HIGH significance at a *district* scale. The impacts of the status quo are *very-likely* in the long-term and result in a **MODERATE-HIGH** impact risk.

Project impact (unmitigated)

Operational phase is considered to be the phase with the largest impact on the ambient air quality. Impacts from the operational ash disposal facility will probably result in elevated annual average ground-level PM10 concentrations, exceeding the annual NAAQS, across an area of approximately 6 647 ha, affecting two of the identified sensitive receptors, Kelvin Primary Farm School and Dwaalfontein Primary School. This area is projected for the maximum ash disposal facility foot-print (1 627 ha) without any mitigation of dust emissions. The scale impact of the disposal facility on the ground-level PM2.5 concentrations is likely to be similar to PM10 concentrations. The impacts of the proposed ash facility, under unmitigated operation, are *very likely* to result in impacts of VERY HIGH significance at *district scale* over the long-term, resulting in **HIGH** impact risk.

Cumulative impact

The cumulative impact of proposed ash disposal facility – when dust emissions are unmitigated – is likely to result in regular exceedances of the NAAQS for PM10 and PM2.5. These permanent impacts will be of HIGH significance at a *provincial scale*. The *very-likely* probability will result in **HIGH** impact risk.

Mitigation measures

Mitigation measures to ensure elimination or at least minimisation of dust associated with construction activities will include:

- Regular wetting of the exposed areas of disposed ash;
- Stabilisation of the exposed areas of ash with a top-soil covering;
- Wetting of exposed top-soil for additional mitigation of dust emissions from the top-soil layer;
- Re-vegetation of ash disposal facility through application of a deeper top-soil layer and seeding with appropriate grass seeds; and
- Vegetation clearance should be undertaken only when construction activities necessitates removal of vegetation and site preparation.

Residual impact

The residual impact of the ash disposal facility with frequent watering and progressive re-vegetation of the exposed areas the impact of the ash disposal facility is predicted to reduce substantially. The impacts are reduced to within NAAQS, even on-site. The impacts are thus, similar to the status quo impacts, *very likely* to be of MODERATE-HIGH significance at a *district scale* over the long term, resulting in **MODERATE-HIGH** impact risk.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-17.

Table 10-17: Operational phase impact assessment matrix: Air Quality

Rated By:	*Dr T Bird*	Site A						
IMPACT DESCRIPTION		Direction of Impact	**Degree of Certainty**	Magnitude	Spatial	Temporal	Probability	**Impact Risk**
Code	*Phase*							
AirQual01	***OPERATIONAL***							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	4 MODH	5 DIS	4 LONG	4 VLIKE	**-3.8 MODH**
Project Impact 1	Non-compliance with annual PM_{10} standards at sensitive receptors	Negative	**Probable**	6 VHIGH	5 DIS	4 LONG	4 VLIKE	**-4.4 HIGH**
Project Impact 2	Impacted area where non-compliance with PM_{10} standards are expected	Negative	**Probable**	6 VHIGH	5 DIS	4 LONG	4 VLIKE	**-4.4 HIGH**
Project Impact 3	Non-compliance with annual $PM_{2.5}$ standards and sensitive receptors	Negative	**Probable**	6 VHIGH	5 DIS	4 LONG	4 VLIKE	**-4.4 HIGH**
Project Impact 4	Impacted area where dust-fall >400 $mg.m^{-2}.day^{-1}$	Negative	**Probable**	6 VHIGH	5 DIS	4 LONG	4 VLIKE	**-4.4 HIGH**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	4 MODH	6 PRO	5 PERM	4 VLIKE	**-4.4 HIGH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	4 MODH	5 DIS	4 LONG	4 VLIKE	**-3.8 MODH**

10.2.2 Geology

Status quo

The geology underlain by site A almost exclusively tillite, however a small portion of the south eastern part of the site contains Arenite (sandstone). At present the geology of site A is not impacted.

Project impact (unmitigated)

During the operational phase profiling will continue using conventional construction methods and equipment as the operational phase will consist out of construction and operational activities. This will require cut and fill operations using conventional plant equipment. Such cut and fill operations will likely affect only shallow geological strata (typically less than ~10m deep). The project impact will include removal of shallow geological strata and excavation of tillite to act as clay material for use in the barrier system.

The combined weighted project impact to geology (prior to mitigation) will definitely be of a LOW negative significance, affecting the *development site*. The impact will be permanent and will *occur*. The impact risk class is thus **MODERATE-HIGH**.

Cumulative impact

The cumulative impact of the ADF on the geology during construction will not exceed that of the project impact above. Therefore, the combined weighted project impact to geology (prior to mitigation) will definitely be of a MODERATE-LOW negative significance, affecting the *development site*. The impact will be permanent and will *occur*. The impact risk class is thus **MODERATE-HIGH**.

Mitigation measures

There are no mitigation measures that can be implemented to reduce the significance of geological impacts.

Residual impact

As no mitigation measures are possible the residual impact will be the same as the cumulative impact above i.e. project impact to geology will definitely be of a MODERATE-LOW negative significance, affecting the *development site*. The impact will be permanent and will *occur*. The impact risk class is thus **MODERATE-HIGH**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-18.

Table 10-18: Operational phase impact assessment matrix: Geology

Rated By:	M Vosloo	Site A						
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	Phase							
Geol01	OPERATIONAL							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	Definite	0 NO				0 NO
Project Impact 1	Impacts on geological formations	Negative	Probable	3 MODL	2 DEV	5 PERM	5 OCCUR	-3.7 MODH
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	Probable	3 MODL	2 DEV	5 PERM	5 OCCUR	-3.7 MODH
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	Probable	3 MODL	2 DEV	5 PERM	5 OCCUR	-3.7 MODH

The impact on the geology of the development site will be permanent. Therefore, closure and post-closure will have no impact on the geology as the impact will already be felt during the construction and operational phase of the ADF development. Closure and post-closure impacts are thus not considered any further.

10.2.3 Topography

Status quo

The topography of the region is a gently to moderately undulating landscape of the Highveld plateau. The topography of the area encompassed by site A is draining in a north westerly direction. At present the topography of site A is not impacted.

Project impact (unmitigated)

During the operational phase construction and operational activities will take place. Concurrent rehabilitation, which includes shaping of the ADF sides, will be undertaken. Profiling of the terrain will be permanent, and will affect surface water drainage patterns beyond the life of the facility.

The combined weighted project impact to topography (prior to mitigation) will probably be of a MODERATE-LOW negative significance, affecting the *development site*. The impact will be permanent and is going to *occur*. The impact risk class is thus **MODERATE-HIGH**.

Cumulative impact

The cumulative impact will not exceed that of the project impact above. Open cast mining activities to the north-east and east of the study area are also having further impacts to the topography in the region; and this should be considered when assessing cumulative impacts. Predicted future runoff from the modified topography resulting from the ADF has been modelled to be less than 2 % less than current runoff. It is therefore anticipated that the cumulative impact will not exceed that of the project impact.

Therefore, the combined weighted project impact to topography will definitely be of a MODERATE-LOW negative significance, affecting the *development site*. The impact will be permanent and will *occur*. The impact risk class is thus **MODERATE-HIGH**.

Mitigation measures

- Install a clean water cut-off system that at a minimum ensures that:
  - clean water cut-off canals are installed such that they tie into the adjacent terrain;
  - a free draining profile is established on all clean areas, and that storm water is allowed to move unhindered off the site;
  - the clean water cut-off system is designed as close to the facilities (outside the dirty water channels) as possible to maximise the clean water leaving the site;
  - the clean water cut off system is installed prior to other construction activities are undertaken on the ADF or conveyor;
- Ensure a profile is established that contains all dirty water within the designated infrastructure in the facility footprint; and
- Ensure that any areas impacted during the construction phase are rehabilitated as soon as practically possible.

Residual impact

With mitigation in place, the project impact to topography will definitely be of a VERY LOW negative significance, affecting the *development site*. The impact will be permanent and will *occur*. The impact risk class is thus **MODERATE-LOW**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-19.

Table 10-19: Operational phase impact assessment matrix: Topography

Rated By:	M Vosloo	Site A						
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	Phase							
Topo01	OPERATIONAL							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	Definite	0 NO				0 NO
Project Impact 1	Impacts on topography	Negative	Probable	3 MODL	2 DEV	5 PERM	5 OCCUR	-3.7 MODH
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	Probable	3 MODL	2 DEV	5 PERM	5 OCCUR	-3.7 MODH
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	Probable	1 VLOW	2 DEV	5 PERM	5 OCCUR	-2.9 MODL

10.2.4 Soils and land capability

Status quo

The geomorphological characteristics of the soils in Site A are influenced by the negative water balance and semi-arid environment, with the effects of evaporites and the development of laterites being highlighted as aspects of importance to the ecological status, and conditions that will influence the capability of the land. Soil groupings on site A include sandy and silty loams, sandy and silty clay loams, rocky sandy loams and wet soils, which are moderately easily worked but generally have a poor organic content matter. Site A has areas of cultivated pastures and commercial cropping, however with limited arable potential and moderate grazing potential.

The status quo is therefore characterised by agricultural impacts with soils that require commercial additives to increase arable and grazing potential. The status quo impact to soils and land capability is thus probably of a MODERATE-HIGH negative significance, affecting the *local* area. The impact is long term and is *occurring*. The impact risk class is thus **HIGH**.

Project impact (unmitigated)

The project impact relates to the loss of utilisable soil resources due to (sterilization and erosion), compaction, de-nutrification and contamination, or salinisation. The operation of the Ash Disposal Facility may result in the potential for spillage and contamination of the in-situ and stockpiled materials, contamination due to dirty water run-off and/or contaminated dust deposition/dispersion, the de-nutrification of the stockpiled soils due to excessive through flow and the leaching out of nutrients and metals due to rain water on unconsolidated and poorly protected soils. Further impacts include the potential for compaction of the in-situ materials by uncontrolled vehicle movement and the loss to the environment (down-wind and downstream) of soil by wind and water erosion over un-protected ground.

Unmanaged soil stockpiles and soil that is left uncovered/unprotected will be lost to wind and water erosion, will lose the all-important, albeit moderately poor nutrient content and organic carbon stores (fertility), and will be prone to compaction. A positive impact will be the rehabilitation of the temporary infrastructure used during the start-up and construction phase.

In the un-managed scenario these activities will probably result in a MODERATE to HIGH negative significance that will affect the *development footprint and adjacent sites* for the medium to long term. These effects are *very likely to occur*.

Cumulative impact

The cumulative impact is driven by the loss of arable soils and grazing pasture within the development footprint of site A, mainly stemming from the identified project impacts. In the un-managed scenario these activities will probably result in a MODERATE-HIGH negative impact that will affect the *development footprint and adjacent sites*. This impact will be permanent are *very likely to occur*. The impact risk class is thus **HIGH**.

Mitigation measures

The impacts on the soils during the operational phase may be mitigated in the following manner:

- Minimisation of the area that can potentially be impacted (eroded, compacted, sterilized or de-nutrified);
- Timeous replacement of the soils so as to minimise/reduce the area of affect and disturbance;
- Effective soil cover and adequate protection from wind (dust) and dirty water contamination;
- Regular servicing of all vehicles in well-constructed and bunded areas;
- Regular cleaning and maintenance of all haulage ways, conveyancing routes and service ways, drains and storm water control facilities;
- Containment and management of any spillage;
- Soil replacement and the preparation of a seed bed to facilitate and accelerate the re-vegetation program and to limit potential erosion on all areas that become available for rehabilitation (temporary servitudes), and
- Soil amelioration (rehabilitated and stockpiled) to enhance the growth capability of the soils and sustain the soils ability to retain oxygen and nutrients, thus sustaining vegetative material during the storage stage.

Residual impact

In the long term (Life of the operation and beyond) and if implemented correctly, the above mitigation measures will probably reduce the negative impact on the utilisable soil reserves (erosion, contamination, sterilization) to a significance rating of MODERATE-LOW in the medium term, and is *very likely to occur*. The impact risk class is thus **MODERATE-LOW**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-20.

Table 10-20: Operational phase impact assessment matrix: Soils and land capability

Rated By:	Earth Science Solutions (IJ)	Ash Dump - Site A						
	IMPACT DESCRIPTION	Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	Impact Risk
Code	*Phase*							
	OPERATIONAL PHASE							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	3 MODL	3 ADJ	4 LONG	5 OCCUR	**-3.7 MODH**
Project Impact 1	Continued loss of soil resource (perminant) and utilization potential, plus possible contamination of footprint soil and loss of land capability due to iposition of the Ash Dump.	Negative	**Definite**	5 HIGH	3 ADJ	5 PERM	5 OCCUR	**-4.8 HIGH**
Project Impact 2	Loss of resource due to unprotected overland flow of water (suspended solids) and erosion of soil due to wind from dry ash material - potentially off site - dust issue.	Negative	**Probable**	4 MODH	4 LOC	4 LONG	5 OCCUR	**-4.4 HIGH**
Project Impact 3	Continued loss of soil utilisation due to contamination by operational activities - Ash dumping/deposition and vehicle plus conveyer impacts - hydrocarbons, reagents and natural by products (dirty water and dust).	Negative	**Probable**	4 MODH	4 LOC	3 MED	4 VLIKE	**-3.2 MODH**
Project Impact 4	The continued loss of resource and utilization potential due to operation of the Ash Dump and its associated infrastructure/facilities (conveyer, pipelines, access road and water management infrastructure (Return Water Dam etc.) and loss of nutrient pool and organic carbon due to leaching over unprotected soils. Loss of land capability potential.	Negative	**Probable**	3 MODL	2 DEV	4 LONG	4 VLIKE	**-2.7 MODL**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	4 MODH	3 ADJ	5 PERM	5 OCCUR	**-4.4 HIGH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	3 MODL	3 ADJ	4 LONG	4 VLIKE	**-2.9 MODL**

10.2.5 Surface water

<u>Status quo</u>

Surface water resources within Site A are the Holfonteinspruit and Klipfonteinspruit. There is also a tributary that drains Kusile Power Station and flows directly into Klipfonteinspruit. The footprint of the Site A is currently utilised extensively for agriculture, mostly cultivation, though some livestock grazing is also known to occur. These activities have had limited impact on the streams in the area with some impacts on water quality from agricultural run-off.

A wetland is located at the headwaters of Klipfonteinspruit. The water quality results at the sample sites for the area show high levels of fluoride (F), sulphate (SO_4), conductivity (EC) and total dissolved solids (TDS), exceeding the RWQOs. This may be the result of mining activity upstream of these points, the Kusile co-disposal facility in close proximity and commercial agriculture such as the presence of a piggery close to the proposed site. The water quality downstream of the Klipfonteinspruit shows an improved water quality indicating the functionality of the wetland. A number of farm road crossings have also lead to reduction of flow in the streams.

The status quo impact to surface water is thus probably of a VERY LOW negative significance, occurring at *isolated sites*. The impact is <u>incidental</u> and will <u>*likely*</u> occur. The impact risk class is thus **VERY LOW**.

Project impact (unmitigated)

Most of the impacts expected during the operational phase are a continuation of impacts expected during the construction phase, as construction activities will persist for most of the operational phase as the ADF footprint expands in 5 year sections. Impacts include loss or disturbance of streams, increased sediment transport into water resources, increased erosion, and altered flows. Water quality deterioration in adjacent water resources will likely follow the same trend as identified during the construction phase.

Construction and operational activities during the operational phase are also likely to increase the disturbance footprint beyond the boundaries of the actual development footprint through temporary stockpiles, laydown areas, construction camps and uncontrolled driving of machinery leading to increased flow velocities off the site, increasing the risk of erosion with sediments potentially transported down the water resources and deposited in the Wilge River.

The combined weighted project impact to water resources (prior to mitigation) will definitely be of a MODERATE-HIGH negative significance, affecting the *local area*. The impact will act in the medium term and is *very likely to occur*. The impact risk class is thus **MODERATE-HIGH**.

Cumulative impact

The agricultural activities on site have had a limited impact on the water resources quality, while farm dam construction has resulted in some flow alteration. Commercial (piggery, intensive agriculture) and industrial (construction of Kusile Power Station) activities has had an impact on downstream water quality while the proposed New Largo Mine is also likely to result in further water quality deterioration in the sub-catchment.

The baseline impacts are considered to be low and additional project impact (if no mitigation measures are implemented) will increase the significance of the existing baseline impacts, the cumulative unmitigated impact will probably be of a MODERATE-HIGH negative significance, affecting the *study area* in extent. The impact is *very likely* and will be medium term. The impact risk class is thus **MODERATE-HIGH**.

Mitigation measures

Because of the 5 year incremental footprint extension, mitigation during operation would be similar to the construction mitigation:

- Optimise design of the ADF to minimise the size of the footprint;
- Ensure full containment of dirty water from the ADF through successful implementation of the dirty water containment system;
- Minimise area of vegetation clearing;

- Where practically possible, undertake the clearing of vegetation during the dry season to minimise erosion;
- Maintain sediment traps as part of the storm water management plan where necessary and especially upstream of discharge points where erosion protection measures and energy dissipaters should be in place;
- Clean spills as quickly as possible;
- Store and handle potentially polluting substances and waste in designated, bunded facilities;
- Waste should be regularly removed from the construction site by suitably equipped and qualified operators and disposed of in approved facilities;
- Locate temporary waste and hazardous substance storage facilities out of the 1 : 100 flood line;
- Locate temporary sanitation facilities out of the 1 : 100 year flood line;
- Maintain infrastructure for river crossings adequately to prevent spillages; and
- Maintain a water quality monitoring programme.

Residual impact

The residual impact of the construction and operation of the ADF will include the permanent loss of water resources (flow), as well as a potential decline in water quality. Most of these impacts are expected to be mostly restricted to the local scale, however the potential deterioration of water quality within the Wilge River will increase the extent of the impacts.

The residual impact to water resources beyond the operational phase of the project will be reduced through mitigation but not to within baseline conditions as the residual impact is not likely to reduce the impacts all the way to pre-development conditions. After mitigation the impacts to the water resources will probably be of a MODERATE-LOW negative significance, affecting the *adjacent area* in extent. The impact *is likely* and will be permanent. The impact risk class is however still **LOW**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-21.

Table 10-21: Operational phase impact assessment matrix: Surface water

Rated By:	L Boyd / T Coleman	Site A						
	IMPACT DESCRIPTION	Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	Phase							
SurfWat01	***OPERATIONAL***							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	1 VLOW	1 ISO	1 INCID	3 LIKE	**-0.7 VLOW**
Project Impact 1	Water quality deterioration	Negative	**Probable**	4 MODH	4 LOC	4 LONG	4 VLIKE	**-3.5 MODH**
Project Impact 2	Flow alteration			2 LOW	4 LOC	3 MED	4 VLIKE	**-2.7 MODL**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	4 MODH	4 LOC	3 MED	4 VLIKE	**-3.2 MODH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	3 MODL	3 ADJ	3 MED	3 LIKE	**-2 LOW**

10.2.6 Groundwater

Status quo

If no ash is disposed on Site A, the different commercial and industrial activities and natural processes that lead to the established baseline groundwater conditions will prevail. Contaminant transport from upstream of the Klipfonteinspruit would probably continue downstream if no remediation action is taken. The groundwater elevations would also probably continue to decrease. The analysis of the monitoring data (water levels) at Kusile power station shows an average annual decrease of 0.77m. The model simulation results in a maximum drawdown of 2.5 m over 3 years.

Impacts to the groundwater resources status quo will definitely be of a MODERATE-HIGH negative significance, affecting the *local area* in extent. The impact will *occur* and will be medium term. The impact risk class is however still **HIGH**.

Project impact (unmitigated)

The following impacts have been considered and quantified during the operational phase:

- Groundwater pollution due to seepage, leachate infiltration (leak of liner) from ADF, contaminated water trenches and pollution control dams;
- Possible alteration of the groundwater flow system due to groundwater pumping (different uses), in the event that pumping becomes necessary to maintain groundwater levels below the water table.

Prior to mitigation (with lining systems), the overall (combined impacts) impact risk that the operation of the coal Ash Disposal Facility would have on the underlying groundwater systems would be LOW in ~~Alternative~~ Site A. This is related to the fact that the impact risk related to seepage, leachate infiltration (leak of liner) from ADF, contaminated water trenches and pollution control dams are MODERATELY-LOW in ~~Alternative~~ Site A.

The proposed barrier system is designed to prevent any movement of contaminants across the barrier. Therefore installation of the barrier system will prevent any contamination of the groundwater resources below the ADF.

In some instances a number of factors (e.g. deferential settlement of soil below the ADF) may cause the barrier system to tear and leak after the ash facility has been developed. In these instances minor leakage of the barrier system may occur once this has been identified through the leachate collection system. In order to understand the potential impact of a barrier system that leaks, pollution plumes originating from a leak covering 3 % of the ADF area were simulation. The considered leaking points (centre of ADF, and dams) were assumed to be the more sensitive point to leaks.

Simulated plume migration was found to occur in one direction (East-West) toward the Wilge River. At the end of five (5) years of operation, the pollution plume would be localised at the immediate vicinity (less 50 m) of the ADF, whereas within 20 and 60 years, the pollution plume would move approximately 1.2 km and 3.2 km, respectively, downstream of the ADF. Under these circumstances mitigation measures can still be successfully implemented, e.g. the installation of a pollution cut-off curtain and active pumping of the groundwater to maintain the water table below a potential pollution plume.

Overall project impacts to the groundwater resources will range between LOW to HIGH negative significance, affecting the *local and adjacent area* in extent.

Cumulative impact

The main cumulative impacts of concern are the impacts from New Largo. Necessary groundwater dewatering would probably be implemented, which might create a cone of groundwater depression around the open pit at New Largo. The groundwater flow regime, currently from New Largo towards Site A, would therefore be altered and reversed toward the New Largo. This would help in containing any pollution associated with open cast mining, at New Largo, but will result in the spreading of the pollution from the 60 years ADF towards the south and east of Site A.

Cumulative impacts to the groundwater resources will probably be of a MODERATE-HIGH negative significance, affecting the *local area* in extent. The impact is *very likely* *to occur* and will occur in the medium term. The impact risk class is therefore **MODERATE-HIGH**.

Mitigation measures

- Any waste and spills (especially during construction, operation and closure) need to be managed according to the departmental requirements;
- A representative groundwater monitoring network should be installed before commencement of any construction activities on site;
- The monitoring network should be updated per project phase according to the DWS requirements;
- Authorities need to be notified in the event of a spill or leachate during construction and closure;
- In the case of any groundwater dewatering, pumped water should be re-injected into the aquifer system at downstream of the site. If the groundwater is contaminated, treatment needs to take place to ensure that the quality of the re-injected water complies with the groundwater quality reserve as required by DWS;
- Avoid long lag times between liner installation and subsequent ash disposal;
- Proper operation and maintenance of contaminated water trenches and dams; and
- All pollution control facilities (dams, trenches) must be operated to have a minimum freeboard above full supply level as recommended by GN 704 in terms of the National Water Act (36 of 1998).

<u>Residual impact</u>

After the application of the mitigation measures, the groundwater risk impacts would be successfully reduced. The reduced impact risks together with the base line (status quo) impacts risk will constitute the residual risk impacts.

Residual impacts to the groundwater resources will probably be of a LOW negative significance, affecting the *development site and adjacent area* in extent. The impact would be limited to <u>isolated incidences</u> and would be <u>*unlikely to occur*</u>. The impact risk class is therefore **VERY LOW**.

<u>Impact Matrix</u>

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-22.

Table 10-22: Operational phase impact assessment matrix: Groundwater

Rated By:	*P Ahokpossi*			Site A				
	IMPACT DESCRIPTION	Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	**Impact Risk**
Code	*Phase*							
GroundW01	***OPERATIONAL***							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	4 MODH	4 LOC	3 MED	5 OCCUR	**-4.1 HIGH**
Project Impact 1	Groundwater pollution due to seepage, lewachate infiltration from ADF, contaminated water trenches and PCDs	Positive	**Possible**	5 HIGH	4 LOC	4 LONG	3 LIKE	**-2.9 MODL**
Project Impact 2	Alteration of the groundwater flow systemdue to groundwater pumping	Negative	**Definite**	2 LOW	3 ADJ	2 SHORT	2 UNLIKE	**-1 VLOW**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	5 HIGH	4 LOC	4 LONG	4 VLIKE	**-3.8 MODH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	2 LOW	3 ADJ	1 INCID	2 UNLIKE	**-0.9 VLOW**

10.2.7 Terrestrial ecology

<u>Status quo</u>

Site A is situated in close proximity to Kusile Power Station and is mostly characterised by cultivated land under maize production. Natural habitat occurs in the form of the moist grass and sedge community associated with on-site wetlands, and the adjacent dry mixed grasslands. These areas are important habitat for fauna and flora, some of which may be Red Data/protected species. These natural areas are part of a larger habitat network that connects with the Wilge River riparian area.

The Kusile Power Station construction site is located immediately north of the Site A, while the proposed New Largo Colliery is located to the east. The site is thus largely surrounded by transformed or highly disturbed land. The proposed conveyor corridor link from Site A to Kusile Power Station is relatively short and will run adjacent to the existing tarred road and the Kusile co-disposal facility.

Status quo impacts to terrestrial ecology will definitely be of a HIGH negative significance, affecting the *development site* in extent. The impact *has occurred* and over the long term. The impact risk class is therefore **HIGH**.

Project impact (unmitigated)

As construction of the proposed ADF progresses during the operational phase, remaining natural habitat within the development footprint of site A will continue to be cleared and earth works undertaken causing direct habitat loss and fragmentation. These impacts will commence during the construction phase and will persist throughout the entire life of the facility.

Considering the nature of the proposed project, mitigating habitat loss is difficult as vegetation clearing is inevitable. The proposed conveyor will further cause major habitat fragmentation. It will reduce habitat connectivity and prevent or severely restrict fauna movement and dispersal throughout the area. This may significantly affect local fauna populations. Habitat loss and habitat fragmentation are thus the principle environmental impacts of concern and will affect Site A.

Project impacts to terrestrial ecology will range from MODERATE-LOW to SEVERE negative significance, affecting the *development site and adjacent area* in extent. The impacts are *very likely to occur* or *will occur* and will be permanent in some cases. The impact risk class therefore range from **LOW** to **HIGH**.

Cumulative impact

Large portions of land immediately surrounding Site A are already transformed or will be transformed through commercial and industrial activities in the near future. Kusile Power station development footprint has transformed the land to the north, while the proposed New Largo above-ground mining operation will transform the land to the east of Site A.

Cumulative impacts to terrestrial ecology will be a SEVERE negative significance, affecting the *local area* in extent. The impacts *will occur* and will be permanent. The impact risk class is therefore **VERY HIGH**.

Mitigation measures

- All mitigation measures identified for implementation during the construction phase will remain applicable during the operational phase of the project.

Residual impact

Residual impacts to the terrestrial ecology will probably be of a VERY HIGH negative significance, affecting the *local area* in extent. The impact will be long term and is *very likely to occur*. The impact risk class is therefore **HIGH**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-23.

Table 10-23: Operational phase impact assessment matrix: Terrestrial Ecology

Rated By:	A Zinn	Site A						
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	*Phase*							
TerrEcol01	***OPERATIONAL***							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	5 HIGH	2 DEV	4 LONG	5 OCCUR	**-4.1 HIGH**
Project Impact 1	Habitat fragmentation through loss of habitat and erection of artificial barriers	Positive	**Possible**	6 VHIGH	4 LOC	4 LONG	4 VLIKE	**-4.1 HIGH**
Project Impact 2	Increase in erosion and possible sedimentation of drainage features	Negative	**Definite**	4 MODH	4 LOC	4 LONG	3 LIKE	**-2.7 MODL**
Project Impact 3	Increased dust generation	Negative	**Probable**	4 MODH	4 LOC	3 MED	5 OCCUR	**-4.1 HIGH**
Project Impact 4	Increased exotic and/or declared Category 1, 2 & 3 invader species	Negative	**Probable**	3 MODL	3 ADJ	4 LONG	3 LIKE	**-2.2 MODL**
Project Impact 5	Killing or injuring of fauna in the study area	Negative	**Unsure**	3 MODL	3 ADJ	2 SHORT	3 LIKE	**-1.8 LOW**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	7 SEV	4 LOC	5 PERM	5 OCCUR	**-5.9 VHIGH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	6 VHIGH	4 LOC	4 LONG	4 VLIKE	**-4.1 HIGH**

10.2.8 Aquatic Ecology

Status quo

The main current impacts to surface water include agriculture (primarily livestock grazing with crop production prevailing to the west of the Wilge River) and construction activities related to the Kusile Power Station. Mining-related water quality impacts were evident within the Klipfonteinspruit.

Status quo impacts to aquatic ecology will probably be of a MODERATE-LOW negative significance, affecting the *local area* in extent. The impact *will very likely occur* over the short term. The impact risk class is therefore **MODERATE-LOW**.

Project impact (unmitigated)

The main impact risks during the Operational Phase are likely to be related to possible decline in water quality. Surface runoff that comes into contact with ash is likely to become contaminated. Without mitigation these contaminants may be carried into downstream ecosystems. Wind-blown ash or conveyor spills as well as subsurface seepage are likely to cause additional contamination. Overflowing or structurally ineffective pollution control dams pose the greatest risk. The major water quality impacts are likely to be due to salts (sulphates in particular), acidity and heavy metals. A decline in water quality is likely to cause a loss of taxa that are sensitive to changes in water quality. This may affect animals higher up in the food chain (e.g. otters and water mongooses) that may rely on these taxa for food (e.g. crabs, fish).

Impacts to habitats due to erosion, turbidity and sedimentation, as mentioned for the construction phase, will be ongoing during the operational phase, resulting in further declines in diversity as the availability of suitable habitats declines. As the Klipfonteinspruit continues to erode, its capacity to buffer against impacts to the Wilge River will decline and it is possible that there may be a loss or displacement of sensitive taxa from the Wilge River.

The combined weighted project impact to aquatic ecosystems (prior to mitigation) during the operational phase will probably be of a VERY HIGH negative significance, at the *district* scale. The impact will act in the long term and will *definitely occur*. The impact risk class is thus **VERY HIGH**.

Cumulative impact

Decline in water quality in the Klipfonteinspruit due to site A is unlikely to significantly impact on the already depauperate aquatic biota within the Klipfonteinspruit. However, where water of poor quality reaches the Wilge River there are likely to be significant impacts. Impacts to the Wilge River will exacerbate impacts to the Olifants River system, potentially pushing these impacts beyond a critical level. Major pollution events (e.g. major spills or structural collapses) could potentially be carried as far as Mozambique, with international implications.

The baseline impacts are considered to be substantial, and additional project impact (if no mitigation measures are implement) will increase the significance of the existing baseline impacts, the cumulative unmitigated impact will probably be of a VERY HIGH negative significance, at the *provincial to national scale*. The impact is *going to happen* and will be permanent. The impact risk class is thus **VERY HIGH**.

Mitigation measures

All general mitigation given in the impact assessment for the construction phase should apply to all phases of the development equally. The following additional mitigation measures apply to the Operational, Closure and Post-Closure phases:

- Pollution Control dams should be designed according to strict safety requirements and should be regularly inspected for leaks, damage or maintenance requirements. Where irregularities are detected, they should be speedily remedied to avoid the risk of structural failure;

- Conveyor and road crossings of wetlands should be regularly inspected for erosion, mechanical problems, leaks or spillages. These should be timeously repaired;
- Should larger spillages occur due to malfunctioning of the conveyor or for any other reason, clean-up of the spillages should be undertaken as soon as possible following the incident. In this regard regular inspection of the entire conveyor route should be undertaken;
- An emergency response plan should be compiled to address structural failures and major accidental spillages;
- It is understood that the Ash Disposal Facility will be irrigated to reduce dust. Dampness should be monitored to ensure a balance is maintained between dust suppression and slumping/collapses due to excessive wetting;
- Storm water should be used for dust suppression to avoid the need for abstraction from natural water resources;
- It is recommended that the catchment-level approach be adopted to manage the Klipfonteinspruit and Wilge River throughout the operational and closure phases;
- Placement of topsoil must be uniformly applied so as to prevent pooling of water;
- Revegetated areas should be regularly inspected for erosion rills and these should be timeously managed so as to prevent structural collapses;
- Sediment trapping mechanisms should prevent soils from being washed into wetlands; and
- Movement of machinery and vehicles during the infrastructure removal process must be strictly controlled to prevent disturbance to wetland areas.

<u>Residual impact</u>

The residual impact of the development is likely to declines in water quality and habitat suitability and/or availability. These impacts are likely to be, for the most part, restricted to the local scale. However, it is anticipated that water quality in the Wilge River will decline, even with mitigation as a result of existing status quo impacts from upstream regions.

After mitigation the impacts to aquatic ecosystems will probably be of a MODERTE-HIGH negative significance, affecting the *district* area in extent. The impact is only <u>*likely*</u> and will be <u>long term</u>. The impact risk class is thus **MODERATE-LOW**.

<u>Impact Matrix</u>

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below in Table 10-24.

Table 10-24: Operational phase impact assessment matrix: Aquatic Ecology

Rated By:	N Sharratt			Site A				
	IMPACT DESCRIPTION	Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	*Phase*							
AquaEcol01	***OPERATIONAL***							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	3 MODL	4 LOC	2 SHORT	4 VLIKE	**-2.7 MODL**
Project Impact 1	Habitat loss due to sedimentation	Positive	**Probable**	4 MODH	4 LOC	3 MED	4 VLIKE	**-3.2 MODH**
Project Impact 2	Habitat loss due to erosion	Negative	**Probable**	6 VHIGH	3 ADJ	4 LONG	5 OCCUR	**-4.8 HIGH**
Project Impact 3	Decline in water quality due to ash dust /ash spill into aquatic systems	Negative	**Definite**	5 HIGH	5 DIS	4 LONG	5 OCCUR	**-5.2 VHIGH**
Project Impact 4	Decline in water quality due to spills, leaks, and solid waste	Negative	**Definite**	3 MODL	3 ADJ	2 SHORT	4 VLIKE	**-2.4 MODL**
Project Impact 5	Loss of sensitive species and biodiversity due to declines in water quality and habitats	Negative	**Possible**	5 HIGH	4 LOC	5 PERM	3 LIKE	**-3.1 MODH**
Project Impact 6	Impacts to overall integrity of ecologically sensitive and important downstream ecosystems	Negative	**Probable**	5 HIGH	4 LOC	4 LONG	5 OCCUR	**-4.8 HIGH**
Project Impact 7	Impacts to habitats and biodiversity due to conveyor crossings of the Klipfonteinspruit and	Negative	**Definite**	5 HIGH	4 LOC	4 LONG	5 OCCUR	**-4.8 HIGH**
Project Impact 8	Impacts to downstream reaches due to diversion of the Klipfonteinspruit	Negative	**Probable**	4 MODH	5 DIS	4 LONG	5 OCCUR	**-4.8 HIGH**
Project Impact 9	Loss of species and biodiversity and decline in overall integrityof downstream ecosystems	Negative	**Definite**	6 VHIGH	7 NAT	5 PERM	3 LIKE	**-4 MODH**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	6 VHIGH	6 PRO	4 LONG	5 OCCUR	**-5.9 VHIGH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	4 MODH	5 DIS	4 LONG	3 LIKE	**-2.9 MODL**

10.2.9 Wetlands

Status quo

Status quo remains unchanged as described under section 10.1.9 (Impacts during construction phase).

Project impact (unmitigated)

Most of the impacts expected during the operational phase are a continuation of impacts anticipated during the construction phase, as construction activities will persist for most of the operational phase. Impacts, additional to those discussed in section 10.1.9, include:

- Water quality deterioration due to seepage out of the ADF;
- Decreased flow within adjacent wetlands;
- Water quality deterioration due to ash dust from the ADF; and
- Water quality deterioration due to ash dust from the conveyor.

Contaminated surface water runoff or water seeping out of the ADF or the PCDs will result in water quality deterioration in receiving water resources. Overflow of PCDs could also occur and impact on water quality within receiving systems. The Klipfonteinspruit drains into the Wilge River and any water quality impacts to the Klipfonteinspruit are likely to also affect the Wilge River. Direct deposition of this dust into wetlands could result in contamination of surface waters with a resultant loss in sensitive species.

The combined weighted project impact to wetlands (prior to mitigation) will probably be of a VERY HIGH negative significance, affecting the *district area*. The impact will act in the long term and *will occur*. The impact risk class is thus **VERY HIGH**.

Cumulative impact

The agricultural activities on site have resulted in wetland habitat degradation, although most of the wetlands still exist and are at least partially functional compared to their reference condition and functions they were likely to support. Changes in water quality and flow characteristics as a consequence of the ADF impacts will place further pressures and stress on the Klipfonteinspruit wetland system which already is under strain from the existing Kusile developments.

The baseline impacts are considered to be substantial, and additional project impact (if no mitigation measures are implemented) will increase the significance of the existing baseline impacts. The cumulative unmitigated impact will probably be of a VERY HIGH negative significance, affecting the *provincial area* in extent. The impact *is going to happen* and will be permanent. The impact risk class is thus **VERY HIGH**.

Mitigation measures

All mitigation measures recommended in section 10.1.9 will apply. Additional mitigation measures will include:

1) Water quality deterioration due to seepage out of the ADF

- Isolate the ADF from the surrounding catchment through installation of a liner (as per waste classification guidelines and best practice standards) and seepage collection infrastructure, as well as separation of clean and dirty water;
- Water management infrastructure should be sized as per best practice guidelines and GN704 in terms of the National Water Act (36 of 1998);
- Water management infrastructure should be regularly inspected and maintained fully functional at all times. Implement a water quality monitoring plan; and
- An emergency response plan for handling large spills or leaks due to infrastructure failure must be compiled and put in place, with regular practice drills to ensure its effectiveness.

2) Decrease flows within adjacent wetlands

- Ensure all clean water and water derived from the upstream catchment are diverted around the ADF and discharged back into downstream water resources;
- All discharge points should incorporate sediment barriers or sediment traps designed to cope with the flow velocities and volumes at the point of discharge; and
- All discharge points should be regularly inspected for signs of erosion, sediment deposition or obstructions.

3) Water quality deterioration due to ash from the ADF or conveyor

- Implement all dust suppression mitigation measures as detailed in the air quality specialist assessment;
- Implement a water quality monitoring plan to monitor potential impacts to water quality;
- Implement corrective measures to address any water quality impairment that may be observed;
- Gantries should be installed along the conveyor for the full extent of all wetland crossings to limit ash and dust fallout into the wetland;
- Ash transported on the conveyor should contain sufficient moisture to minimise dust generation. Refer to air quality report for guidelines; and
- All transfer stations along the conveyor should be considered dirty water areas and isolated from surrounding runoff and water resources.

Residual impact

The residual impact of the operation of the ADF will include the permanent loss of wetland habitat, as well as declines in water quality and degradation of downstream wetland habitat. Most of these impacts are expected to be mostly restricted to the local scale, though the possible deterioration of water quality within the Wilge River will increase the extent of the impacts.

The residual impact to wetlands beyond the closure phase of the project will be reduced through mitigation measures but not to within baseline conditions. After mitigation the impacts to wetlands will probably be of a MODERATE-HIGH negative significance, affecting the *adjacent area* in extent. The impact *is going to happen* and will be permanent. The impact risk class is thus **HIGH**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below in Table 10-25.

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Table 10-25: Operational phase impact assessment matrix: Wetlands

Rated By:		Site A						
	IMPACT DESCRIPTION	Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	Impact Risk
Code	*Phase*							
	OPERATION							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	3 MODL	2 DEV	4 LONG	5 OCCUR	**-3.3 MODH**
Project Impact 1	Loss of wetland habitat	Negative	**Definite**	6 VHIGH	3 ADJ	5 PERM	5 OCCUR	**-5.2 VHIGH**
Project Impact 2	Water quality deterioration due to seepage out of the ADF	Negative	**Definite**	6 VHIGH	5 DIS	4 LONG	5 OCCUR	**-5.5 VHIGH**
Project Impact 3	Increased sediment transport into wetlands	Negative	**Definite**	4 MODH	3 ADJ	2 SHORT	5 OCCUR	**-3.3 MODH**
Project Impact 4	Increased erosion within adjacent wetlands	Negative	**Probable**	4 MODH	3 ADJ	4 LONG	4 VLIKE	**-3.2 MODH**
Project Impact 5	Water quality deterioration in adjacent wetlands & water resources	Negative	**Probable**	4 MODH	4 LOC	2 SHORT	3 LIKE	**-2.2 MODL**
Project Impact 6	Decreased flows within adjacent wetlands	Negative	**Probable**	4 MODH	3 ADJ	4 LONG	5 OCCUR	**-4.1 HIGH**
Project Impact 7	Loss of Red Data species and protected species	Negative	**Probable**	4 MODH	2 DEV	5 PERM	5 OCCUR	**-4.1 HIGH**
Project Impact 8	Increase in alien vegetation	Negative	**Probable**	4 MODH	2 DEV	4 LONG	4 VLIKE	**-2.9 MODL**
Project Impact 9	Water quality deterioration due to ash dust from the ADF	Negative	**Possible**	5 HIGH	6 PRO	4 LONG	5 OCCUR	**-5.5 VHIGH**
Project Impact 10	Water quality deterioration due to ash dust from the conveyor	Negative	**Possible**	4 MODH	4 LOC	4 LONG	4 VLIKE	**-3.5 MODH**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	5 HIGH	6 PRO	5 PERM	5 OCCUR	**-5.9 VHIGH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	4 MODH	3 ADJ	5 PERM	5 OCCUR	**-4.4 HIGH**

10.2.10 Avifauna

Status quo

The status quo remains the same for the construction, operational and closure phases as discussed in section 10.1.10.

Project impact (unmitigated)

The project impact remains the same for the construction, operational and closure phases as discussed in section 10.1.10.

Cumulative impact

The cumulative impact remains the same for the construction, operational and closure phases as discussed in section 10.1.10.

Mitigation measures

- Mitigation measures remain the same for the construction, operational and closure phases as discussed in section 10.1.10.

Residual impact

The residual remains the same for the construction, operational and closure phases as discussed in section 10.1.10.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-26.

Table 10-26: Operational phase impact assessment matrix: Avifauna

				Site A				
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	Impact Risk
Code	*Phase*							
	OPERATION							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	6 VHIGH	4 LOC	4 LONG	4 VLIKE	**-4.1** **HIGH**
Project Impact 1	Reduction in species diversity and abundance due to habitat transformation and fragmentation.	Negative	**Probable**	5 HIGH	4 LOC	5 PERM	5 OCCUR	**-5.2** **VHIGH**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	6 VHIGH	4 LOC	5 PERM	5 OCCUR	**-5.5** **VHIGH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	5 HIGH	4 LOC	4 LONG	5 OCCUR	**-4.8** **HIGH**

10.2.11 Bats

Status quo

The status quo remains the same as discussed for the construction phase in section 10.1.11. Status quo impacts on bats will definitely be of a LOW negative significance, affecting the *development and adjacent area* in extent. The impact *will occur* and will be permanent. The impact risk class is therefore **MODERATE-HIGH**.

Project impact (unmitigated)

Project impacts on bats will include the loss of bat feeding habitat and roosting sites. Construction during the operational phase of the ADF will sterilise the existing vegetation units on site, including the wetlands associated with the Holfonteinspruit and Klipfonteinspruit, which serves at feeding grounds for bats.

Project impacts on bats will be of a LOW negative significance, affecting the *development and adjacent area* in extent. The impact *will occur* and will be permanent. The impact risk class is therefore **MODERATE-HIGH**.

Cumulative impact

Cumulative impact resulting from the status quo impacts and project impacts will have the same conclusion as impacts resulting solely from project impacts related to construction of the ADF. Airspace over the fields and natural vegetation in site A will be replaced by the starter platform of the ADF. Displacement of the bats from the area will thus also occur gradually as construction and operational phase continues.

Cumulative impacts on bats will be of a LOW negative significance, affecting the *development and adjacent area* in extent. The impact will occur and will be permanent. The impact risk class is therefore **MODERATE-HIGH**.

Mitigation measures

- Mitigation measures remain the same for the construction, operational and closure phases as discussed in section 10.1.11.

Residual impact

The transformation into a hostile area for bats will continue. However, even though the presence of bats at the location of the preferred site A will cease, resident bats will roost and forage at nearby locations.

Residual impacts on bats will be of a LOW negative significance, affecting the *development and adjacent area* in extent. The impact will occur and will be permanent. The impact risk class is therefore **MODERATE-HIGH**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-27.

Table 10-27: Operational phase impact assessment matrix: Bats

Rated By:	Dr I Rautenbach	Site A						
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	Phase							
Bats01	OPERATIONAL							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	Definite	2 LOW	3 ADJ	5 PERM	5 OCCUR	-3.7 MODH
Project Impact 1	Impact on bats	Negative	Probable	2 LOW	3 ADJ	5 PERM	5 OCCUR	-3.7 MODH
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	Probable	2 LOW	3 ADJ	5 PERM	5 OCCUR	-3.7 MODH
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	Probable	2 LOW	3 ADJ	5 PERM	5 OCCUR	-3.7 MODH

10.2.12 Noise

Status quo

The most notable sources of intrusive noise in the vicinity of site Sites A include Kusile Power Station and national/regional roads.

The impact of Kusile Power Station's construction phase on Site A is considered LOW in magnitude, limited to the *study area*, of medium duration (i.e. will last for the duration of the power station's operation) and will *definitely occur*, resulting in a negative **MODERATE** impact risk.

Project impact (unmitigated)

The most significant noise sources during construction and operational phases of the ADF development include:

- Movement and offloading of trucks carrying ash to the starter platform;
- Site preparation and construction activities; and
- Conveyor transfer and ash stacking.

Operational phase impacts are considered LOW in magnitude, limited to the *development area*, of short duration (project life) and *very likely to occur*, resulting in a negative **LOW** impact risk.

Cumulative impact

Cumulative impacts from the status quo and project impacts will not exceed ambient day and noise levels if noise receptors are kept more than 800 m away from the source of the noise during the night, and more than 150 m from the source of the noise during the day. Operational phase impacts are considered LOW in magnitude, limited to the *development area*, of short duration (project life) and *very likely to occur*, resulting in a negative **LOW** impact risk.

Mitigation measures

- Mitigation measures remain the same as was proposed for the construction phase in section 10.1.12 of this report.

Residual impact

The residual noise impact can be successfully mitigated to a lower significance level. Operational phase impacts are considered LOW in magnitude, limited to the *development* *area*, of medium duration (project life) and *likely to occur*, resulting in a negative **LOW** impact risk.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-28.

Table 10-28: Operational phase impact assessment matrix: Noise

Rated By:	N von Reiche			Site A				
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	Phase							
Noise01	OPERATIONAL							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	Definite	2 LOW	2 DEV	3 MED	5 OCCUR	-2.6 MODL
Project Impact 1	Environmental noise impacts as a result of the project	Negative	Probable	2 LOW	2 DEV	2 SHORT	4 VLIKE	-1.8 LOW
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	Probable	2 LOW	2 DEV	2 SHORT	4 VLIKE	-1.8 LOW
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	Probable	2 LOW	2 DEV	3 MED	3 LIKE	-1.5 LOW

10.2.13 Visual

Status quo

The proposed project is located in a landscape of moderate value that, by the time of the implementation of the Project, already includes negative visual elements.

Project impact (unmitigated)

Operational activities will be prominent but may not necessarily be considered to be substantially uncharacteristic due to the presence of the Kusile Power Station and being located adjacent to it. Operational activities would however result in a moderate change in landscape characteristics over an extensive area resulting in a moderate changes to key views.

Cumulative impact

Operational activities will add to the cumulative negative effect on the visual quality of the landscape.

Mitigation measures

- Dust suppression techniques should be in place at all times during the construction phase;
- As much vegetation as possible should be kept during site clearance;

- Rehabilitate / restore exposed areas as soon as possible after construction activities are complete;
- Avoid high pole top security lighting along the periphery of the project area and use only lights that are activated on illegal entry to the project area; and
- Light public movement areas (pathways and roads) with low level 'bollard' type lights and avoid post top lighting.

Residual impact

Although mitigation measures will be implemented due to the landscape character and height of structures, residents and travellers will still be able to see the operational activities. Mitigation will only partially obstruct views.

Impact Matrix

The impacts identified and discussed above have been rated and presented below in Table 10-29.

Table 10-29: Operational phase impact assessment matrix: Visual

Rated By:	M Cilliers / M Vosloo	Site A						
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	Phase							
Visual01	OPERATIONAL							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	Definite	3 MODL	3 ADJ	3 MED	3 LIKE	-2 LOW
Project Impact 1	Visual impact on residents within and travellers through the study area	Positive	Probable	3 MODL	4 LOC	5 PERM	5 OCCUR	-4.4 HIGH
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	Probable	3 MODL	4 LOC	5 PERM	5 OCCUR	-4.4 HIGH
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	Probable	3 MODL	4 LOC	5 PERM	5 OCCUR	-4.4 HIGH

10.2.14 Heritage

Status quo

Four cemeteries, consisting of 47 graves in total, were identified in the study area. The cemeteries contain African farmworker graves. It is likely that some of the graves will be 60 years or older and thus protected under Section 36 of the NHRA. The remains of a recent farmhouse and farm workers housing were also identified.

Impacts identified are natural (burrowing animals and vegetation) and impacts mainly the cemeteries and graves within the area, while the demolishing and subsequent scavenging of building material has led to the destruction of houses and outbuildings on farmsteads.

The combined weighted base line impact to heritage resources will definitely be of a VERY LOW negative significance, affecting *isolated sites*. The impact will be incidental and *likely to occur*. The impact risk class is thus **VERY LOW**.

Project impact (unmitigated)

The operation phase is characterised by construction, operational and rehabilitation activities. It is only during the operational phase that the complete extent of the development footprint will be transformed. Impact related to construction of the ADF and conveyor route may still be possible on heritage resources within the development footprint.

During the operational phase construction activities will continue to impact identified and chance find heritage resources. These impacts will occur in the same magnitude as during the construction phase and will impacts resulting from topsoil stripping, excavations and vegetation clearing. The most notable impacts will be on the existing cemeteries and the palaeontological sensitive substrata in the south western section of the study area.

The combined weighted project impact to cemeteries and palaeontological resources (prior to mitigation) will definitely be of a HIGH negative significance, affecting *isolated sites*. The impact will be permanent and is *going to happen*. The impact risk class is thus **MODERATE-HIGH** to **HIGH**.

Cumulative impact

The baseline impacts are considered to be VERY LOW, and additional project impact (if no mitigation measures are implement) will increase the significance of the existing baseline impacts, the cumulative unmitigated impact will definitely be of a HIGH negative significance, *isolated sites* in extent. The impact is *going to happen* and will be permanent. The impact risk class is thus **HIGH**.

Mitigation measures

- All mitigation measures identified for implementation during the construction phase will be applicable to the operational phase as well.

Residual impact

The impact to heritage resources will be permanent as heritage resources cannot be restored. The proposed mitigation measures will enable the documentation of any palaeontology found and the preservation of human remains through the relocation to cemeteries as requested by the next-of-kin.

The residual impact on heritage resources during the construction phase of the project will be reduced through mitigation measures but not to within baseline conditions. After mitigation the impacts to heritage resources will probably be of a LOW negative significance, affecting the *isolated sites*. The impact is *going to happen* and will be permanent. The impact risk class is thus **MODERATE-LOW**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-30.

Table 10-30: Operational phase impact assessment matrix: Heritage

Rated By:	W Fourie	Site A						
	IMPACT DESCRIPTION	Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	*Phase*							
Heritage01	***OPERATIONAL***							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	1 VLOW	1 ISO	1 INCID	3 LIKE	**-0.7 VLOW**
Project Impact 1	Cemeteries	Positive	**Probable**	5 HIGH	1 ISO	5 PERM	5 OCCUR	**-4.1 HIGH**
Project Impact 2	Palaeontology	Negative	**Probable**	5 HIGH	1 ISO	5 PERM	4 VLIKE	**-3.2 MODH**
Project Impact 3	Historical Structures	Negative	**Definite**	1 VLOW	1 ISO	5 PERM	4 VLIKE	**-2.1 MODL**
Project Impact 4	Stone Age Site	Negative	**Definite**	1 VLOW	1 ISO	5 PERM	2 UNLIKE	**-1 VLOW**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	6 VHIGH	1 ISO	5 PERM	5 OCCUR	**-4.4 HIGH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	2 LOW	1 ISO	5 PERM	5 OCCUR	**-2.9 MODL**

The construction impact on heritage resources will either have destroyed any heritage resources within the development footprint or would have allowed removal of heritage resources or relocation of graves. Therefore, no further impacts can be expected during the closure or post-closure phases. Closure or post-closure impacts are therefore not discussed.

10.2.15 Social

Status quo

The status quo remains the same as described in during the construction phase social status quo, in section 10.1.15.

Project impact (unmitigated)

Most of the social impacts anticipated in the operation phase are likely to be a continuation of impacts that started during the construction or pre-construction phases of the project, e.g. dust nuisance and noise. Opportunistic jobseekers may continue to come to the area, leading to pressure on physical and social infrastructure, an increased presence of strangers in the area, as well as an increase in crime.

During the operation of the project there may be an increase in dust in the area, as well as noise and an increase in traffic. An increase in dust will have an impact on livestock, crops as well as the health and well-being of humans. The aesthetic quality and sense of place of the area will change as a result of the visual presence of the ash disposal facility.

Community members are of the opinion that many impacts cannot be mitigated effectively and that mitigation measures are not consistently applied, using current projects in the area as frame of reference.

The operation phase may lead to an increase in the number of available permanent job opportunities in the area, however these job opportunities can only be confirmed at a later stage. People from the Bravo Cooperative expect to benefit from the job opportunities, as do people from Phola. Residents from Phola felt that they were excluded from jobs during the construction of the Kusile power station although they were the nearest community because they were in a different municipal area.

Cumulative impact

It is almost impossible to ascribe a portion of a social impact to a specific project, but it is estimated that the bulk of the existing negative impacts in the area occur as a result of current mining activities in the area, as well as the construction of the Kusile power station and the New Largo mine. The baseline impacts are considered as already being substantial and the additional project impact without mitigation measures will probably be of a MODERATELY-HIGH negative significance affecting the area on a *district level* (more than 5 km from the project site). Some of the impacts will *definitely happen* and most of the will last for the life of the operation. The impact risk class is **HIGH**. It must be noted that social impacts are not linear in nature and thus cannot cancel out one another. When expressing an opinion about a group of impacts like this, one must be guided by the impacts with the most severe effect and use them as a guideline.

Mitigation measures

- Ensure that the recommendations of the relevant bio-physical studies (noise, air quality, etc.) are followed to minimise impacts. Create a grievance mechanism, e.g. complaints register, to ensure nuisances can be reported and dealt with quickly;
- Make sure workers wear identification cards and vehicles can easily be identified. Create/join a community policing forum for the area with buy-in from neighbours and local police;
- Create an employment policy and communicate it to the stakeholders. Employ local people where possible;
- Compile a stakeholder communication strategy and appoint a community liaison officer;
- Implement a drug and alcohol management policy for employees; and
- Implement health and safety programme, including training, on site.

Residual impact

Most of the impacts mentioned cannot be reversed through mitigation measures, but through effective mitigation measures, their impacts can be managed. It is very important that mitigation measures must be implemented consistently and according to the ways prescribed. The identified impacts will still be there, but to a lesser extent. With mitigation, the impacts will possibly be of a MODERATELY-LOW negative significance, with effects experienced on a *local level*. The impact is <u>*very likely to happen*</u> and is likely to last for the <u>life of the operation</u>. The impact risk is thus **MODERATELY-LOW**.

<u>Impact Matrix</u>

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-31.

Table 10-31: Operational phase impact assessment matrix: Social

Rated By:	*S-M Aucamp*			Site A				
	IMPACT DESCRIPTION	Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	*Phase*							
Social01	***OPERATIONAL***							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	3 MODL	1 ISO	1 INCID	3 LIKE	**-1.1 LOW**
Project Impact 1	Impacts on livelihoods in terms of dust, noise and water impacts on neigbouring properties	Negative	**Definite**	5 HIGH	4 LOC	3 MED	5 OCCUR	**-4.4 HIGH**
Project Impact 2	Impacts on the health of humans and livestock	Negative	**Probable**	4 MODH	4 LOC	3 MED	4 VLIKE	**-3.2 MODH**
Project Impact 3	Threats to safety and security - increase in crime, intruders on properties	Negative	**Probable**	4 MODH	5 DIS	3 MED	5 OCCUR	**-4.4 HIGH**
Project Impact 4	Change in quality of life as a result of impacts on livelihoods and on health	Negative	**Probable**	4 MODH	3 ADJ	4 LONG	4 VLIKE	**-3.2 MODH**
Project Impact 5	Creation of employment	Negative	**Definite**	3 MODL	5 DIS	3 MED	5 OCCUR	**-4.1 HIGH**
Project Impact 6	Increase in traffic	Positive	**Definite**	3 MODL	5 DIS	3 MED	4 VLIKE	**-3.2 MODH**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	4 MODH	5 DIS	3 MED	5 OCCUR	**-4.4 HIGH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	3 MODL	4 LOC	3 MED	4 VLIKE	**-2.9 MODL**

10.2.16 Traffic

<u>Status quo</u>

Site A can be easily accessed off existing roads. The existing traffic recorded is much higher than anywhere else between the Kusile construction access and the Kusile Road & R545 intersection due to Kusile Power Station construction activities. The impact will be arrested with the mitigation measure proposed.

The overall status quo impact's significance is MODERATE-LOW, the spatial scale is limited to areas *adjacent to the site*, duration is <u>medium term</u> and the impact is <u>*likely to occur*</u>. The impact risk is thus **LOW**.

<u>Project impact (unmitigated)</u>

This traffic relates to the operations and maintenance of the facility. This impact will only occur once the construction of the ash disposal facility is complete and the facility is operational. The operational traffic will be less than the construction traffic. The rating of the post construction traffic took cognisance of the mitigation measures proposed in the construction traffic scenario.

The project impact significance is VERY LOW. The spatial scale will be limited to the *development footprint*. The duration will be medium term and is *unlikely to occur*. The impact risk is thus **VERY LOW**.

Cumulative impact

The cumulative impact takes into account the close proximity and association of site A to Kusile Road. The cumulative rating further takes cognisance of the Kusile Power Station and the proposed New Largo traffic and mitigation measures proposed in their respective reports.

The project impact significance is MODERATE-LOW. The spatial scale will be limited to the *development footprint and adjacent to the site*. The duration will be medium term and is *likely to occur*. The impact risk is thus **LOW**.

Mitigation measures

1. Pointsmen to be deployed at both the Kusile Power Station and New Largo Mine Access during the construction phase, which extends into the operational phase, to control the traffic so that the traffic from both developments can be afforded some gaps on Kusile Road.

Residual impact

The proposed mitigation will improve the flow at intersections affected by the developments within the study area. The significance of the impact after mitigation will be MODERATE-LOW, spatial scale will be limited to intersections *development footprint and adjacent to the site*, the impact will occur in the medium term. The impact is *unlikely to occur* with the proposed mitigation implemented. The degree of certainty is probable and the impact risk is low. The impact risk is thus **LOW**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-32.

Table 10-32: Operational phase impact assessment matrix: Traffic

Rated By:	N Miya / A Brislin	Site A						
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	Phase							
Traffic01	OPERATIONAL							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	Definite	3 MODL	3 ADJ	3 MED	3 LIKE	-2 LOW
Project Impact 1	Additional delays at intersections due to additional traffic generated by the development	Negative	Probable	1 VLOW	2 DEV	3 MED	2 UNLIKE	-0.9 VLOW
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	Probable	3 MODL	3 ADJ	3 MED	3 LIKE	-2 LOW
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	Probable	3 MODL	3 ADJ	3 MED	2 UNLIKE	-1.3 LOW

10.3 CLOSURE PHASE

Closure and decommissioning of the ADF will only be done at the end of the power station life. It is consequently very difficult to predict possible impacts and mitigation measures for activities more than 60 years into the future. At closure of the ADF appropriate measures and legal requirements, in line with best practice standards and guidelines of the time, will be implemented. However, if the current legislation and best practise standards / guidelines still prevail at the closure and decommissioning stage of the ADF, the mitigation measures discussed in the following sections will be appropriate.

10.3.1 Air quality

Status quo

The status quo is as was discussed in section 10.1.1 for the construction phase.

Project impact (unmitigated)

Impact on air quality during the closure phase will not impact the ambient air quality more than the status quo situation.

Cumulative impact

The cumulative impact will not exceed the status quo ambient air quality.

Mitigation measures

- Mitigation measures recommended in section 10.1.1 for the construction phase will be applicable to the closure phase.

Residual impact

The residual impact on air quality during closure is expected not to exceed the status quo impact. The impacts are *very likely* to be of MODERATE-HIGH significance at a *district* scale over the long-term, resulting in **MODERATE-HIGH** impact risk. However, the impact of dust outfall on adjacent land is **LOW**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-33.

Table 10-33: Closure phase impact assessment matrix: Air Quality

Rated By:	Dr T Bird	Site A						
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	*Phase*							
AirQual01	***CLOSURE***							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	4 MODH	5 DIS	4 LONG	4 VLIKE	**-3.8 MODH**
Project Impact 1	Impacted area where dust-fall >400 $mg.m^{-2}.day^{-1}$	Negative	**Probable**	2 LOW	3 ADJ	3 MED	2 UNLIKE	**-1.2 LOW**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	4 MODH	5 DIS	4 LONG	4 VLIKE	**-3.8 MODH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	4 MODH	5 DIS	4 LONG	4 VLIKE	**-3.8 MODH**

10.3.2 Topography

Status quo

The topography of the region is a gently to moderately undulating landscape of the Highveld plateau. The topography of the area encompassed by site A is draining in a north westerly direction. At present the topography of site A is not impacted.

Project impact (unmitigated)

The closure phase will include rehabilitation and landscaping activities of the last 5 year potion of the ADF, as well as decommissioning of these activities. Profiling of the terrain will be permanent, and will affect surface water drainage patterns beyond the life of the facility.

The combined weighted project impact to topography (prior to mitigation) will probably be of a LOW negative significance, affecting the *development site*. The impact will be permanent and is going to *occur*. The impact risk class is thus **MODERATE-HIGH**.

Cumulative impact

As with the construction and operational phases, the cumulative impact will not exceed that of the project impact above. Open cast mining activities to the north-east and east of the study area will also have further impacts to the topography in the region. Predicted future runoff from the modified topography resulting from the ADF has been modelled to be less than 2 % of the current runoff. It is therefore anticipated that the cumulative impact will not exceed that of the project impact.

Therefore, the combined weighted project impact to topography will definitely be of a LOW negative significance, affecting the *development site*. The impact will be permanent and will *occur*. The impact risk class is thus **MODERATE-HIGH**.

Mitigation measures

The topography of the development site will change permanently due to the disposal of ash on the development footprint. The primary mitigation measure to alleviate the change in topography is to shape the profile of the decommissioned ADF to gently undulating topography in order to blend into the natural environment. Sloping and profiling will commence during the construction phase and will continue as the ADF develops up to the closure phase of the development.

Some secondary consequences of the change in topography will also need to be mitigated. These impacts include changes in storm water run-off from the ADF and controlled release of runoff into the environment. The following mitigation measures are recommended:

- Install a clean water cut-off system that, at a minimum, ensures that a free draining profile is established on the ADF, and that storm water is allowed to move unhindered off the site;
- Ensure that any areas of the sloped ADF impacted during the construction phase are rehabilitated as soon as practically possible.

Residual impact

With mitigation in place, the project impact to topography will definitely be of a VERY LOW negative significance, affecting the *development site*. The impact will be permanent and will *occur*. The impact risk class is thus **MODERATE-LOW**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-34.

Table 10-34: Closure phase impact assessment matrix: Topography

Rated By:	M Vosloo			Site A				
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	Phase							
Topo01	CLOSURE							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	Definite	0 NO				0 NO
Project Impact 1	Impacts on topography	Negative	Probable	2 LOW	2 DEV	5 PERM	5 OCCUR	-3.3 MODH
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	Probable	2 LOW	2 DEV	5 PERM	5 OCCUR	-3.3 MODH
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	Probable	1 VLOW	2 DEV	5 PERM	5 OCCUR	-2.9 MODL

No impacts on topography is expected during the post-closure phase as all the landscaping and cut and fill activities would have been done in the preceding phases. Impacts on topography during the post-closure phase are thus not discussed.

10.3.3 Soils and land capability

Status quo

The geomorphological characteristics of the soils in the study area are influenced by the negative water balance and semi-arid environment, with the effects of evaporites and the development of laterites being highlighted as aspects of importance to the ecological status, and conditions that will influence the capability of the land. Soil groupings on site A include sandy and silty loams, sandy and silty clay loams, rocky sandy loams and wet soils, which are moderately easily worked but generally have a poor organic content matter. Site A has areas of cultivated pastures and commercial cropping, however with limited arable potential and moderate grazing potential.

The status quo is therefore characterised by agricultural impacts with soils that require commercial additives to increase arable and grazing potential. The status quo impact to soils and land capability is thus probably of a MODERATE-HIGH negative significance, affecting the *local* area. The impact is long term and is *occurring*. The impact risk class is thus **HIGH**.

Project impact (unmitigated)

The project impact relate to the net loss of soil volumes and utilization potential due to change in material status (Physical and Chemical) and loss of nutrient base. The impacts on the soil resource during the closure phase have both a positive and a negative effect, with:

- The loss of the soil's original nutrient status and store and the reduction in the already very low organic carbon by leaching of the soils while in storage;
- Erosion and de-oxygenation of materials while stockpiled;
- Compaction and dust contamination due to vehicle movement and wind impacts on the soil while rehabilitating the area;
- Erosion of soils during slope stabilization and re-vegetation of disturbed areas;

- Contamination of replaced soils by use of dirty water for plant watering and dust suppression on roadways;
- Hydrocarbon or chemical spillage from contractor and supply vehicles; and
- Positive impacts of reduction in areas of disturbance and return of soil utilization potential, uncovering of areas of storage and rehabilitation of compacted materials.

The impact will probably remain the net loss of the soil resource if no intervention or mitigating strategy is implemented. The intensity potential will remain MODERATE-LOW and positive for the medium to short term for all of the activities if there is no active management (rehabilitation and intervention) in the decommissioning phase, and closure will not be possible. The impacts will be confined to the development area and its adjacent buffer, and is likely to happen.

<u>Cumulative impact</u>

The cumulative impact is driven by the loss of arable soils and grazing pasture within and directly adjacent to the site A, mainly stemming from the identified project impacts. In the un-managed scenario these activities will probably result in a MODERATE-HIGH negative impact that will affect the *development footprint and adjacent sites*. This impact will be <u>permanent</u> are *very likely to occur*. The impact risk class is thus **MODERATE-HIGH**.

<u>Mitigation measures</u>

- All mitigation measures identified for implementation during the construction and operational phases will remain;
- A potential positive impact of re-establishing top-soil on the ADF is the possible use of the ADF surface to continue agricultural activities. The impact of these kinds of activity on the stability of the ADF surface and erosion, however, has not been quantified.

<u>Residual impact</u>

On closure of the ashing operation the long-term negative impact on the soils will be reduced from a significance ranking of MODERATE to LOW if the proposed mitigation measures identified through the life of the development is effectively implemented. These impacts will be confined to the <u>development site and its adjacent environments</u>, and is <u>*very likely to occur*</u>.

At closure (obtaining of certificate of closure from authorities) the residual impact should, if all rehabilitation and management efforts have been complied with, result in a positive impact, with the area being returned to a land capability of low intensity grazing or wilderness status, and the use of the land being returned to that of livestock management.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-35.

Table 10-35: Closure phase impact assessment matrix: Soils and land capability

Rated By:	I Jones			Site A				
	IMPACT DESCRIPTION	Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	Phase							
Traffic01	DECOMMISSIONING AND CLOSURE							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	Definite	3 MODL	3 ADJ	4 LONG	5 OCCUR	-3.7 MODH
Project Impact 1	Loss of soil nutrients and organic carbon while in storage	Negative	Definite	5 HIGH	4 LOC	4 LONG	4 VLIKE	-3.8 MODH
Project Impact 2	Contamination by dirty water used for watering re-vegetation, and dust from unprotected ash material	Negative	Probable	4 MODH	4 LOC	4 LONG	4 VLIKE	-3.5 MODH
Project Impact 3	Hydrocarbon spills from rehab vehicles, compaction and dust	Negative	Probable	4 MODH	4 LOC	3 MED	4 VLIKE	-3.2 MODH
Project Impact 4	Addition of fertilisers (possible pollutant if over applied)	Positive	Probable	3 MODL	2 DEV	3 MED	3 LIKE	-1.8 LOW
Project Impact 5	Animal and vehicle impacts (Compaction, erosion and dust)	Negative	Probable	3 MODL	2 DEV	3 MED	3 LIKE	-1.8 LOW
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	Probable	4 MODH	3 ADJ	5 PERM	4 VLIKE	-3.5 MODH
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	Probable	4 MODH	2 DEV	3 MED	4 VLIKE	-2.7 MODL

Not soil impacts are anticipated during the post-closure phase and were not considered during assessment of the post-closure phase.

10.3.4 Surface water

Status quo

Surface water resources within Site A are the Holspruit and Klipfonteinspruit. There is also a tributary that drains Kusile Power Station and flows directly into Klipfonteinspruit. The footprint of the Site A is currently utilised extensively for agriculture, mostly cultivation, though some livestock grazing is also known to occur. These activities have had limited impact on the streams in the area with some impacts on water quality from agricultural run-off. A wetland is located at the headwaters of Klipfonteinspruit. The water quality results at the sample sites for the area show high levels of fluoride (F), sulphate (SO_4), conductivity (EC) and total dissolved solids (TDS), exceeding the RWQOs. This is very possibly due to the mining activity upstream of these points and the Kusile co-disposal facility in close proximity. The water quality downstream of the Klipfonteinspruit shows an improved water quality indicating the functionality of the wetland. A number of farm road crossings have also lead to reduction of flow in the streams.

The status quo impact to surface water is thus probably of a MODERATE-LOW negative significance, occurring in the *local area*. The impact is long term and will *very likely* occur. The impact risk class is thus **MODERATE-HIGH**.

Project impact (unmitigated)

A number of impacts are expected to materialise as a consequence of the closure phase of the 60 year ADF and the associated infrastructure. Impacts relating to the rehabilitation of the ADF are also applicable to the operational phase of the project, as rehabilitation will take place concurrently. The decommissioning and removal of infrastructure during the closure phase is also likely to result in a number of impacts similar to the construction phase impacts. Impacts include loss or disturbance of streams, increased sediment transport into water resources, increased erosion, water quality deterioration in adjacent water resources, and altered flows.

Ash is likely to contain a number of pollutants. Contaminated surface water runoff from the ADF or water seeping out of the ADF or the pollution control dams may result in water quality deterioration in receiving water resources. Overflow of pollution control dams could also occur and impact on water quality within receiving systems.

Rehabilitation of the ADF will include the placement of topsoil on the side slopes and crest and the establishment of vegetation on the ADF. Surface runoff on the steep side slopes is likely to erode the topsoil in the initial stages prior to the establishment of sufficient vegetation. Decommissioning activities along the conveyor route may result in disturbance to the water course that increases the risk of erosion within the affected water resources.

The combined weighted project impact to water resources (prior to mitigation) will definitely be of a MODERATE-HIGH negative significance, affecting the *local area*. The impact will act in the medium term and is *very likely to occur*. The impact risk class is thus **MODERATE-HIGH**.

Cumulative impact

The agricultural activities on site have had a limited impact on the water resources quality, while farm dam construction has resulted in some flow alteration. The Kusile Power Station construction has had an impact on downstream water quality while the proposed New Largo Mine is also likely to result in further water quality deterioration.

Due to the fact that several upstream impacts are already occurring when considering significance rating for cumulative impacts for each of the proposed sites, the impact class will not change considerably. However, should mitigation be put in place then the local cumulative impacts would reduce the significance rating for the local area but may not have much of a positive impact on the broader catchment. This would need to be assessed considering all other users in the catchment.

The baseline impacts are considered to be low and additional project impact (if no mitigation measures are implemented) will increase the significance of the existing baseline impacts, the cumulative unmitigated impact will probably be of a MODERATE-HIGH negative significance, affecting the *study area* in extent. The impact is *very likely* and will be medium term. The impact risk class is thus **MODERATE-HIGH**.

Mitigation measures

Mitigation during closure would be to:

- Comply with GN704 in relation to storm water measures so that sediment transport off site is minimised and clean water is diverted around the cleared area;
- Maintain sediment traps as part of the storm water management plan where necessary and especially upstream of discharge points where erosion protection measures and energy dissipaters should be in place; and
- Maintain the water quality monitoring programme at closure and post-closure.

Residual impact

The residual impact of the closure of the ADF will include the potential loss of storm water runoff (flow), as well as a potential decline in water quality. Most of these impacts are expected to be mostly restricted to the local scale, however the potential deterioration of water quality within the Wilge River as a result of the cumulative impact of the activities and industries in the sub-catchment will increase the extent of the impacts.

The residual impact to water resources beyond the closure phase of the project will be reduced through mitigation but not to within baseline conditions. After mitigation the impacts to the water resources will probably be of a MODERATE-LOW negative significance, affecting the *adjacent area* in extent. The impact *is likely* and will be permanent. The impact risk class is however still **LOW**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-36.

Table 10-36: Closure phase impact assessment matrix: Surface water

Rated By:	*L Boyd / T Coleman*	Site A						
	IMPACT DESCRIPTION	Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	*Phase*							
SurfWat01	***CLOSURE***							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	3 MODL	4 LOC	4 LONG	4 VLIKE	**-3.2** **MODH**
Project Impact 1	Water quality deterioration	Negative	**Probable**	4 MODH	4 LOC	4 LONG	4 VLIKE	**-3.5** **MODH**
Project Impact 2	Flow alteration			2 LOW	4 LOC	3 MED	4 VLIKE	**-2.7** **MODL**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	4 MODH	4 LOC	4 LONG	4 VLIKE	**-3.5** **MODH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	2 LOW	4 LOC	2 SHORT	3 LIKE	**-1.8** **LOW**

Surface water impacts expected during the post-closure phase are expected to be the same as for the closure phase. Post-closure impacts are therefore not discussed further.

10.3.5 Groundwater

Status quo

If no ash is disposed on Site A, the different man-made activities and natural processes that lead to the established baseline groundwater conditions will prevail. Contaminant transport from upstream of the Klipfonteinspruit would probably continue downstream if no remediation action is taken. The water elevations would also probably continue to decrease. The analysis of the monitoring data (water levels) at Kusile power station shows an average annual decrease of 0.77m. The model simulation results in a maximum drawdown of 2.5 m over 3 years.

Impacts to the groundwater resources status quo will definitely be of a MODERATE-HIGH negative significance, affecting the *local area* in extent. The impact will occur and will be medium term. The impact risk class is however still **HIGH**.

Project impact (unmitigated)

The following impacts have been considered and quantified during the closure phase:

- Deterioration of groundwater quality due to waste, and spills related to closure activities; and
- Possible continuation of groundwater pollution due to seepage, leachate infiltration (leak of liner) from a ADF, contaminated water trenches and pollution control dams.

The overall (combined) impact risks at the closure of the coal Ash Disposal Facility would have on site A have been rated to be a LOW impact risk. The impacts risk (MODERATE-LOW) associated with deterioration of groundwater quality due to waste, and spills related to closure activities are of most concern. The installation of a linear low-density polyethylene (LLDPE) geomembrane at the top soil layers will reduce possible groundwater pollution due to seepage, from the ADF.

Overall project impacts to the groundwater resources will range between VERY LOW to MODERATE-LOW negative significance, affecting the *local and adjacent area* in extent.

Cumulative impact

The main cumulative impacts of concern are the impacts from New Largo. Necessary groundwater dewatering would probably be implemented, which might create a cone of groundwater depression around the open pit at New Largo. The groundwater flow regime would therefore be altered, and flow between Site A and New Largo would probably be reversed toward the New Largo. This would help in containing any pollution associated with open cast mining, at New Largo, but will result in the spreading of the pollution from the 60 years ADF towards the south of Site A. At the 60 years horizon, New Largo dewatering will result in a plume expansion of an extra 800 m (further than without dewatering) at the south of site A. This would involve an extra 2.4 km^2 polluted area at the south of site A.

Cumulative impacts to the groundwater resources will probably be of a MODERATE-HIGH negative significance, affecting the *local area* in extent. The impact is *very likely to occur* and will occur in the medium term. The impact risk class is therefore **MODERATE-HIGH**.

Mitigation measures

- Rehabilitation of the ADF should start immediately after the deposition of the last coal ash.

Residual impact

After the application of the mitigation measures, the groundwater risk impacts would be successfully reduced. The reduced impact risks together with the base line (status quo) impacts risk will constitute the residual risk impacts.

Residual impacts to the groundwater resources will probably be of a LOW negative significance, affecting the *development site and adjacent area* in extent. The impact would be limited to isolated incidences and would be *unlikely to occur*. The impact risk class is therefore **VERY LOW**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-37.

Table 10-37: Closure phase impact assessment matrix: Groundwater

Rated By:	*P Ahokpossi*	Site A						
IMPACT DESCRIPTION		Direction of Impact	**Degree of Certainty**	Magnitude	Spatial	Temporal	Probability	**Impact Risk**
Code	*Phase*							
GroundW01	***CLOSURE***							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	4 MODH	4 LOC	3 MED	5 OCCUR	**-4.1 HIGH**
Project Impact 1	Deterioration of groundwater quality due to waste, and spills related to closure activities	Positive	**Possible**	4 MODH	4 LOC	3 MED	3 LIKE	**-2.4 MODL**
Project Impact 2	Groundwater pollution due to seepage, lewachate infiltration from ADF, contaminated water trenches and PCDs	Negative	**Definite**	3 MODL	4 LOC	3 MED	2 UNLIKE	**-1.5 LOW**
Project Impact 3	Alteration of the groundwater flow systemdue to groundwater pumping	Negative	**Probable**	2 LOW	3 ADJ	2 SHORT	2 UNLIKE	**-1 VLOW**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	4 MODH	4 LOC	3 MED	4 VLIKE	**-3.2 MODH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	2 LOW	3 ADJ	1 INCID	2 UNLIKE	**-0.9 VLOW**

10.3.6 Terrestrial ecology

Status quo

Site A is situated in close proximity to Kusile Power Station and is mostly characterised by cultivated land under maize production. Natural habitat occurs in the form of the moist grass and sedge community associated with on-site wetlands, and the adjacent dry mixed grasslands. These areas are important habitat for fauna and flora, some of which maybe Red Data/protected species. These natural areas are part of a larger habitat network that connects with the Wilge River riparian area.

The Kusile Power Station construction site is located immediately north of the Site A, while the proposed New Largo Colliery is located to the west. The site is thus largely surrounded by transformed or highly disturbed land. The proposed conveyor corridor link from Site A to Kusile Power Station is relatively short and will run adjacent to the existing tarred road and the Kusile co-disposal facility.

Status quo impacts to terrestrial ecology will definitely be of a HIGH negative significance, affecting the *development site* in extent. The impact *will occur* and over the long term. The impact risk class is therefore **HIGH**.

Project impact (unmitigated)

Impacts anticipated during the closure phase include:

- Increase in erosion and possible sedimentation of drainage features;
- Increased dust generation; and
- Increased exotic and/or declared Category 1, 2 & 3 invader species.

The closure phase will be characterised by rehabilitation of the last 5 year development area. Mitigation to prevent erosion, sedimentation, dust generation and the establishment of exotic or invader species will thus be required to ensure rehabilitation processes are completed successfully.

Project impacts to terrestrial ecology will be of MODERATE-LOW negative significance, affecting the *development site and adjacent area* in extent. The impacts are *very likely to occur* and will be felt in the long term. The impact risk class therefore range from **MODERATE-LOW** to **MODERATE-HIGH**.

Cumulative impact

Large portions of land immediately surrounding Site A are already transformed or will be transformed in the near future. Kusile Power station and its associated facilities have transformed the land to the north, while the proposed New Largo above-ground mining operation will transform the land to the east of Site A.

Cumulative impacts to terrestrial ecology will be a SEVERE negative significance, affecting the *local area* in extent. The impacts will occur and will be permanent. The impact risk class is therefore **VERY HIGH**.

Mitigation measures

- All mitigation measures identified for implementation during the construction phase will remain applicable during the operational phase of the project.

Residual impact

Residual impacts to the terrestrial ecology will probably be of a HIGH negative significance, affecting the *local area* in extent. The impact will be long term and is *likely to occur*. The impact risk class is therefore **MODERATE-LOW**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below in Table 10-38.

Table 10-38: Closure phase impact assessment matrix: Terrestrial Ecology

Rated By:	*A Zinn*	Site A						
	IMPACT DESCRIPTION	Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	*Phase*							
TerrEcol01	***CLOSURE***							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	5 HIGH	2 DEV	4 LONG	5 OCCUR	**-4.1** **HIGH**
Project Impact 1	Increase in erosion and possible sedimentation of drainage features	Positive	**Possible**	3 MODL	4 LOC	4 LONG	3 LIKE	**-2.4** **MODL**
Project Impact 2	Increased dust generation	Negative	**Probable**	3 MODL	4 LOC	4 LONG	4 VLIKE	**-3.2** **MODH**
Project Impact 3	Increased exotic and/or declared Category 1, 2 & 3 invader species	Negative	**Probable**	3 MODL	3 ADJ	4 LONG	4 VLIKE	**-2.9** **MODL**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Definite**	7 SEV	4 LOC	5 PERM	5 OCCUR	**-5.9** **VHIGH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	5 HIGH	4 LOC	4 LONG	3 LIKE	**-2.9** **MODL**

10.3.7 Aquatic Ecology

Status quo

The main current impacts to surface water include agriculture (primarily livestock grazing with crop production prevailing to the west of the Wilge River) and construction activities related to the Kusile Power Station. Mining-related water quality impacts were evident within the Klipfonteinspruit.

Status quo impacts to aquatic ecology will probably be of a MODERATE-LOW negative significance, affecting the *local area* in extent. The impact *will very likely occur* over the short term. The impact risk class is therefore **MODERATE-LOW**.

Project impact (unmitigated)

All impacts associated with the operational phase will continue to be relevant during the decommissioning and closure phases. In addition, the dismantling of infrastructure will create solid waste and will increase the potential for spills.

The combined weighted project impact to aquatic ecosystems (prior to mitigation) during the Closure and Post-Closure phases will probably be of a MODERATE-LOW to VERY HIGH negative significance, at the *district and local* scale. The impact will act in the long term or will be permanent and will *definitely occur*. The impact risk class is thus **MODERATE-LOW** to **MODERATE-HIGH**.

Cumulative impact

Decline in water quality in the Klipfonteinspruit due to site A is unlikely to significantly impact on the already depauperate aquatic biota within the Klipfonteinspruit. However, where water of poor quality reaches the Wilge River there are likely to be significant impacts. Impacts to the Wilge River will exacerbate impacts to the Olifants River system, potentially pushing these impacts beyond a critical level. Major pollution events (e.g. major spills or structural collapses) could potentially be carried as far as Mozambique, with international implications.

The baseline impacts are considered to be substantial, and additional project impact (if no mitigation measures are implement) will increase the significance of the existing baseline impacts, the cumulative unmitigated impact will probably be of a VERY HIGH negative significance, at the *provincial to national scale*. The impact is *going to happen* and will be permanent. The impact risk class is thus **VERY HIGH**.

Mitigation measures

All general mitigation given in the impact assessment for the construction phase should apply to all phases of the development equally. The following additional mitigation measures apply to the Operational, Closure and Post-Closure phases:

- Pollution Control dams should be designed according to strict safety requirements and should be regularly inspected for leaks, damage or maintenance requirements. Where irregularities are detected, they should be speedily remedied to avoid the risk of structural failure;
- Conveyor and road crossings of wetlands should be regularly inspected for erosion, mechanical problems, leaks or spillages. These should be timeously repaired;

- Should larger spillages occur due to malfunctioning of the conveyor or for any other reason, clean-up of the spillages should be undertaken as soon as possible following the incident. In this regard regular inspection of the entire conveyor route should be undertaken;
- An emergency response plan should be compiled to address structural failures and major accidental spillages;
- It is understood that the Ash Disposal Facility will be irrigated to reduce dust. Dampness should be monitored to ensure a balance is maintained between dust suppression and slumping/collapses due to excessive wetting;
- Storm water should be used for dust suppression to avoid the need for abstraction from natural water resources;
- It is recommended that the catchment-level approach be adopted to manage the Klipfonteinspruit and Wilge River throughout the operational and closure phases;
- Placement of topsoil must be uniformly applied so as to prevent pooling of water;
- Revegetated areas should be regularly inspected for erosion rills and these should be timeously managed so as to prevent structural collapses;
- Deconstruction activities should be confined to a minimum area, which should be clearly demarcated;
- Delineated wetlands should be considered no-go areas during decommissioning and closure;
- Sediment trapping mechanisms should prevent soils from being washed into wetlands; and
- Movement of machinery and vehicles during the infrastructure removal process must be strictly controlled to prevent disturbance to wetland areas.

<u>Residual impact</u>

The residual impact of the development is likely to include loss of wetland areas and declines in water quality and habitat suitability and/or availability. These impacts are likely to be, for the most part, restricted to the local scale. However, it is anticipated that water quality in the Wilge River will decline, even with mitigation. In addition, there is a significant risk that large-scale spills will impact on water quality further afield within the Olifants River system, potentially extending as far as Mozambique.

After mitigation the impacts to aquatic ecosystems will probably be of a MODERATELY-HIGH negative significance, affecting the *district* area in extent. The impact is <u>*very likely to happen*</u> and will occur over the <u>long term</u>. The impact risk class is thus **MODERATELY-HIGH**.

<u>Impact Matrix</u>

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-39.

Table 10-39: Closure phase impact assessment matrix: Aquatic Ecology

Rated By:	N Sharratt	Site A						
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	Phase							
AquaEcol01	CLOSURE							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	Definite	3 MODL	4 LOC	2 SHORT	4 VLIKE	-2.7 MODL
Project Impact 1	Habitat loss due to sedimentation	Positive	Probable	4 MODH	3 ADJ	3 MED	4 VLIKE	-2.9 MODL
Project Impact 2	Habitat loss due to erosion	Negative	Probable	4 MODH	3 ADJ	4 LONG	4 VLIKE	-3.2 MODH
Project Impact 3	Decline in water quality due to ash dust /ash spill into aquatic systems	Negative	Definite	5 HIGH	4 LOC	4 LONG	4 VLIKE	-3.8 MODH
Project Impact 4	Decline in water quality due to spills, leaks, and solid waste	Negative	Definite	3 MODL	3 ADJ	2 SHORT	4 VLIKE	-2.4 MODL
Project Impact 5	Loss of sensitive species and biodiversity due to declines in water quality and habitats	Negative	Possible	6 VHIGH	4 LOC	5 PERM	3 LIKE	-3.3 MODH
Project Impact 6	Impacts to overall integrity of ecologically sensitive and important downstream ecosystems	Negative	Probable	5 HIGH	4 LOC	4 LONG	4 VLIKE	-3.8 MODH
Project Impact 7	Impacts to habitats and biodiversity due to conveyor crossings of the Klipfonteinspruit and	Negative	Possible	4 MODH	5 DIS	4 LONG	4 VLIKE	-3.8 MODH
Project Impact 8	Impacts to downstream reaches due to diversion of the Klipfonteinspruit	Negative	Possible	4 MODH	5 DIS	4 LONG	5 OCCUR	-4.8 HIGH
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	Probable	6 VHIGH	6 PRO	4 LONG	5 OCCUR	-5.9 VHIGH
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	Probable	4 MODH	5 DIS	4 LONG	4 VLIKE	-3.8 MODH

Aquatic ecology impact anticipated during the post-closure phase will be exactly the same as was discussed for the closure phase above. Post-closure impact on aquatic ecology is thus not discussed further.

10.3.8 Wetlands

<u>Status quo</u>

Status quo remains unchanged as described under section 10.1.9.

<u>Project impact (unmitigated)</u>

Impacts relating to the rehabilitation of the ADF are also applicable to the operational phase of the project, as concurrent rehabilitation will take place. Impacts include:

- Water quality deterioration due to seepage out of the ADF;
- Water quality deterioration due to ash dust from the ADF;
- Increased sediment transport into wetlands due to erosion of side slopes;
- Disturbance of wetland habitat;
- Water quality deterioration due to spills and leaks during ongoing construction activities;
- Increased risk of erosion in wetlands;
- Loss of Red Data and protected species; and
- Increase in alien vegetation.

Rehabilitation of the ADF will include the placement of topsoil on the side slopes and crest of the ADF and the establishment of vegetation on the ADF. Surface runoff on the steep side slopes of the ADF is likely to erode the placed topsoil, especially in the initial stages prior to the establishment of sufficient vegetation cover.

Decommissioning activities along the conveyor route and at the ADF could also result in disturbance to the footprint beyond the boundaries of the actual development footprint through temporary stockpiles, laydown areas, contractors camps, uncontrolled driving of machinery etc., resulting in a loss of vegetation cover, increased erosion and impacts on wetlands and Wilge River. Areas disturbed as a result of the decommissioning activities, be it direct or indirect disturbances, are likely to be susceptible to invasion by alien vegetation.

The combined weighted project impact to wetlands (prior to mitigation) will probably be of a VERY HIGH negative significance, affecting the *district area*. The impact will be permanent and *will occur*. The impact risk class is thus **VERY HIGH**.

Cumulative impact

The agricultural activities on site have resulted in wetland habitat degradation, though most of the wetlands still exist and are at least partially functional compared to their reference condition and functions they were likely to support. Changes in water quality and flow characteristics as a consequence of the ADF development will place further pressures and stress on the Klipfonteinspruit wetland system which already is under strain from the existing Kusile developments.

The baseline impacts are considered to be substantial, and additional project impact (if no mitigation measures are implemented) will increase the significance of the existing baseline impacts. The cumulative unmitigated impact will probably be of a VERY HIGH negative significance, affecting the *provincial area* in extent. The impact *is going to happen* and will be permanent. The impact risk class is thus **SEVERE**.

Mitigation measures

All mitigation measures recommended in section 10.1.9 and 10.2.9 will apply. Additional mitigation measures will include:

1) Increased risk of erosion in wetlands

- Limit decommissioning and closure activities to the footprint of the servitude;
- Undertake decommissioning activities during the dry season;
- Complete conveyor decommissioning activities within a single dry season;
- Do not locate any temporary stockpiles or laydown areas in wetlands;
- Restrict access to all wetland areas except where unavoidable; and
- Rehabilitate disturbed areas as soon as possible.

Residual impact

The residual impact of the closure of the ADF will include the permanent loss of wetland habitat, as well as declines in water quality and degradation of downstream wetland habitat. Most of these impacts are expected to be mostly restricted to the local scale, though the possible deterioration of water quality within the Wilge River will increase the extent of the impacts.

The residual impact to wetlands beyond the closure phase of the project will be reduced through mitigation measures but not to within baseline conditions. After mitigation the impacts to wetlands will probably be of a MODERATE-LOW negative significance, affecting the *adjacent area* in extent. The impact is going to happen and will be permanent. The impact risk class is thus **HIGH**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-40.

Table 10-40: Closure phase impact assessment matrix: Wetlands

Rated By:				Site A				
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	Impact Risk
Code	*Phase*							
	Closure							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	3 MODL	2 DEV	4 LONG	5 OCCUR	**-3.3 MODH**
Project Impact 1	Water quality deterioration due to seepage out of the ADF	Negative	**Definite**	6 VHIGH	5 DIS	4 LONG	5 OCCUR	**-5.5 VHIGH**
Project Impact 2	Water quality deterioration due to ash dust	Negative	**Possible**	5 HIGH	6 PRO	4 LONG	5 OCCUR	**-5.5 VHIGH**
Project Impact 3	Increased sediment transport into wetlands	Negative	**Probable**	4 MODH	3 ADJ	3 MED	5 OCCUR	**-3.7 MODH**
Project Impact 4	Disturbance of wetland habitat	Negative	**Probable**	3 MODL	2 DEV	2 SHORT	4 VLIKE	**-2.1 MODL**
Project Impact 5	Water quality deterioration due to spills and leaks	Negative	**Possible**	4 MODH	3 ADJ	2 SHORT	3 LIKE	**-2 LOW**
Project Impact 6	Increased risk of erosion at conveyor crossings	Negative	**Possible**	3 MODL	3 ADJ	4 LONG	4 VLIKE	**-2.9 MODL**
Project Impact 7	Increase in alien vegetation	Negative	**Probable**	4 MODH	2 DEV	4 LONG	4 VLIKE	**-2.9 MODL**
Project Impact 8								
Project Impact 9								
Project Impact 10								
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	6 VHIGH	6 PRO	5 PERM	5 OCCUR	**-6.3 SEV**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	3 MODL	3 ADJ	5 PERM	5 OCCUR	**-4.1 HIGH**

10.3.9 Avifauna

Status quo

The status quo remains the same for the construction, operational and closure phases as discussed in section 10.1.10.

Project impact (unmitigated)

The project impact remains the same for the construction, operational and closure phases as discussed in section 10.1.10.

Cumulative impact

The cumulative impact remains the same for the construction, operational and closure phases as discussed in section 10.1.10.

Mitigation measures

- Mitigation measures remain the same for the construction, operational and closure phases as discussed in section 10.1.10.

Residual impact

The residual remains the same for the construction, operational and closure phases as discussed in section 10.1.10.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-41.

Table 10-41: Closure phase impact assessment matrix: Avifauna

		Site A						
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	Impact Risk
Code	*Phase*							
	CLOSURE							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	6 VHIGH	4 LOC	4 LONG	4 VLIKE	**-4.1** **HIGH**
Project Impact 1	Reduction in species diversity and abundance due to habitat transformation and fragmentation.	Negative	**Probable**	5 HIGH	4 LOC	5 PERM	5 OCCUR	**-5.2** **VHIGH**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	6 VHIGH	4 LOC	5 PERM	5 OCCUR	**-5.5** **VHIGH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	5 HIGH	4 LOC	4 LONG	5 OCCUR	**-4.8** **HIGH**

10.3.10 Bats

Status quo

The status quo remains the same as discussed for the construction phase in section 10.1.11. Status quo impacts on bats will definitely be of a LOW negative significance, affecting the *development and adjacent area* in extent. The impact *will occur* and will be permanent. The impact risk class is therefore **MODERATE-HIGH**.

Project impact (unmitigated)

Project impacts during this phase will include rehabilitation activities on the ADF and along the conveyor route. Rehabilitation is unlikely to create sufficient habitat and roosting sites for bats.

Project impacts on bats will be of a LOW negative significance, affecting the *development and adjacent area* in extent. The impact *will occur* and will be permanent. The impact risk class is therefore **MODERATE-HIGH**.

Cumulative impact

Cumulative impact resulting from the status quo impacts and project impacts will have the same conclusion as impacts resulting solely from project impacts related to construction of the ADF. Airspace over the fields and natural vegetation in site A will be replaced by the starter platform of the ADF. Displacement of the bats from the area will thus also occur gradually as construction and operational phase continues.

Cumulative impacts on bats will be of a LOW negative significance, affecting the *development and adjacent area* in extent. The impact *will occur* and will be permanent. The impact risk class is therefore **MODERATE-HIGH**.

Mitigation measures

- Mitigation measures remain the same for the construction, operational and closure phases as discussed in section 10.1.11.

Residual impact

Further transformation into a hostile area for bats will cease during this phase. However, the environmental restoration is unlikely to have advantages for hawking bats.

Residual impacts on bats will be of a LOW negative significance, affecting the *development and adjacent area* in extent. The impact *will occur* and will be permanent. The impact risk class is therefore **MODERATE-HIGH**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-42.

Table 10-42: Closure phase impact assessment matrix: Bats

Rated By:	*Dr I Rautenbach*			Site A				
	IMPACT DESCRIPTION	Direction of Impact	**Degree of Certainty**	Magnitude	Spatial	Temporal	Probability	**Impact Risk**
Code	*Phase*							
Bats01	***CLOSURE***							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	2 LOW	3 ADJ	5 PERM	5 OCCUR	**-3.7** **MODH**
Project Impact 1	Impact on bats	Negative	**Probable**	2 LOW	3 ADJ	5 PERM	5 OCCUR	**-3.7** **MODH**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	2 LOW	3 ADJ	5 PERM	5 OCCUR	**-3.7** **MODH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	2 LOW	3 ADJ	5 PERM	5 OCCUR	**-3.7** **MODH**

10.3.11 Noise

Status quo

The status quo impacts remain the same as was discussed under the construction and operational phases.

Project impact (unmitigated)

The most significant noise sources during closure include landscaping and rehabilitation activities at the end of the operational phase.

During the closure phase of the ash disposal facility, noise impacts are considered LOW in magnitude, limited to the *isolated areas* of construction, short in duration and *likely to occur*, resulting in a negative **LOW** impact risk.

Cumulative impact

During the closure phase of the ash disposal facility, cumulative noise impacts are considered LOW in magnitude, limited to the *isolated areas* of construction, short in duration and *likely to occur*, resulting in a negative **LOW** impact risk.

Mitigation measures

- Mitigation measures remain the same for the construction, operational and closure phases

Residual impact

During the closure phase of the ash disposal facility, residual noise impacts are considered LOW in magnitude, limited to the *isolated areas* of construction, short in duration and *could occur*, resulting in a negative **LOW** impact risk.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-43.

Table 10-43: Closure phase impact assessment matrix: Noise

Rated By:	N von Reiche			Site A				
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	Phase							
Noise01	CLOSURE							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	Definite	2 LOW	2 DEV	3 MED	5 OCCUR	-2.6 MODL
Project Impact 1	Environmental noise impacts as a result of the project	Negative	Probable	2 LOW	1 ISO	2 SHORT	3 LIKE	-1.1 LOW
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	Probable	2 LOW	1 ISO	2 SHORT	3 LIKE	-1.1 LOW
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	Probable	2 LOW	1 ISO	2 SHORT	3 LIKE	-1.1 LOW

No noise impacts are anticipated as a result of the ADF development during post-closure phase, therefore noise is not addressed in the post-closure impact statement

10.3.12 Visual

Status quo

The proposed project is located in a landscape of moderate value that, by the time of the implementation of the Project, already includes negative visual elements.

Project impact (unmitigated)

After rehabilitation and the correct and effective implementation of the proposed mitigation measures, the negative impact could be reduced even though the structure would remain permanently and become part of the landscape.

Cumulative impact

The presence of the partially rehabilitated ADF will add to the cumulative negative effect on the visual quality of the landscape.

Mitigation measures

- Dust suppression techniques should be in place at all times during the rehabilitation process;
- The ADF should be covered with the appropriate system ending with a good layer of topsoil on top where after it should be re-vegetated;
- Only use indigenous plant species; and
- Ensure that all plant material has properly established during the maintenance phase.

Residual impact

The body of the ADF would remain after the operational life time. However it can be rehabilitated to blend in with the natural environmental setting to reduce the contrast between the ADF and the surrounding landscape character.

Impact Matrix

The impacts identified and discussed above have been rated and presented below in Table 10-44.

Table 10-44: Closure phase impact assessment matrix: Visual

Rated By:	M Cilliers / M Vosloo	Site A						
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	Phase							
Visual01	CLOSURE & POST-CLOSURE							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	Definite	3 MODL	3 ADJ	3 MED	3 LIKE	-2 LOW
Project Impact 1	Visual impact on residents within and travellers through the study area	Positive	Probable	3 MODL	4 LOC	5 PERM	5 OCCUR	-4.4 HIGH
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	Probable	3 MODL	4 LOC	5 PERM	5 OCCUR	-4.4 HIGH
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	Probable	2 LOW	4 LOC	5 PERM	5 OCCUR	-4.1 HIGH

10.3.13 Social

Status quo

Some of the communities in the area are characterised by poverty and unemployment.

Project impact (unmitigated)

Closure of the ash disposal facility would in all likelihood lead to job losses if the employees could not be accommodated elsewhere in the organisation. There can also be a loss of livelihood of those who depended on the project to make a living, but were not necessarily employed by Eskom. It must be noted that it is almost impossible to anticipate impacts more exactly so far in the future and the social environment in the area may at the time look very different from the status quo.

Cumulative impact

Should the status quo of the social environment still be valid at the time of closure, the additional project impact without mitigation measures will be probably be of a MODERATELY-HIGH negative significance affecting the area on a *local level*. Some of the impacts will *definitely happen* and most of the will extend beyond the life of the operation. The impact risk class is **MODERATELY-HIGH**.

Mitigation measures

The following mitigation measures are suggested:

- Prepare employees for closure phase well in advance. Employee assistance programme can assist with mental and physical preparation of employees;
- Assist staff with finding alternative employment;
- Give referrals to regular suppliers, especially SMME's; and
- Follow IFC retrenchment guidelines.

Residual impact

Most of the impacts mentioned cannot be reversed through mitigation measures, but through effective mitigation measures, their impacts can be softened. It is very important that mitigation measures must be implemented consistently and according to the ways prescribed. The identified impacts will still be there, but to a lesser extent. With mitigation, the impacts will possibly be of a MODERATELY-HIGH negative significance, with effects experienced on a *local level*. The impacts are *very likely to happen* and are likely to last just beyond the life of the operation. The impact risk is thus **MODERATELY-HIGH**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-45.

Table 10-45: Closure phase impact assessment matrix: Social

Rated By:	*S-M Aucamp*	Site A						
	IMPACT DESCRIPTION	Direction of Impact	**Degree of Certainty**	Magnitude	Spatial	Temporal	Probability	**Impact Risk**
Code	*Phase*							
Social01	***CLOSURE***							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	3 MODL	1 ISO	1 INCID	3 LIKE	**-1.1** **LOW**
Project Impact 1	Loss of employment	Negative	**Definite**	4 MODH	4 LOC	4 LONG	5 OCCUR	**-4.4** **HIGH**
Project Impact 2	Loss of livelihoods	Negative	**Probable**	4 MODH	4 LOC	4 LONG	5 OCCUR	**-4.4** **HIGH**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	4 MODH	4 LOC	4 LONG	4 VLIKE	**-3.5** **MODH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	4 MODH	4 LOC	3 MED	4 VLIKE	**-3.2** **MODH**

10.3.14 Traffic

Status quo

Site A can be easily accessed off existing roads. The existing traffic recorded is much higher than anywhere else between the Kusile construction access and the Kusile Road & R545 intersection due to Kusile Power Station construction activities. The impact will be arrested with the mitigation measure proposed.

The overall status quo impact's significance is MODERATE-LOW, the spatial scale is limited to areas *adjacent to the site*, duration is medium term and the impact is *likely to occur*. The impact risk is thus **LOW**.

Project impact (unmitigated)

This traffic relates to the rehabilitation of the facility. The traffic expected in this scenario is negligible and will therefore have no impact on the road network surrounding the site. The lifespan of the facility is the same as those of the Kusile Power Station and the New Largo mine therefore the operational traffic of all three by then will have decreased.

The project impact significance is VERY LOW. The spatial scale will be limited to the *development footprint*. The duration will be medium term and is *unlikely to occur*. The impact risk is thus **VERY LOW**.

Cumulative impact

The cumulative impact takes into account the close proximity and association of site A to Kusile Road. The cumulative rating further takes cognisance of the Kusile Power Station and the proposed New Largo traffic and mitigation measures proposed in their respective reports.

The project impact significance is MODERATE-LOW. The spatial scale will be limited to the *development footprint and adjacent to the site*. The duration will be medium term and is *likely to occur*. The impact risk is thus **LOW**.

Mitigation measures

1. Pointsmen to be deployed at both the Kusile Power Station and New Largo Mine Access during the construction phase to control the traffic so that the traffic from both developments can be afforded some gaps on Kusile Road.

Residual impact

The status quo of the study area is LOW even though the existing traffic impacts resulting from the construction phase of the Kusile Power Station. Traffic during the closure phase will be much diminished at the site. The proposed mitigation will improve the flow at intersections affected by the developments within the study area. The significance of the impact after mitigation will be MODERATE-LOW, spatial scale will be limited to intersections *development footprint and adjacent to the site*, the impact will occur in the medium term. The impact is *unlikely to occur* with the proposed mitigation implemented. The degree of certainty is probable and the impact risk is low. The impact risk is thus **LOW**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-46.

Table 10-46: Closure phase impact assessment matrix: Traffic

Rated By:	N Miya / A Brislin	Site A						
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	Phase							
Traffic01	CLOSURE							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	3 MODL	3 ADJ	3 MED	3 LIKE	**-2** **LOW**
Project Impact 1	Additional delays at intersections due to additional traffic generated by the development	Negative	**Probable**	1 VLOW	1 ISO	2 SHORT	2 UNLIKE	**-0.6** **VLOW**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	3 MODL	3 ADJ	3 MED	3 LIKE	**-2** **LOW**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	3 MODL	3 ADJ	3 MED	2 UNLIKE	**-1.3** **LOW**

10.4 POST-CLOSURE PHASE

The Post-Closure phase will only be done at the end of the power station life and rehabilitation phase. It is consequently very difficult to predict possible impacts and mitigation measures for activities more than 60 years into the future. At closure of the ADF appropriate measures and legal requirements, in line with best practice standards and guidelines of the time, will be implemented. However, if the current legislation and best practise standards / guidelines still prevail at the closure and decommissioning stage of the ADF, the mitigation measures discussed in the following sections will be appropriate.

10.4.1 Air quality

Status quo

The status quo remains as was discussed in section 10.1.1 for the construction phase.

Project impact (unmitigated)

Impact on air quality during the post-closure phase will include dust generated from rehabilitation processes and will not impact the ambient air quality more than the status quo situation.

Cumulative impact

The cumulative impact will not exceed the status quo ambient air quality.

Mitigation measures

- Impacts remain the same as recommended in section 10.1.1 for the construction phase.

Residual impact

The residual impact on air quality during post-closure is expected not to exceed the status quo impact. The impacts are *very likely* to be of MODERATE-HIGH significance at a *district* scale over the long-term, resulting in **MODERATE-HIGH** impact risk. However, the impact of dust outfall on adjacent land is **LOW**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-47.

Table 10-47: Post-Closure phase impact assessment matrix: Air Quality

Rated By:	*Dr T Bird*	Site A						
IMPACT DESCRIPTION		Direction of Impact	**Degree of Certainty**	Magnitude	Spatial	Temporal	Probability	**Impact Risk**
Code	*Phase*							
AirQual01	***POST-CLOSURE***							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	4 MODH	5 DIS	4 LONG	4 VLIKE	**-3.8** **MODH**
Project Impact 1	Impacted area where dust-fall >400 $mg.m^{-2}.day^{-1}$	Negative	**Probable**	2 LOW	3 ADJ	3 MED	2 UNLIKE	**-1.2** **LOW**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	4 MODH	5 DIS	4 LONG	4 VLIKE	**-3.8** **MODH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	4 MODH	5 DIS	4 LONG	4 VLIKE	**-3.8** **MODH**

10.4.2 Groundwater

Status quo

If no ash is disposed on Site A, the different man-made activities and natural processes that lead to the established baseline groundwater conditions will prevail. Contaminant transport from upstream of the Klipfonteinspruit would probably continue downstream if no remediation action is taken. The water elevations would also probably continue to decrease. The analysis of the monitoring data (water levels) at Kusile power station shows an average annual decrease of 0.77m. The model simulation results in a maximum drawdown of 2.5 m over 3 years.

Impacts to the groundwater resources status quo will definitely be of a MODERATE-HIGH negative significance, affecting the *local area* in extent. The impact will *occur* and will be medium term. The impact risk class is however still **HIGH**.

Project impact (unmitigated)

The following aspects may impact the groundwater conditions (quality and quantity) and have been quantified for post-closure phase:

- Groundwater pollution due to leachate (leak) from the ADF, contaminated water trenches and other contaminated water storage facilities;
- Reduction of infiltration rates; and
- Alteration of the groundwater flow system due to groundwater pumping (different uses).

The overall (combined) impact risks at the closure of the coal Ash Disposal Facility would have on site A have been rated to be a LOW impact risk. The impacts risk (MODERATELY-LOW) associated with deterioration of groundwater quality due to waste, and spills related to closure activities are of most concern. The installation of a linear low-density polyethylene (LLDPE) geomembrane at the top soil layers will reduce possible groundwater pollution due to seepage, from the ADF.

Overall project impacts to the groundwater resources will range between VERY LOW to MODERATE-LOW negative significance, affecting the *local and adjacent area* in extent.

Cumulative impact

The main cumulative impacts of concern are the impacts from New Largo. Necessary groundwater dewatering would probably be implemented, which might create a cone of groundwater depression around the open pit at New Largo. The groundwater flow regime would therefore be altered, and flow between Site A and New Largo would probably be reversed toward the New Largo. This would help in containing any pollution associated with open cast mining, at New Largo, but will result in the spreading of the pollution from the 60 years ADF towards the south of Site A. At the 60 years horizon, New Largo dewatering will result in a plume expansion of an extra 800 m (further than without dewatering) at the south of site A. This would involve an extra 2.4 km^2 polluted area at the south of site A.

Cumulative impacts to the groundwater resources will probably be of a MODERATE-HIGH negative significance, affecting the *local area* in extent. The impact is *very likely to occur* and will occur in the medium term. The impact risk class is therefore **MODERATE-HIGH**.

Mitigation measures

- Rehabilitation of the ADF should start immediately after the deposition of the last coal ash.

Residual impact

After the application of the mitigation measures, the groundwater risk impacts would be successfully reduced. The reduced impact risks together with the base line (status quo) impacts risk will constitute the residual risk impacts.

Residual impacts to the groundwater resources will probably be of a LOW negative significance, affecting the *development site and adjacent area* in extent. The impact would be limited to isolated incidences and would be *unlikely to occur*. The impact risk class is therefore **VERY LOW**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-48.

Table 10-48: Post-Closure phase impact assessment matrix: Groundwater

Rated By:	P Ahokpossi	Site A						
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	Phase							
GroundW01	POST-CLOSURE							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	Definite	4 MODH	4 LOC	3 MED	5 OCCUR	-4.1 HIGH
Project Impact 1	Reduction in infiltration rates	Positive	Possible	4 MODH	3 ADJ	2 SHORT	3 LIKE	-2 LOW
Project Impact 2	Groundwater pollution due to seepage, lewachate infiltration from ADF, contaminated water trenches and PCDs	Negative	Definite	4 MODH	3 ADJ	4 LONG	3 LIKE	-2.4 MODL
Project Impact 3	Alteration of the groundwater flow system due to groundwater pumping	Negative	Probable	2 LOW	3 ADJ	2 SHORT	2 UNLIKE	-1 VLOW
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	Probable	4 MODH	3 ADJ	4 LONG	4 VLIKE	-3.2 MODH
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	Probable	2 LOW	1 ISO	1 INCID	2 UNLIKE	-0.6 VLOW

10.4.3 Terrestrial ecology

Status quo

Site A is situated in close proximity to Kusile Power Station and is mostly characterised by cultivated land under maize production. Natural habitat occurs in the form of the moist grass and sedge community associated with on-site wetlands, and the adjacent dry mixed grasslands. These areas are important habitat for fauna and flora, some of which maybe Red Data/protected species. These natural areas are part of a larger habitat network that connects with the Wilge River riparian area.

The Kusile Power Station construction site is located immediately north of the Site A, while the proposed New Largo Colliery is located to the west. The site is thus largely surrounded by transformed or highly disturbed land. The proposed conveyor corridor link from Site A to Kusile Power Station is relatively short and will run adjacent to the existing tarred road and the Kusile co-disposal facility.

Status quo impacts to terrestrial ecology will definitely be of a HIGH negative significance, affecting the *development site* in extent. The impact *will occur* and over the long term. The impact risk class is therefore **HIGH**.

Project impact (unmitigated)

Impacts anticipated during the post-closure phase will be a continuation of the impacts identified during the closure phase. There include:

- Increase in erosion and possible sedimentation of drainage features;
- Increased dust generation; and
- Increased exotic and/or declared Category 1, 2 & 3 invader species.

The post-closure phase will be characterised by monitoring of the rehabilitated area on the ADF and along the conveyor route within the development area. Therefore, mitigation to prevent erosion, sedimentation, dust generation and the establishment of exotic or invader species will still be required to ensure rehabilitation processes are completed successfully. Monitoring of the rehabilitated areas must continue until photographic evidence of successful rehabilitation can be produced for assessment by the regulating authority.

Project impacts to terrestrial ecology will be of MODERATE-LOW negative significance, affecting the *development site and adjacent area* in extent. The impacts are *very likely to occur* and will be felt in the long term. The impact risk class therefore range from **MODERATE-LOW** to **MODERATE-HIGH**.

Cumulative impact

It is near impossible to identify cumulative and future impacts at the closure of the ADF facility in 60 years from the present. The status quo indicated that large portions of land immediately surrounding Site A are already transformed or will be transformed in the near future. Kusile Power station and its associated facilities have transformed the land to the north, while the proposed New Largo above-ground mining operation will transform the land to the east of Site A. Future impacts may thus contribute greatly to the impact on terrestrial ecology of the area. However, given the information known at this time the cumulative impacts to terrestrial ecology is expected be a HIGH negative significance, affecting the *local area* in extent. The impacts *will occur* and will be permanent. The impact risk class is therefore **VERY HIGH**.

Mitigation measures

- All mitigation measures identified for implementation during the construction phase will remain applicable during the operational phase of the project.

Residual impact

Residual impacts to the terrestrial ecology will probably be of a HIGH negative significance, affecting the *local area* in extent. The impact will be long term and is *likely to occur*. The impact risk class is therefore **MODERATE-LOW**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below in Table 10-49.

Table 10-49: Post-closure phase impact assessment matrix: Terrestrial Ecology

Rated By:	*A Zinn*	Site A						
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	*Phase*							
TerrEcol01	***POST-CLOSURE***							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	5 HIGH	2 DEV	4 LONG	5 OCCUR	**-4.1** **HIGH**
Project Impact 1	Increase in erosion and possible sedimentation of drainage features	Positive	**Possible**	3 MODL	4 LOC	4 LONG	3 LIKE	**-2.4** **MODL**
Project Impact 2	Increased dust generation	Negative	**Probable**	3 MODL	4 LOC	4 LONG	4 VLIKE	**-3.2** **MODH**
Project Impact 3	Increased exotic and/or declared Category 1, 2 & 3 invader species	Negative	**Probable**	3 MODL	3 ADJ	4 LONG	4 VLIKE	**-2.9** **MODL**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Definite**	5 HIGH	4 LOC	5 PERM	5 OCCUR	**-5.2** **VHIGH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	5 HIGH	4 LOC	4 LONG	3 LIKE	**-2.9** **MODL**

10.4.4 Wetlands

Status quo

Status quo remains unchanged as described under section 10.1.9.

Project impact (unmitigated)

These impacts have been discussed within the operational and closure phases of the project. Impacts expected to materialise during the post-closure phase of the ADF include:

- Water quality deterioration due to seepage out of the ADF;
- Water quality deterioration due to ash dust from the ADF;
- Increased sediment transport into wetlands due to erosion of side slopes; and
- Increase in alien vegetation.

The combined weighted project impact to wetlands (prior to mitigation) will probably be of a VERY HIGH negative significance, affecting the *district area*. The impact will be permanent and *will occur*. The impact risk class is thus **VERY HIGH**.

Cumulative impact

Cumulative impacts on wetlands during post-closure phase will be the same as was identified for the closure phase in section 10.3.8. The baseline impacts are considered to be substantial, and additional project impact (if no mitigation measures are implemented) will increase the significance of the existing baseline impacts. The cumulative unmitigated impact will probably be of a VERY HIGH negative significance, affecting the *provincial area* in extent. The impact *is going to happen* and will be permanent. The impact risk class is thus **SEVERE**.

Mitigation measures

Mitigation measures recommended for the post-closure phase will be identical to those recommended during the closure phase in section 10.3.8.

Residual impact

The residual impact to wetlands beyond the closure phase of the project will be reduced through mitigation measures but not to within baseline conditions. After mitigation the impacts to wetlands will probably be of a MODERATE-LOW negative significance, affecting the *local area* in extent. The impact *very likely to happen* and will be long term. The impact risk class is thus **MODERATE-HIGH**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-50.

Table 10-50: Post-Closure phase impact assessment matrix: Wetlands

Rated By:				Site A				
	IMPACT DESCRIPTION	Direction of Impact	**Degree of Certainty**	Magnatude	Spatial	Temporal	Probability	**Impact Risk**
Code	*Phase*							
	Post-closure							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	3 MODL	2 DEV	4 LONG	5 OCCUR	**-3.3 MODH**
Project Impact 1	Water quality deterioration due to seepage	Negative	**Probable**	5 HIGH	6 PRO	4 LONG	4 VLIKE	**-4.4 HIGH**
Project Impact 2	Water quality deterioration due to ash deposition in wetlands	Negative	**Unsure**	4 MODH	4 LOC	4 LONG	4 VLIKE	**-3.5 MODH**
Project Impact 3	Increased sedimentation in wetlands	Negative	**Probable**	4 MODH	4 LOC	4 LONG	4 VLIKE	**-3.5 MODH**
Project Impact 4	Increase in alien vegetation	Negative	**Probable**	4 MODH	2 DEV	4 LONG	4 VLIKE	**-2.9 MODL**
Project Impact 5								
Project Impact 6								
Project Impact 7								
Project Impact 8								
Project Impact 9								
Project Impact 10								
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	6 VHIGH	5 DIS	5 PERM	5 OCCUR	**-5.9 VHIGH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	4 MODH	4 LOC	4 LONG	4 VLIKE	**-3.5 MODH**

10.4.5 Avifauna

Status quo

The status quo remains the same for the construction, operational and closure phases as discussed in section 10.1.10.

Project impact (unmitigated)

The impact to the habitat (grasslands and wetlands) on the site itself will be permanent as pre-development land capability will not be restored, the best that can be hoped to achieve is a post closure land capability that will be some form of restored grassland. In this regard there will be a loss of avifaunal habitat on the site itself.

The combined weighted impact on avifauna will definitely be of a HIGH negative significance affecting the *local area*. The impact will be permanent and *is going to happen*. The impact risk class during construction is thus **VERY HIGH**.

Cumulative impact

The existing and anticipated future impacts as outlined in the above status quo section combined with the impacts as a result of construction, operation and closure of the 60 year ash disposal facility will definitely have a VERY HIGH cumulative impact. This impact will affect the bird population in the *local area*. The impact *is going to happen* and will be permanent. The impact risk class is thus **VERY HIGH**.

Mitigation measures

- Establish off-sets i.e. conserve and improve suitable alternative grassland and wetland habitat in the region in order to improve and provide additional suitable habitat for impacted avifaunal species. Off-set mitigation should be concentrated in one specific area e.g. on site C or a suitable alternate locality;
- Contribute towards existing grassland and wetland conservation initiatives already active in the region;
- The proposed recommendations of the Terrestrial Ecology and Wetland Specialist Study for the Environmental Management Programme should be strictly applied to minimise the impact on the natural environment, specifically on the remaining wetlands and natural grasslands, as this is the most important bird habitat types in the study area.
- Maximum use should be made of existing infrastructure (e.g. access roads) to minimise the further fragmentation of natural grassland and wetland areas.

Residual impact

The residual impact to avifauna beyond the closure phase of the project will be reduced through mitigation measures but not to within baseline conditions. After mitigation the impacts to avifauna will definitely be of a HIGH negative significance, affecting the *development area* in extent. The impact will be long term impact and *is going to happen*. The impact risk class is thus **HIGH**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-51.

Table 10-51: Post-Closure phase impact assessment matrix: Avifauna

IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Site A Magnatude	Spatial	Temporal	Probability	Impact Risk
Code	*Phase*							
	POST CLOSURE							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	6 VHIGH	4 LOC	4 LONG	4 VLIKE	**-4.1 HIGH**
Project Impact 1	Reduction in species diversity and abundance due to habitat transformation and fragmentation.	Negative	**Probable**	5 HIGH	4 LOC	5 PERM	5 OCCUR	**-5.2 VHIGH**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	6 VHIGH	4 LOC	5 PERM	5 OCCUR	**-5.5 VHIGH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	5 HIGH	2 DEV	4 LONG	5 OCCUR	**-4.1 HIGH**

10.4.6 Bats

<u>Status quo</u>

The status quo remains the same as discussed for the construction phase in section 10.1.11. Status quo impacts on bats will definitely be of a LOW negative significance, affecting the *development and adjacent area* in extent. The impact <u>*will occur*</u> and will be <u>permanent</u>. The impact risk class is therefore **MODERATE-HIGH**.

<u>Project impact (unmitigated)</u>

Project impacts during this phase will include maintenance activities on the ADF and along the conveyor route. Rehabilitation is unlikely to create sufficient habitat and roosting sites for bats.

Project impacts on bats will be of a LOW negative significance, affecting the *development and adjacent area* in extent. The impact <u>*will occur*</u> and will be <u>permanent</u>. The impact risk class is therefore **MODERATE-HIGH**.

<u>Cumulative impact</u>

Cumulative impacts on bats will be of a LOW negative significance, affecting the *development and adjacent area* in extent. The impact <u>*will occur*</u> and will be <u>permanent</u>. The impact risk class is therefore **MODERATE-HIGH**.

<u>Mitigation measures</u>

- Mitigation measures remain the same for the construction, operational and closure phases as discussed in section 10.1.11.

Residual impact

The restoration process will be completed. However, it cannot be predicted whether the planted grass will support invertebrates, and whether bats will return to hawk for such areal prey 90 meters above the surrounding plains.

Residual impacts on bats will be of a LOW negative significance, affecting the *development and adjacent area* in extent. The impact *will occur* and will be permanent. The impact risk class is therefore **MODERATE-HIGH**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-52.

Table 10-52: Post-Closure phase impact assessment matrix: Bats

Rated By:	Dr I Rautenbach			Site A				
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	Phase							
Bats01	POST-CLOSURE							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	Definite	2 LOW	3 ADJ	5 PERM	5 OCCUR	-3.7 MODH
Project Impact 1	Impact on bats	Negative	Probable	2 LOW	3 ADJ	5 PERM	5 OCCUR	-3.7 MODH
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	Probable	2 LOW	3 ADJ	5 PERM	5 OCCUR	-3.7 MODH
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	Probable	2 LOW	3 ADJ	5 PERM	5 OCCUR	-3.7 MODH

10.4.7 Visual

Status quo

The proposed project is located in a landscape of moderate value that, by the time of the implementation of the Project, already includes negative visual elements.

Project impact (unmitigated)

After rehabilitation and closure, the negative impact could be reduced even though the structure would remain permanently and become part of the landscape.

Cumulative impact

The occurrence of the rehabilitated ADF will add to the cumulative negative effect on the visual quality of the landscape.

Mitigation measures

- Dust suppression techniques should be in place at all times during the rehabilitation process;
- The ADF should be covered with the appropriate system ending with a good layer of topsoil on top where after it should be re-vegetated;
- Only use indigenous plant species; and
- Ensure that all plant material has properly established during the maintenance phase.

Residual impact

The body of the ADF would remain after the operational life time. However it can be rehabilitated to blend in with the natural environmental setting to reduce the contrast between the ADF and the surrounding landscape character.

Impact Matrix

The impacts identified and discussed above have been rated and presented below in Table 10-53.

Table 10-53: Closure phase impact assessment matrix: Visual

Rated By:	M Cilliers / M Vosloo	Site A						
IMPACT DESCRIPTION		Direction of Impact	**Degree of Certainty**	Magnitude	Spatial	Temporal	Probability	**Impact Risk**
Code	*Phase*							
Visual01	***CLOSURE & POST-CLOSURE***							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	3 MODL	3 ADJ	3 MED	3 LIKE	**-2** **LOW**
Project Impact 1	Visual impact on residents within and travellers through the study area	Positive	**Probable**	3 MODL	4 LOC	5 PERM	5 OCCUR	**-4.4** **HIGH**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	3 MODL	4 LOC	5 PERM	5 OCCUR	**-4.4** **HIGH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	2 LOW	4 LOC	5 PERM	5 OCCUR	**-4.1** **HIGH**

10.4.8 Social

Status quo

Some of the communities in the area are characterised by poverty and unemployment. Property values may already have been affected by developments in the area.

Project impact (unmitigated)

Those who experienced job losses and loss of livelihoods as identified in the closure phase will in all likelihood still be experiencing economic hardship. It must be noted that it is almost impossible to anticipate impacts more exactly so far in the future and the social environment in the area may at the time look very different from the status quo.

Cumulative impact

Should the status quo of the social environment still be valid at the time of closure, the additional project impact without mitigation measures will be probably be of a MODERATELY-HIGH negative significance affecting the area on a *local level*. These impacts will *very likely happen* and most of the will extend beyond the life of the operation. The impact risk class is **MODERATELY-HIGH**.

Mitigation measures

The following mitigation measures are suggested:

- Redeploy staff where possible;
- Assist staff with finding alternative employment;
- Give referrals to regular suppliers, especially SMME's; and
- Follow IFC retrenchment guidelines.

Residual impact

Most of the impacts mentioned cannot be reversed through mitigation measures, but through effective mitigation measures, their impacts can be softened. It is very important that mitigation measures must be implemented consistently and according to the ways prescribed. The identified impacts will still be there, but to a lesser extent. With mitigation, the impacts will possibly be of a MODERATELY-HIGH negative significance, with effects experienced on a *local level*. The impacts are *very likely to happen* and are likely to last just beyond the life of the operation. The impact risk is thus **MODERATELY-HIGH**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented below Table 10-54.

Table 10-54: Post-Closure phase impact assessment matrix: Social

Rated By:	*S-M Aucamp*	Site A						
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	*Phase*							
Social01	***POST-CLOSURE***							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	**Definite**	3 MODL	1 ISO	1 INCID	3 LIKE	**-1.1** **LOW**
Project Impact 1	Loss of employment	Negative	**Definite**	4 MODH	4 LOC	4 LONG	5 OCCUR	**-4.4** **HIGH**
Project Impact 2	Loss of livelihoods	Negative	**Probable**	4 MODH	4 LOC	4 LONG	5 OCCUR	**-4.4** **HIGH**
Project Impact 3	Decrease in property values	Negative	**Possible**	4 MODH	3 ADJ	4 LONG	3 LIKE	**-2.4** **MODL**
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	**Probable**	4 MODH	4 LOC	4 LONG	4 VLIKE	**-3.5** **MODH**
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	**Probable**	4 MODH	4 LOC	3 MED	4 VLIKE	**-3.2** **MODH**

10.4.9 Traffic

Status quo

Site A can be easily accessed off existing roads. The existing traffic recorded is much higher than anywhere else between the Kusile construction access and the Kusile Road & R545 intersection due to Kusile Power Station construction activities. The impact will be arrested with the mitigation measure proposed.

The overall status quo impact's significance is MODERATE-LOW, the spatial scale is limited to areas *adjacent to the site*, duration is medium term and the impact is *likely to occur*. The impact risk is thus **LOW**.

Project impact (unmitigated)

This scenario will have no impact on the road network and intersections close to the sites.

Cumulative impact

The cumulative impact only takes into account the close proximity and association of site A to Kusile Road at resent. The cumulative rating further takes cognisance of the Kusile Power Station and the proposed New Largo traffic and mitigation measures proposed in their respective reports.

The project impact significance is MODERATE-LOW. The spatial scale will be limited to the *development footprint and adjacent to the site*. The impact will occur in isolated incidents and is *unlikely to occur*. The impact risk is thus **LOW**.

Mitigation measures

2. Pointsmen to be deployed at both the Kusile Power Station and New Largo Mine Access during the construction phase to control the traffic so that the traffic from both developments can be afforded some gaps on Kusile Road.

Residual impact

The proposed mitigation will improve the flow at intersections affected by the developments within the study area. The significance of the impact after mitigation will be MODERATE-LOW, spatial scale will be limited to intersections *development footprint and adjacent to the site*, the impact will occur in isolated incidents. The impact is *unlikely to occur* with the proposed mitigation implemented. The degree of certainty is probable and the impact risk is low. The impact risk is thus **VERY LOW**.

Impact Matrix

The impacts identified and discussed above have been rated according to the impact assessment methodology described in section 3.2.2, and presented in Table 10-55 below.

Table 10-55: Post-Closure phase impact assessment matrix: Traffic

Rated By:	N Miya / A Brislin	Site A						
IMPACT DESCRIPTION		Direction of Impact	Degree of Certainty	Magnitude	Spatial	Temporal	Probability	Impact Risk
Code	Phase							
Traffic01	POST-CLOSURE							
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	Negative	Definite	3 MODL	3 ADJ	1 INCID	2 UNLIKE	-1 VLOW
Project Impact 1	Additional delays at intersections due to additional traffic generated by the development	Negative	Probable	0 NO				
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	Negative	Probable	3 MODL	3 ADJ	1 INCID	2 UNLIKE	-1 VLOW
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	Negative	Probable	3 MODL	3 ADJ	1 INCID	2 UNLIKE	-1 VLOW

10.4.10 Overall cumulative impacts within site A

The cumulative impacts resulting either from the cumulative result from different impacts within the same geographical location or from similar impacts occurring within the local or regional context is discussed in this section.

10.4.10.1 Cumulative impacts resulting from different impacts within the same geographic location include impacts on water resources through:

- sterilisation of wetland areas,
- potential sedimentation and turbidity impacts from construction activities,
- possible reduction in surface water runoff
- potential contamination of ground water resources through liner leakage, and
- potential spillage of dirty water from PCDs or canals.

The impacts above will all impact or contribute to deterioration of surface and groundwater resources, and ultimately the Wilge River if mitigation measures are not implemented and managed pro-actively. The strategy to manage this cumulative impact is through implementation of the proposed mitigation management and monitoring plan that has been included in this FEIR and EMPr. The benefit of having the preferred Site A being located close to the Kusile Power Station construction area, co-disposal facility, New Largo Colliery and other existing agricultural and industrial activities within the sub-catchment in question, is that a comprehensive and encompassing water resource management plan (as part of the EMPr) can be implemented to manage temporary and permanent impacts associated with these developments. This includes addressing many of the fringe impacts from neighbouring activities through such an approach that may otherwise have been managed poorly or not at all. This water resource management plan should clearly distinguish between impacts originating on Eskom property with off-site impacts upstream or downstream of the Kusile Power Station. With this approach users within the sub-catchment that pollutes can be identified and corrective action taken. As some of these activities have not commenced yet, or just starting e.g. New Largo and proposed Kusile ADF, the EMPr must for the basis of the water resource management plan which will be developed and refined over time as future activities comes online.

10.4.10.2 Cumulative impacts resulting from similar impacts within the local or regional context include ash and dust fallout impacts from the ADF contributing to air quality impacts in the region.

The cumulative impact of proposed ADF when dust emissions are unmitigated is likely to result in regular exceedances of the NAAQS for PM10 and PM2.5. The current sources of particulate emissions in the vicinity of the Kusile Power Station include mining, other power stations and agriculture. The Kusile Power Station falls within the Highveld Priority Area, near to the eMalahleni Hot Spot. The eMalahleni Hot Spot is an area of already poor air quality where the NAAQS for daily PM10 concentrations are frequently exceeded.

The air quality specialist recommended the following mitigation and management measures:

- Regular wetting of the exposed areas of disposed ash
- Stabilisation of the exposed areas of ash with a top-soil covering
- Wetting of exposed top-soil for additional mitigation of dust emissions from the top-soil layer
- Re-vegetation of ash disposal facility through application of a deeper top-soil layer and seeding with appropriate grass seeds.

Based on the air quality specialist's assessment the following was concluded: "The residual impact of the ash disposal facility with frequent watering and progressive re-vegetation of the exposed areas the impact of the ash disposal facility is predicted to reduce substantially. The impacts are reduced to within NAAQS, even on-site. The impacts are thus, similar to the status quo impacts, very-likely to be of MODERATE-HIGH significance at a district scale over the long-term, resulting in MODERATE-HIGH impact risk."

The EMPr highlights mitigation measures that must be implemented to ensure air quality pollution is minimised to within acceptable levels.

11 EAP OPINION

The reasoned opinion of the principal EAP who conducted this assessment is provided below.

Should this project proceed?

The EAP recommends the implementation of the project for the following reasons:

1. The National Environmental Management Act (No 107 of 1998) and National Environmental Management: Waste Act Kusile (No 59 of 2008),l amongst others, are the principle piece of legislation governing the disposal of a hazardous waste to land fill and protecting the environment from all adverse impacts of such developments. These acts propagate that if the produced waste stream cannot be disposed to landfill in an environmentally responsible manner, the activity cannot be condoned.
2. A comprehensive assessment of the waste stream through consideration of the waste disposal hierarchy was undertaken. Conclusion of this process indicated that there is no alternative means available for the ~~disposal~~ management of the ash waste stream, thus ~~storage or~~ disposal on land is the only feasible solution for this waste stream;
3. The Kusile Power Station is currently being constructed ~~and is earmarked for "first fire" towards the middle of 2015~~. The ~~Kusile~~ Power Station employs a dry cooling technology to minimise the release of fly ash into the environment through capturing fly and bottom ash in order to be disposed in an environmentally acceptable manner;
4. The power station currently has an approved ash disposal facility in place, referred to as "the 10-year ash dump" that will co-dispose first production ash and gypsum. The ash may be disposed for approximately five (5) years, while the gypsum will be disposed in the facility for the life of the station. ~~can cater for approximately 10 years of ash and gypsum disposal, however,~~ The station will require "dry ashing" facilities for the disposal of its ash for a period of 60 years, hence the current project;
5. The No-Go alternative is considered to be fatally flawed because it will result in the closure of Kusile Power Station – having an unacceptable impact to the social and economic environment at a national, and possible also international, level. This impact will persist beyond the post closure life of this project if it were implemented;
6. Impact assessments by relevant specialists in the natural and socio-economic environments have shown that although some of the impacts will have a high and very high impact risks, such as the direct loss of wetlands, it can be mitigated to acceptable levels.
7. A Comprehensive EIA and PP process, including extensive consultation with DEA/DWS was undertaken.

Given the aforementioned the EAP states that all reasonable measures have been taken and included in the EMPr for the avoidance and reduction of environmental impacts, and as such recommends that the project may be implemented, and its impacts managed.

Which site should be developed?

- A comprehensive site identification and selection, and Environmental Impact Assessment was undertaken to identify the most sustainable site for development of the ADF;
- These abovementioned processed investigated an area with a 15 km radius from the Kusile Power Station to identify feasible sites. Five feasible sites were identified (out of 11), and detailed investigation and comparative assessment of these sites identified **Site A as the most feasible and preferred alternative**.

The EAP recommends the implementation of the project on Site A for the following reasons:

- Site A is situated the closest to the Kusile Power Station and is located within the same catchment as the power station and New Largo mine. The site is thus located in a sub-catchment that is already heavily impacted thus minimising the zone of influence and maximising the potential for focused management interventions for the power station and associated infrastructure;
- Site A is technically the least difficult and complex solution to engineer and implement, and will be the least expensive solution to implement, compared to the other solutions;
- The drainage of clean and dirty water on the site is only in one direction, allowing for impacts to be contained and managed easier;
- The greatest negative impact of Site A is the direct destruction of 227 ha of **wetlands** within the development footprint, which can however be mitigated through an extensive offset mitigation strategy that is implementable for the entire Kusile Power Station development and is accepted by Eskom;
- Site A has a significant advantage over site B. In order to reach site B a conveyor would need to be constructed from the station over the Wilge River, and four other tributaries, which would collectively increase the impact risk to the Wilge River, which is the most important lifeline in the upper Olifants River catchment, to an unacceptable level. Accidental pollution from the conveyor directly into the Wilge River will have significant impacts on the **aquatic ecology**, **water quality**, **groundwater resources**, **aquatic fauna**, **avifauna**, **bats** and **dependent communities**;
- Although Site A might have a similar impact risk, any unexpected incidents of pollution emanating from Site A or its conveyance system can be intercepted and ameliorated before reaching the sensitive Wilge River;
- Site A is owned by Eskom already whereas development of the other feasible site would require negotiation and procurement of the land portions that will be affected. This is especially significant for the Site B solution as this area is markedly productive (commercial agriculture and very successful berry farm and processing plant), thus the ADF will have a severe social impact at this site;
- Site A is the least sensitive from a **heritage** and **social** perspective, and the majority of the specialists reports, including **wetlands**, **groundwater** and **aquatic ecology**, recommended the implementation of the ADF on site A

What are the primary impact risks that must be managed?

The most significant impact risk to the environment from the Kusile 60 year Ash Disposal Facility (without mitigation measures), during the construction phase, will be to the Topography, Wetlands Resources, Aquatic Ecology, heritage and social, and existing infrastructure. This can be explained as follows:

- **Topography**: permanent alternation of surface water drainage patterns;
- **Surface Water and Wetlands**: destruction of wetlands and potential for increased suspended solids and sedimentation of surface water resources from construction activities, decreased recharge of surface water resources from alterations of topography, and installation of a barrier system to prevent water from leaving the ash disposal facility area of the development site;
- Impacts on downstream wetlands and water resources in the Holfonteinspruit and diverted Klipfonteinspruit due to sedimentation, and water quality deterioration;
- **Two cemeteries** will need to be investigated thoroughly and relocated to a new burial ground, whereas existing inhabitants within the footprint and directly adjacent to site A would need to be relocated; and
- **Existing infrastructure**: a 88 kV distribution line will need to be relocated.

The most significant risk to the environment from the Kusile Ash Disposal Facility, during the operational phase, will still include topography, and the destruction of wetlands, and impacts on the aquatic ecology as the operational phase will still include construction of the next five year lined area (years 6 to 60) Additional impacts from disposing of the ash to the ADF will include

- **Air quality**: Impact relating dispersal of ash from disposal activities;
- **Groundwater**: any leachate draining from the facility will percolate through soil and into groundwater resources, but the facility will have an appropriate barrier system.

Impact persisting during the closure and post closure phases of the development will be permanent, e.g. change in topography, impact on soils, visual impact, direct destruction of wetlands.

Are the impact risks considered to be unacceptable?

Project impact risks to the soil and land capability, surface water and groundwater environment would be unacceptable if not mitigated. Fortunately these impacts can be mitigated. With mitigation measures implemented at Site A all impacts can be reduced to within acceptable limits. The primary mitigation measures that will substantially reduce the impacts to the receiving environment are:

- The installation of a suitably designed barrier system needs to be installed below the ash disposal facility. This barrier system must include composite layers and include a leak detection and leachate collection system. The barrier must be maintained in good integrity;

- A storm water management plan that includes clean and dirty water separation must be implemented;
- Rehabilitation of the proposed ash disposal facility at site A;
- Dust suppression through all phases of the development;
- Extensive monitoring of surface and ground water resources; and
- Implementation of a comprehensive wetland and biodiversity offset strategy within the affected catchment.

Can the environment carry this additional impact?

The baseline environment is already substantially impacted by industrial (Kusile Power Station and associated activities), mining (opencast and underground mining from New Largo), and wide spread agricultural (cultivated lands) activities. The geology, topography, surface water, groundwater, and terrestrial environments are most affected. Should development of the ADF be implemented on Site A, it is the EAP's opinion that the environment can accommodate the proposed development if mitigation measures are successfully implemented.

Can the impact risks be mitigated or managed?

Mitigation measures identified are relatively well understood, and with the exception of the installation of a liner system below the dirty water facilities (such as the Ash Disposal Facility and Ash Water Return Dam), the mitigation measures are relatively inexpensive to implement.

12 CONCLUSION AND WAY FORWARD

Eskom appointed Zitholele Consulting to undertake the EIA for the proposed development of a 60 year ash disposal facilities at the Kusile Power Station. This EIA study was undertaken with the aim of investigating potential impacts both positive and negative on the biophysical and socio-economic environment and identifying issues, concerns and queries from I&APs.

This FEIR documents the process followed and the findings and recommendations of the study. Additionally attached to this document is a Draft EMP that has been developed in order to implement the proposed mitigation measures.

The way forward recommended by this study is as follows:

- The Final EIR and EMPr is submitted to the Department of Environmental Affairs (DEA) for consideration and decision making;
- The Final EIR and EMPr will be made available simultaneously to stakeholders to review for a period of 30 days;
- The Water Use Licence Application process will commence shortly after the conclusion of the EIA process. Extensive consultation with the DWS has already commenced during the EIA and will continue at the beginning of the WULA process;
- Once the DEA has reached a decision, DEA will issue their decision; and
- Upon receipt of the decision, Zitholele will notify all I&APs on the stakeholder database of the DEA's decision within the prescribed timeframe as stipulated by the Environmental Authorisation.

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