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Strategic Biodiversity Scoping Assessment for the Continuous Ash Disposal Facility at Majuba Power Station, Mpumalanga Province©

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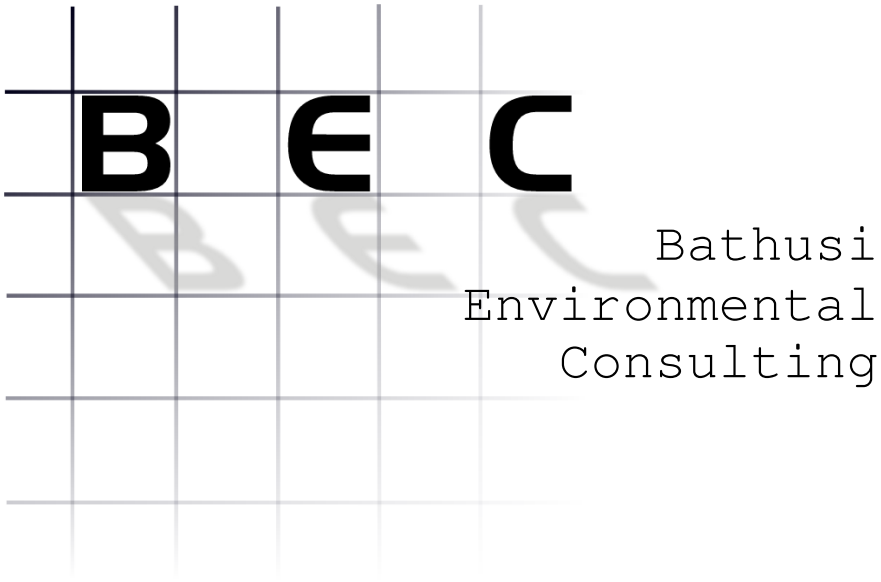

September 2012

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I PROJECT DETAILS

Client:	Lidwala Consulting Engineers, on behalf of Eskom Holdings Limited (Generation Division)
Report name:	Strategic Biodiversity Scoping Assessment for the Continuous Ash Disposal Facility at Majuba Power Station, Mpumalanga Province.
BEC Project number:	LDW – MCA – 2013/07
Report type:	Biodiversity Scoping Assessment
Report version:	2012.10.29.2
Authority Reference:	N/A
Compiled by:	Riaan A.J. Robbeson (Pr.Sci.Nat.), Bathusi Environmental Consulting

II SPECIALIST INVESTIGATORS

The Natural Scientific Professions Act of 2003 aims to '*provide for the establishment of the South African Council of Natural Scientific Professions (SACNASP), and for the registration of professional, candidate and certified natural scientists; and to provide for matters connected therewith'.*

Quoting the Natural Scientific Professions Act of 2003: '*Only a registered person may practice in a consulting capacity*' (20(1) – pg. 14).

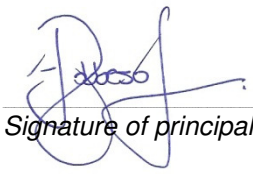
Table 1: Contributing Biodiversity Specialists	
Botanical Investigator:	**Riaan Robbeson (Pr.Sci.Nat.)**
Qualification:	M.Sc. (Botany), UP
Affiliation:	South African Council for Natural Scientific Professions
Fields of Expertise:	Botanical Scientist & Ecological Scientist
Registration Number:	*400005/03*
Affiliation:	Grassland Society of Southern Africa
Membership Status:	Professional Member
Membership Number:	*667.08/08*
Faunal Investigator:	**Dewald Kamffer (Pr.Sci.Nat.)**
Qualification:	M.Sc. (Conservation Biology), UP
Affiliation:	South African Council for Natural Scientific Professions
Fields of expertise:	Ecological Scientist & Zoological Scientist
Registration number:	*400204/05*

III RESERVED COPYRIGHT

IV DECLARATION OF INDEPENDENCE

Individual declarations attached as addendums. All specialist investigators, project investigators and members of companies employed for conducting this biodiversity investigation declare that:

- We act as independent specialist consultants conducting the assessment and compiling the report;
- We consider ourselves bound to the rules and ethics of the South African council for natural scientific professions;
- Bathusi Environmental Consulting cc is not a subsidiary, legally or financially, of either Lidwala Consulting Engineers or Eskom Holdings Limited (Generation Division).
- At the time of completing this report, we did not have any interest, hidden or otherwise, in the proposed development or activity as outlined in this document, other than fair financial compensation for work performed in a professional capacity;
- We will not be affected in any manner by the outcome of the environmental process of which this assessment forms part of, other than being part of the general public;
- We do not necessarily object to or endorse the proposed development, but aim to present facts and recommendations based on scientific data and relevant professional experience; and
- We do not have any influence over decisions made by the governing authorities;
- Undertake to disclose, to the competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the environmental impact assessment regulations, 2005;
- Will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not;
- Should we consider ourselves to be in conflict with any of the above declarations, we shall formally submit a Notice of Withdrawal to all relevant parties and register as an Interested and Affected Party.



Signature of principal ecologist:

Bathusi Environmental Consulting cc (CK1999/052182/23)

Name of company:

27th September 2012

Date:

V LIMITATIONS OF THIS INVESTIGATION

- Findings, results, observations, conclusions and recommendations presented in this report are based on the authors' best scientific and professional knowledge as well as information available to them at the time of compiling this report.
- This company, the consultants and/or specialist investigators do not accept any responsibility for conclusions, suggestions, limitations and recommendations made in good faith, based on the information presented to them, obtained from the surveys or requests made to them at the time of this report.
- Results presented in this report are based on a snapshot investigation of the study area and not on detailed and long-term investigations of all environmental attributes and the varying degrees of biological diversity that may be present in the study area.
- In particular, rare and endemic species normally do not occur in great densities and, because of customary limitations in the search and identification of Red Listed species, the detailed investigation of these species was not possible. Results are ultimately based on estimations and specialist interpretation of imperfect data.
- It is emphasised that information, as presented in this document, only have bearing on the site as indicated on accompanying maps. This information cannot be applied to any other area, however similar in appearance or any other aspect, without proper investigation.
- Furthermore, additional information may become known during a later stage of the process or development. The authors therefore reserve the right to modify aspects of the report including the recommendations should new information may become available from on-going research or additional work in this particular area, or pertaining to this investigation.
- This report should always be considered as a whole. Reading and representing portions of the report in isolation could lead to incorrect conclusions and assumptions. In case of any uncertainty, the authors should be contacted to clarify any viewpoints, recommendations and/ or results.
- Not all areas could be accessed during the respective site investigations. Results are extrapolated to include these properties, but no responsibility could be taken should discrepancies be indicated at a later stage. It is strongly recommended that these areas be subjected to a basic site investigation to confirm initial results.

VI LEGISLATION

This report has been prepared in terms of the *National Environmental Management Act* No. 107 of 1998 (NEMA) and is compliant with Regulation 385 Section 33 – Specialist reports and reports on specialised processes under the Act. Relevant clauses of the above regulation include:
Regulation 33.(1): An applicant or the EAP managing an application may appoint a person who is independent to carry out a specialist study or specialised process.
Regulation 33.(2): A specialist report or a report on a specialised process prepared in terms of these Regulations must contain:

(a) Details of (i) The person who prepared the report, and
(ii) The expertise of that person to carry out the specialist study;
(b) A declaration that the person is independent as may be specified by the competent authority;
(c) An indication of the scope of, and the purpose for which, the report was prepared;
(d) A description of the methodology adopted in preparing the report of carrying out the specialised process;
(e) A description of any assumptions made and any uncertainties or gaps in knowledge;
(f) A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment;
(g) Recommendations in respect of any mitigation measures that should be considered by the applicant and the competent authority;
(h) A summary and copies of any comments that were received during any consultation process;
(i) Any other information requested by the competent authority.

Compliance with provincial, national and international legislative aspects is strongly advised during the planning, assessment, authorisation and execution of this particular project. Legislative aspects of which cognisance were taken during the compilation of this report are summarised, but not necessarily limited to, in Table 2.

Table 2: Legislative guidance for this project	
Biodiversity Act (No. 10 of 2004)	To provide for the management and conservation of South Africa's biodiversity within the framework of the National Environmental Management Act 1998; the protection of species and ecosystems that warrant national protection; the sustainable use of indigenous biological resources; the fair and equitable sharing of benefits arising from bioprospecting involving indigenous biological resources; the establishment and functions of a South African National Biodiversity Institute; and for matters connected therewith.
Conservation of Agricultural Resources Act 43 of 1983	The conservation of soil, water resources and vegetation is promoted. Management plans to eradicate weeds and invader plants must be established to benefit the integrity of indigenous life.
Constitution of the Republic of South Africa (Act 108 of 1996)	The Bill of Rights, in the Constitution of South Africa (No. 108 of 1996), states that everyone has a right to a non-threatening environment and requires that reasonable measures be applied to protect the environment. This protection encompasses preventing pollution and promoting conservation and environmentally sustainable development. These principles are embraced in NEMA and given further expression.
Convention on Biological Diversity, 1995	International legally binding treaty with three main goals; conserve biological diversity (or biodiversity); ensure sustainable use of its components and the fair and equitable sharing of benefits arising from genetic resources.
Convention on International Trade in Endangered Species of Wild Life and Fauna	International agreement between governments, drafted because of a resolution adopted in 1963 at a meeting of members of the International Union for Conservation of Nature (IUCN). Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival and it accords varying degrees of protection to more than 33,000 species of animals and plants.
Environment Conservation Act (No. 73 of 1989)	To provide for the effective protection and controlled utilization of the environment and for matters incidental thereto.
Mineral and Petroleum Resources Development Act (Act No.28 of 2002) (MPRDA)	Compilation of Environmental Impact Assessment (EIA) and Environmental Management Programme (Reports) (EMPR).
Mpumalanga Environmental Management Act (Act No. 10 of 1998)	
Mpumalanga Tourism and Parks Agency Act (Act No. 5 of 2005)	To provide for the establishment of the Mpumalanga Tourism and Parks Agency and for the management thereof by a Board; to provide for the sustainable development and improvement of the tourism industry in Mpumalanga; to provide for conservation management of the natural resources of Mpumalanga; to confer powers and functions upon the Agency; to provide for the registration of certain persons and entities directly involved in tourism; to provide for transitional arrangements; and to provide for matters incidental thereto
Mpumalanga Parks Board Act of 1995	
National Veld & Forest Act Fire Act (Act No. 101 of 1998)	To prevent and combat veld, forest and mountain fires throughout the Republic, to provide for a variety of institutions, methods and practices for achieving the purpose.
National Environmental Management Act (No. 107 of 1998)	Requires adherence to the principles of Integrated Environmental Management (IEA) in order to ensure sustainable development, which, in turn, aims to ensure that environmental consequences of development proposals be understood and adequately considered during all stages of the project cycle and that negative aspects be resolved or mitigated and positive aspects enhanced.
National Environmental Management: Biodiversity Act (Act No. 10 of 2004)	To provide for matters relating to threatened or protected species regulations
National Environmental Management Protected Areas Act (No. 57 of 2003)	To provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes; for the establishment of a national register of all national, provincial and local protected areas; for the management of those areas in accordance with national norms and standards; for intergovernmental co-operation and public consultation in matters concerning protected areas; and for matters in connection therewith.
White Paper on Conservation and Sustainable Use of South Africa's Biological Diversity (July 1997)	Identifies a number of strategies to be developed to give effect to the specific policies, including the enhancement of the protected area network, development of specific strategies such as conservation and sustainable use of reptiles and amphibians. Promotes a "Prosperous, environmentally conscious nation, whose people are in harmonious co-existence with the natural environment, and which derives lasting benefits from the conservation and sustainable use of its rich biological diversity"

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1 EXECUTIVE SUMMARY

Ash generated by Majuba Power Station is currently being disposed by means of 'dry ashing' within the premises of the Majuba Power Station, on Eskom owned land. This existing ash dump was initially designed for the planned life of operation of the Majuba Power Station. Due to recent promulgation of the NEMWA, Eskom decided to apply for a waste license for the remaining portion of their ashing facility up to the 45-year life of the station. This application seeks to ensure that the ashing activities are aligned with the requirements of the National Environmental Management Waste Act, NEMWA, Act 59 of 2008.

Eskom has appointed Lidwala Consulting Engineers as the Environmental Assessment Practitioner (EAP) for the project. Bathusi Environmental Consulting cc was appointed as independent ecologists to conduct an ecological EIA assessment of the study area and compile an impact rating report for the terrestrial biodiversity component of this project. This report forms part of the scoping phase of the project.

A technically suitable area was identified, by Eskom, immediately south of the existing ashing facility (i.e. to continue ashing from the existing facility). This preferred site comprises of 593ha, located on the farm Witkoppies 81-HS. However, in order to allow for a robust environmental process, all land within a radius of 12km (the study area) will be assessed in order to identify potential alternatives sites should sensitive aspects limit the suitability of this particular site. In assessing the suitability of land within the proposed 12km radius, a blanket approach of transformation vs. natural habitat cannot be applied throughout the assessment. Certain areas of existing transformation and sites of future developments/ operations were excluded from the assessment, such as the UCG project for which the environmental application process is currently underway. Existing info bases were implemented in the identification of suitable alternative sites, but recommendations/ proposed site alternatives are heavily influenced by known biodiversity attributes. It should be noted that the mandate of this assessment is to consider the ecological/ biodiversity sensitivity of the receiving environment; financial and technical implications are not considered as it is addressed as a separate assessment.

1.1 Biophysical Attributes

The study area is situated within the Seme District Municipality, which comprises of 522,723ha. The Biodiversity GIS (2007) (BGIS) assessment indicates that approximately 88% of the municipality are currently considered untransformed. This figure is however regarded as an overestimation of the true extent of remaining natural (pristine) grassland habitat in the region and it is extremely likely that remaining untransformed habitat within the municipality is much lower than this estimation. The effects of commercial agriculture (maize production), infestation by alien invasive trees and recent increase in mining activities are evident from the mosaical appearance of land cover in the immediate region. Other noteworthy land transformation effects result from mining, industrial and urban development. Road and railway infrastructure in the region resulted in a moderate level of habitat fragmentation and isolation.

Although no formally declared area of conservation is present within the 12km radius, several areas of conservation are present in the general region, including the following:

- Protected areas, including Paardeplaats and Wakkerstroom Wetland Nature Reserves;
- Baltrasna Proposed conservancy:
- Conservancies, including:
  - Amsterdam (80km northeast);

  - Bloukop (10km north);
  - Mhlangampisi (50km east);
  - Ngwempisi (40km northeast);
  - Reitvaal (10km north, northeast); and
- Maputuland – Pondoland Centre of Endemism (387km southeast).

The Environmental Potential Atlas (2004, (ENPAT) database revealed no significant topographical variability (slopes exceeding 8%) in the study area. However, during previous site investigations, several such areas were observed where localised and small outcrops and ridges occur within the study area. The topography of the study area comprises mostly, 'Strongly undulating plains', but portions do conform to 'Slightly irregular undulating plains and hills' (east) and 'Strongly undulating irregular land' (southwest). Altitude of the study area varies around 1,700m above sea level, from a maximum of 1,800 in the southwest, to a low 1,600 in the northwest, sloping in a northwestern direction.

Areas of surface water are present in the study area in the form of rivers, perennial and non-perennial steams, artificial and natural impoundments and, to a lesser degree, moist grassland/ seepages. Larger rivers and streams include the Palmietspruit, Witbankspruit and Skulpspruit. The study area is situated within the Vaal Primary Catchment area.

The major geological formations of the region include the Vryheid Arenites, Karoo Dolerites, Adelaide & Estcourt Mudstones and Volksrust Shales. The preferred site is situated within the Bd46 land type unit. Other land types represented within the 12km buffer zone include Ae252, Ah86, Bc44 and Bd44.

The Mpumalanga Biodiversity Conservation Plan (MBCP) maps the distribution of Mpumalanga Province's known biodiversity into six categories (Lötter & Ferrar, 2006). These are ranked according to ecological and biodiversity importance and their contribution to meeting the quantitative targets set for each biodiversity feature. The study area comprises four of these categories, namely:

- Highly Significant;
- Important & Necessary;
- No Natural Habitat Remaining; and
- Least Concern.

The proposed development relates to 'Major Development Projects' (Land Use Type 15 – Surface Mining, Dumping & Dredging) (Lötter & Ferrar, 2006). Extensive parts of the study area are situated within areas where major developments are restricted according to the MBCP. This does not necessarily imply that any development will be denied, but rather that specialists studies clearly need to indicate that the proposed development will not adversely affect any sensitive floristic or faunal attributes that occur, or potentially could occur, within the study area or on a local and regional scale. Specialist studies are furthermore required to show that the proposed development will not add to existing cumulative impacts, regional degradation and habitat transformation and the loss of biodiversity on a local or regional scale.

1.2 Botanical Assessment

The study site corresponds to the Grassland Biome as defined by Mucina & Rutherford (VegMap, 2006). This unit is found in the eastern, precipitation-rich regions of the Highveld. The following ecological types are represented within the 12km radius:

- Amersfoort Highveld Clay Grassland (Vulnerable);
- Bloemfontein Karroid Shrubland (Least Threatened);
- Eastern Temperate Freshwater Wetlands (Vulnerable);
- Soweto Highveld Grassland (Endangered); and
- Wakkerstroom Montane Grassland (Least Threatened).

The South African National Biodiversity Institute (SANBI) database [Plants of Southern Africa (POSA), 2012] indicates the known presence of approximately 390 plant species within the ¼-degree grids that are spatially represented in the study area. The high floristic diversity of the immediate region reflects the regional diversity context of the Grassland Biome. However, the paucity of accurate floristic species richness is indicated by the absence of some common plant taxa from the data records as well as the low species richness of certain ¼-degree grids. An appraisal of the growth forms reflects the diverse grassland physiognomy with 189 herb species, 74 grass species, and 45 geophyte species. The physiognomical dominance of the grassland biome is also illustrated by the absence of large trees and low diversity of shrubs (15 species). This species richness also represents 66 plant families, typically dominated by Poaceae, Asteraceae, Fabaceae and Cyperaceae.

Mpumalanga Province comprises 4,256 plant species of which 276 are included in the various conservation categories. Data records indicate the presence of the following plant species of conservation importance within the ¼-degree grids that are sympatric to the study area:

Acalypha caperonioides var. *caperonioides*	Data Deficient
Argyrolobium campicola	Near Threatened
Crinum bulbispermum	Declining
Gladiolus robertsoniae	Near Threatened
Ilex mitis	Declining
Khadia alticola	Rare
Kniphofia typhoides	Near Threatened
Miraglossum davyi	Vulnerable
Nerine platypetala	Vulnerable
Stenostelma umbelluliferum	Near Threatened

In addition to the species currently captured in the SANBI infobase (POSA, 2011), the following provincially protected plants are known to occur within the region of the study area (Mpumalanga Nature Conservation Act No.10 of 1998):

Agapanthus inapertus subsp. *intermedius*	*Eulophia foliosa*
Aloe ecklonis	*Gladiolus crassifolius*
Corycium nigrescens	*Gladiolus dalenii* subsp. *dalenii*
Crinum bulbispermum	*Gladiolus permeabilis* subsp. *edulis*
Cyrtanthus breviflorus	*Gladiolus robertsoniae*
Cyrtanthus tuckii var. *transvaalensis*	*Gladiolus sericeovillosus* subsp. *calvatus*
Cyrtanthus tuckii var. *tuckii*	*Gladiolus sericeovillosus* subsp. *sericeovillosus*

Haemanthus montanus
Kniphofia albescens
Kniphofia typhoides
Leucospermum cuneiforme
Satyrium neglectum subsp. *neglectum* var. *neglectum*
Zantedeschia albomaculata subsp. *macrocarpa*

The following macro habitat types were delineated from aerial imagery of the study area:

Natural Terrestrial Grassland Habitat - Short, low cover of herbaceous species, physiognomically dominated by grasses, but with a high diversity of forbs. The conservation status of these grasslands, on a regional scale, is Endangered and Vulnerable; remaining natural grassland habitats within the study area are therefore regarded sensitive. The presence of plant taxa of conservation importance within the preferred site is documented;

Linear Infrastructure - A number of roads, power line servitudes, railways and conveyor facilities are present. The presence of linear infrastructure should therefore not be considered a restriction to the proposed activity;

Transformed & Degraded Grassland Habitat - Commercial cultivation represents the major land transformation activity in the region resulting. The likelihood of encountering Red Data plant species within these areas is regarded low because of habitat transformation and degradation. A low floristic status is frequently ascribed to these parts. The use of these parts of the study are for the proposed activity is strongly recommended as it unlikely that floristic attributes of conservation importance will be affected within these parts; and

Wetland Vegetation - Vegetation associated with aquatic habitat types are regarded highly sensitive and all impacts should ideally be avoided within, and near to, these features. A wide variety of these habitat types feature in the study area, including perennial and non-perennial streams, rivers, small drainage lines, wetland marshes, hillslope seepages, artificial impoundments and unchannelled valley bottoms. These areas are also frequently colonised by plant taxa of conservation importance. Impacts within these systems are not only reflected on the actual site, but are also 'exported' downstream, resulting in cumulative impacts with large footprints.

1.3 Faunal Assessment

It is important to view the study area on an ecologically relevant scale; consequently; all sensitive animal species (specific faunal groups) known from Mpumalanga were therefore included in this assessment (except for the avifauna which focuses on the Q-grids of the study area). In order to assess the probability of occurrence (PoC) of Red Data species not recorded in the study area during the field assessment, the following criteria were employed:

- the size of the study area;
- the location and connectivity of the study area with regards to other natural faunal habitats; and,
- the presence/absence, status and diversity of natural faunal habitats within the study area.

These criteria were used in conjunction with the known distribution of Red Data species as well as their known habitat requirements to estimate their likelihood of occurring in the study area. A total of 115 Red Data species from five categories (IUCN) are known to occur in the Mpumalanga Province (Invertebrates,

Reptiles, Frogs and Mammals) and the Q-grids 2729BA and 2729BB (birds[1]), included in the following conservation categories:

- 23 species are listed as Data Deficient (DD);
- 42 species are listed as Near Threatened (NT);
- 34 species are listed as Vulnerable (VU);
- 11 species are listed as Endangered (EN); and
- 5 species are listed as Critically Endangered (CR).

Estimations for the PoC for Red Data fauna taxa for the study area yielded the following results:

- 41 species have a low PoC;
- 14 species have a moderate-low PoC;
- 31 species have a moderate PoC;
- 7 species have a moderate-high PoC; and
- 15 species have a high PoC.

Seven Red Data species have been recorded, or are known to occur, in the study area. Mpumalanga includes 31 provincially listed protected species (www.speciesstatus.sanbi.org – NEMBA status); three species are considered at least moderately likely (moderate) and four species highly likely to occur in the study area (high).

The known presence of several conservation important animal taxa in the preferred area renders this portion of land less suitable for the proposed project. Development of this portion of land is likely to result in severe impacts on the faunal component. Results of the ecological assessment established the availability of other portions of land that is less sensitive in terms of faunal attributes and the use of these portions are strongly recommended. The *ex situ* conservation of conservation important species should only be considered as an absolute last resort when no other option is available for the proposed development. The EIA phase of the project will afford the opportunity to establish the presence/ absence of conservation important species on the selected portion of land.

1.4 Ecological Sensitivity& Recommendations

For this particular screening assessment, the degree of transformation was used as a primary decision tool in determining the level of sensitivity of a particular site. A secondary decision was made based on the level of conservation importance ascribed to the regional vegetation type. Lastly, historic sampling records of conservation important flora and fauna taxa within the region were also implemented to ascribe a high level of importance/ sensitivity to a particular site. The ecological sensitivity of areas characterised by natural habitat was assessed using the application of the following criteria:

- The presence of Threatened and/or Protected:
  - plant species **(YES)**;
  - animal species **(YES)**;
  - ecosystems **(YES)**;
- The presence of Critical conservation areas, including:

[1] Please note that general comments pertaining to avifauna are included in this report as it does relate to biodiversity in general. A separate avifaunal report, specifically dealing with birds, was commissioned by Eskom; the aims and objectives of these two studies do differ.

- areas of high biodiversity **(YES)**;
- centres of endemism **(NO)**;

- The presence of Important Ecological Processes, including:
  - Corridors **(NO)**;
  - Mega-conservancy networks **(NO)**;
  - Rivers and wetlands **(YES)**; and
  - Important topographical features **(NO)**.

It is evident from the sensitivity analysis that the western part of the study area, and in particular, the preferred site, is regarded unsuitable for the proposed development due to biodiversity sensitivities. Aspects that contributed to the high sensitivity of this area include the Endangered regional conservation status of the Soweto Highveld Grassland as well as the known/ confirmed presence of several conservation important flora and fauna taxa. The existence of a relocation programme within the region whereby these species (with particular reference to the Sungazer Lizard) are being relocated did not influence the sensitivity.

It is important to note that the presence of conservation important species is a confluence of numerous biological and biophysical characteristics, resulting in habitat that to which they are adapted. Of even greater importance is the fact that loss of habitat resulting from agriculture and industrial developments, results in sustained pressure on the habitat of these plants and animals. Losses to these habitat types are usually irreversible. Even though a relocation programme (*ex situ* conservation) might be successful, the *in situ* conservation of plants and animals should be a priority. The fact that a number of conservation important specie co-exist within this particular site (the preferred site), strongly reflects the importance of this area in terms of biodiversity attributes. Recent studies (BEC 2006, 2008, 2010) have indicated that, although the region is diverse and that various conservation important plant and animal taxa occur throughout the region, this particular site is regarded exceptional in terms of biodiversity importance and diversity.

It is therefore strongly recommended that a suitable area be selected from the eastern side of the study area.

2 TERMS OF REFERENCE

Objectives of this Biodiversity Scoping Assessment are to assess available information in order to provide an overview of the ecology of the proposed site and surrounds. More specifically, the presence/ absence, variability and inherent ecological sensitivity of the proposed project area will be ascertained. Likely and expected impacts on the biological environment will be identified and pertinent recommendations for the EIA phase of the project will be provided. Results of this assessment will ultimately be incorporated into the EIA Assessment that will provide detailed, site-specific information and evaluate all expected and likely impacts on the biological environment.

The Terms of Reference for the floristic assessment are as follows:

- Obtain all relevant Précis and Red Data flora information;
- Conduct a photo analysis of the proposed area;
- Identify preliminary floristic variations;
- Conduct a brief site investigation in order to obtain a understanding of the floristic environment;
- Assess the potential presence of Red List flora species according to information obtained from SANBI;
- Incorporate existing biophysical information of the region into the assessment;
- Describe broad habitat variations present in the study area in terms of biophysical attributes and phytosociological characteristics;
- Compile a floristic sensitivity analysis;
- Incorporate results into the Biodiversity Scoping Evaluation;
- Recommend a suitable site that will not result in significant impacts on the floristic environment;
- Map all relevant aspects;
- Provide pertinent recommendations; and
- Present all results in a suitable format.

The Terms of Reference for the faunal assessment are as follows:

- Obtain available faunal distribution records and Red Data faunal information
- Conduct a brief site investigation in order to obtain an overview of the faunal environment;
- Assess the potential presence of Red Data fauna species;
- Incorporate existing knowledge of the region;
- Describe the status of available habitat in terms of faunal attributes, preferences and conservation potential;
- Compile a faunal sensitivity analysis;
- Incorporate results into the Biodiversity Scoping Evaluation;
- Recommend a suitable site that will not result in significant impacts on the faunal environment;
- Map all relevant aspects; and
- Present all results in a suitable format.

3 INTRODUCTION

Why is Biodiversity Conservation Important? Biodiversity sustains life on earth. An estimated 40 percent of the global economy is based on biological products and processes (www.unep.org). Biodiversity has allowed massive increases in the production of food and other natural materials, which in turn have fed the (uncontrolled) growth and development of human societies. Biodiversity is also the basis of innumerable environmental services that keep humans and the natural environment alive, from the provision of clean water and watershed services to the recycling of nutrients and pollination (ICMM, 2004). Conservation of biodiversity has taken many different forms throughout history, including setting aside land for such reasons as their rare ecology (endemic or Red Listed species) or exceptionally high species diversity; their critical environmental services, such as watershed protection or evolutionary functions; or their continued use by indigenous peoples who are still pursuing 'traditional' lifestyles based on 'wild' resources.

South Africa is recognized as one of the world's few 'megadiverse' countries. In addition to having an entire floral kingdom, it also includes two globally significant biodiversity 'hot spots' (the Cape and succulent Karoo regions), six Centres of Plant Diversity, two Endemic Bird Areas and the richest temperate flora in the world (Cowling, 2000). Recent increases in human demand for space and life-supporting resources are however resulting in rapid losses of natural open space in South Africa. When natural open space systems are rezoned for development, indigenous fauna and flora are replaced by exotic species and converted to sterile landscapes with no dynamic propensity or ecological value (Wood *et al.,* 1994). The conservation of critical biodiversity resources and the use of natural resources therefore appear to be two conflicting ideologies.

In 1992, the Convention of Biological Diversity (CBD), a landmark convention, was signed by more than 90% of all members of the United Nations. The subsequent enactment of the National Environmental Management Biodiversity Act in 2004 (Act No. 10 of 2004), focused on the preservation of biological diversity in its totality, including genetic variability, natural populations, communities, ecosystems up to the scale of landscapes. The CBD not only considers the protection of threatened species and ecosystems, but also recognizes the importance of using resources sustainably, of ensuring equity in the exploitation of such resources, and of the need for sustainable development in developing countries. This concept seeks to ensure that social and economic development follows a path that enhances the quality of life of humans whilst ensuring the long-term viability of the natural systems (resources) on which that development depends (United Nations Conference on Environment and Development, in Rio de Janeiro, Brazil 1992). In southern Africa, acceptance of the concept of sustainable development has been marked by the ratification of international conventions by most countries, particularly the Convention on Biological Diversity, Ramsar Convention and CITES, as well as the development of SADC-based protocols on environmental issues. However, severe capacity constraints in most countries have made it difficult to translate these policies and concepts into practice.

South Africa's biodiversity conservation performance is under increasing scrutiny from NGOs, commentators and financial analysts. In part, this is due to the legacy of environmental neglect, and in part, it is due to increased awareness of the public and authorities. All activities in the natural environment therefore require vigilance to ensure that the heritage of future generations – the biological as well as cultural heritage – is not adversely affected by the activities of today. Achieving a balance requires better understanding and recognition of conservation and development imperatives by all stakeholders, including governments, business and conservation communities.

An proactive approach as well as implementing experience from previous activities will provide much insight and experience for Eskom to minimize or prevent known adverse impacts as well as potentially significant negative impacts from this proposed activity. There might also be further opportunities to enhance biodiversity conservation within areas of operations. Being proactive in the assessment and management of biodiversity is important not only for new operations but also for those that have been operating for many years, usually under regulatory requirements that were less focused on the protection and enhancement of biodiversity.

In summary, threats resulting from all developments in the natural environment to biodiversity are compelling. Unless they are addressed in a holistic manner, which considers social and economic as well as scientific considerations, the benefits of ecosystem services will be substantially diminished for future generations. Furthermore, the next 50 years could see a further acceleration in the degradation of ecosystem services unless action is taken to reverse current trends of environmental decline.

4 PROJECT SYNOPSIS

Ash generated by Majuba Power Station is currently being disposed by means of 'dry ashing' within the premises of the Majuba Power Station, on Eskom owned land. This existing ash dump was initially designed for the planned life of operation of the Majuba Power Station, but Eskom decided to extend the planned operation to 2045. The appurtenant ashing facilities must therefore be able to accommodate the increased ashing requirements of the power station for the next 33 years. With the promulgation of the National Environmental Waste Management Act, Act 59 of 2008, Eskom aims to align its continued ashing activities with the requirements of the waste licensing processes. Towards this goal, they have appointed Lidwala Consulting Engineers as the Environmental Assessment Practitioner (EAP) for the project. Bathusi Environmental Consulting cc was appointed as independent ecologists to conduct an ecological EIA of the study area.

A technically suitable area was identified immediately south of the existing ashing facility (i.e. to continue ashing from the existing facility). This particular area comprises of 593ha, located on the farm Witkoppies 81-HS. However, in order to allow for a robust environmental process, all land within a radius of 12km (the study area) will be assessed in order to identify potential alternatives sites should sensitive aspects limit the suitability of this particular portion of land.

In assessing the suitability of land within the proposed 12km radius, a blanket approach of transformation vs. natural habitat cannot be applied throughout the assessment. Certain areas of existing transformation and sites of future developments/ operations were therefore excluded from the assessment, such as the UCG project for which the environmental application process is currently underway. Existing info bases were implemented in the identification of suitable alternative sites, but recommendations/ proposed site alternatives are heavily influenced by known biodiversity attributes. It should be noted that the mandate of this assessment is to consider the ecological/ biodiversity sensitivity of the receiving environment; financial and technical implications are not considered as it is addressed as a separate assessment.

4.1 Method Statement

While every attempt was made to remove any subjective opinions that might be held on any part of the study area as far as possible, the implementation and collation of existing biodiversity information of the site and region is perceived as a starting point to the ultimate success of this project.

It is an unfortunate fact that scrutiny of all EIA type projects will expose scientific deficiencies, mainly because of shortcomings in available databases and lack of site-specific detail that could be obtained from limited detailed site investigations conducted over a short period. It is also a fact that existing ecological sensitivities cannot always be accurately or adequately captured or illustrated during a brief EIA process. This is also a limitation of every scientific study; it simply is not possible to know everything or to consider aspects to a molecular level of detail. However, the approach followed in this study is considered effective in presenting objective comments on the comparison of biodiversity sensitivity of parts in the study area.

In order to present an objective opinion of biodiversity sensitivities of the study area and how this relates to the suitability/ unsuitability of any area within the site in terms of the proposed development, all opinions and statements presented in this document are based on the following aspects, namely:

- A desk-top assessment of all available biological and biophysical data;
- Augmentation of existing knowledge by means of site specific and detailed field surveys;
- Specialist interpretation of available data, or known sensitivities of certain regional attributes; and
- An objective scoping assessment, estimating potential impacts on biological and biophysical attributes.

In assessing the suitability of land within the proposed 12km radius, a blanket approach of transformation vs. natural habitat cannot be applied throughout the assessment. Certain areas of existing transformation were therefore excluded from the assessment, such as residential areas, Majuba Power Station, mining activities and the existing ash disposal facility. Similarly, cognisance is taken of future developments/ operations, such as the UCG project for which the environmental application is currently undertaken. These areas are forthright excluded from the assessment. Recommended alternatives will therefore be based on suitable (sensible) options as far as biodiversity attributes are concerned and is likely to include, or be situated near to, existing areas of transformation, such as the existing ash disposal facility.

While existing info bases (ENPAT, Google Earth, POSA. etc.) are implemented in the identification of suitable alternatives, recommendations/ proposed site alternatives are also heavily influenced by known biodiversity attributes. New information becomes available through recent documentations and historic surveys conducted in the region. Every effort will be made to implement available information in order to derive suitable recommendations. It should be noted that the mandate of this assessment is to consider the ecological/ biodiversity sensitivity of the receiving environment; financial and technical implications are not considered as it is addressed as a separate assessment.

4.2 Assessment Philosophy

The objective of the scoping assessment is to collate and review as much existing floristic and faunal information on the study area and the surrounds as possible in order to identify sensitive areas that should be avoided during development. Pertinent recommendations will be provided to guide the proposed activity towards less sensitive areas in terms of ecological attributes.

The overall goal of this scoping assessment is to establish a reference point for the biophysical and ecological attributes and sensitivities of the study area by means of the Ecosystem Approach Principles and the Landscape Ecology Approach. These approaches are advocated by the Convention on Biological Diversity (www.cbd.int), recognizing that people and biodiversity are part of the broader ecosystems on which they depend, and that it should thus be assessed in an integrated way. Effective conservation of landscape heterogeneity (sensitive habitat types/ ecosystems frequently associated with biodiversity elements of high sensitivity or conservation importance) will effectively result in the conservation/ protection of species that are highly sensitive to changes in the environment.

It is inevitable that this approach will not function effectively in all cases since extremely localised and small areas of sensitivity are likely to exist in the region (www.umass.edu/landeco/about/landeco.pdf). These areas are not always accurately captured on available databases or might have been missed during the initial site investigations. Therefore, the compilation of basic species lists from available infobases and the identification of localised habitat types by means of a brief site investigation will be implemented to augment initial results. It is important to identify areas of sensitivity on a local scale and, where possible, communities or species of conservation importance, that could potentially be affected by influences arising from the proposed development. The Precautionary Principal is applied throughout the assessment[2].

Thus, the general approach adopted for this type of study is to identify any biodiversity issues that may lead to:

- the decision that the proposed project cannot take place, i.e. to specifically focus on red flags and/or potential fatal flaws; or
- where the proposed development protocol needs to be adapted to allow for the protection of biodiversity aspects of sensitivity.

4.3 Method Statement - Botanical Assessment

The botanical assessment was compiled by R. A. J. Robbeson (Pr.Sci.Nat.).

4.3.1 General Botanical Attributes

In preparation for the site survey, physiognomic homogenous units are identified and delineated on digital aerial photos, using standard aerial photo techniques. Images are downloaded from www.googleearth.com and georectified in Arcview 3.2. A brief site visit was conducted to examine the general floristic attributes and diversity of the study area and the development alternatives. Objectives of this particular investigation included the verification and ground truthing of preliminary habitat types and making preliminary

[2](www.pprinciple.net/the_precautionary_principle.html).

assessments of the status and sensitivity of available habitat types. These preliminary sensitivity observations will ultimately be relayed to the ranking of preferred alternatives for the proposed development.

It is not the intention of this report to provide a comprehensive list of species that occur on the site; this aspect will be addressed in more detail in the EIA phase of the project.

4.3.2 Flora Species of Conservation Importance

The purpose of listing Red Data plant species is firstly to provide information on the potential occurrence of species of special concern in the study area that may be affected by the proposed development. Secondly, the potential occurrence of these species can then be assessed in terms of their habitat requirements in order to determine whether they have a likelihood of occurring in habitats that may be affected by the proposed infrastructure. Red Listed flora information, as presented by SANBI was used as a point of departure for this assessment. A snapshot investigation of an area, such as this particular investigation, represents a severe limitation in terms of locating and identification potential Red Listed flora species. Particular emphasis is therefore placed on the identification and assessment of habitat deemed suitable for the potential presence of Red Listed.

It should be noted that Red List species are, by nature, usually rare and difficult to locate. Compiling a list of species that could potentially occur in an area is furthermore limited by the paucity of collection records that make it difficult to predict whether a species may occur in an area or not. Notwithstanding the application of the Precautionary Principle, there is always the likelihood that a species that is not included in a list might be unexpectedly present in an area.

4.4 Method Statement - Faunal Assessment

The faunal assessment was compiled by D. Kamffer (Pr.Sci.Nat.).

4.4.1 Ecological Status

The extent to which a site is ecologically connected to surrounding areas is an important determinant of its sensitivity. Systems with a high degree of landscape connectivity or with extensive grassland and drainage systems amongst one another are perceived to be more sensitive and will be those contributing to important faunal sensitivity or overall preservation of faunal diversity. A brief site investigation was conducted to establish the current ecological status of available habitat types. A preliminary sensitivity assessment is presented in this report, but the preferred/ recommended option will ultimately be subjected to detailed surveys during the EIA phase of the project. A major objective of this part of the project is to identify areas that are regarded important on a local or regional scale that are likely to have a bearing on the project.

4.4.2 Red Listed Fauna Probabilities

Three parameters are used to assess the Probability of Occurrence of Red Listed species that could potentially occur in the study area:

- Habitat requirements (HR) - Red Listed animals have specific habitat requirements and the presence of these habitat characteristics in the study area is evaluated.

- Habitat status (HS) - The status or ecological condition of available habitat in the study area is assessed. Often, a high level of degradation of a specific habitat type will negate the potential presence of Red Listed species (especially wetland-related habitats where water quality plays a major role); and
- Habitat linkage (HL) - Movement between areas used for breeding and feeding purposes forms an essential part of ecological existence of many species. The connectivity of the study area to surrounding habitats and adequacy of these linkages are evaluated for the ecological functioning of Red Listed species within the study area.

4.5 Ecological Sensitivity

The aim of this exercise is to present an opinion on the inherent ecological sensitivity of macro habitat type of the study area. These issues are assessed by documenting whether any important biodiversity features occur on site, including species, ecosystems or processes that maintain ecosystems and/or species. These can be organised in a hierarchical fashion, as follows:

- Threatened and/or Protected-:
  - plant species;
  - animal species;
  - ecosystems;
- Critical conservation areas, including:
  - areas of high biodiversity;
  - centres of endemism;
- Important Ecological Processes, including:
  - Corridors;
  - Mega-conservancy networks;
  - Rivers and wetlands; and
  - Important topographical features.

High Sensitivity Values indicate areas that are considered pristine, unaffected by human influences or generally managed in an ecological effective manner. These areas are comparable to nature reserves and even well managed farm areas. Low Sensitivity Index Values indicate areas of lower ecological status or importance in terms of vegetation attributes, or areas that have been negatively affected by human impacts or poor management. Sensitivity Criteria employed in assessing the sensitivity of separate units may vary between different areas, depending on location, type of habitat, size, etc. Furthermore, in estimating the importance or sensitivity of a specific site, the type of development that is planned for the area is also taken into consideration. The measure of invasion or habitat destruction that will result from the proposed activity is therefore likely to affect the level of sensitivity attributed to a site.

5 PROJECT ALTERNATIVES

A preferred site has been indicated, situated directly adjacent (south) of the existing ashing facility (*i.e.* to continue ashing southwards from the existing facility). However, in order to allow for a robust process, all land within a radius of 12km is included in this assessment so that suitable alternatives could be identified should biodiversity aspects of sensitivity be identified on the preferred site.

6 BACKGROUND TO GRASSLAND ECOLOGY

From: Mpumalanga Biodiversity Conservation Plan Handbook (2007).

Grassland defines itself: landscapes dominated by grass. Although grasses are the most visible plants, grasslands are frequently characterised by a higher diversity of herbs and forbs, especially those with belowground storage organs such as bulbs or tubers. These plants produce many of our spectacular wild flowers and contribute to a species richness that is second only to that of the Cape Fynbos. The large number of rare and endangered species in grasslands is a particular problem for environmental impact assessments. They are mostly small, very localised and visible for only a few weeks in the year when they flower. Most surveys will not pick them up and special skills are required to locate and identify them reliably. The highest biodiversity is found in rocky grassland habitats and on sandy soils, while biodiversity tends to be lower in areas dominated by clay soils.

The grassland biome contains some of the most threatened vegetation types in South Africa. It is estimated that 60 to 80% of South African grasslands have already been irreversibly transformed by agriculture, forestry, urban and industrial development and mining. An alarmingly low 2% of the remaining pockets of pristine grasslands – areas of surprisingly high plant and animal diversity – are formally under conservation in 142 publicly owned nature reserves. On the positive side, by correlation of the geographic distribution, the 3,378 plant species found in the grassland biome, and the distribution of these nature reserves, it is estimated that 78% of these species are indeed represented in conservation areas.

Large parts of our grasslands occur on deep fertile soils of high agricultural value and much of this landscape has therefore already been converted to crops, timber or intensive animal production. Grasslands originally covered 61% of Mpumalanga, but 44% of this is already transformed. This substantial and irreversible reduction of the biome is due mainly to cultivation, especially industrial scale agriculture and timber growing. These land uses destroy biodiversity but extensive livestock grazing can be reasonably biodiversity-friendly, provided good management and safe stocking rates are applied. While timber growing is mainly restricted to grasslands, its impact is not limited to the plantation “footprint”. It significantly reduces surface and underground water and causes the spread of some of the most damaging alien species. These effects, along with flammability of its tree species and the fire protection measures required, also substantially change the fire regime in grasslands.

Most plants are perennials and surprisingly long lived, with very few annual species, which are the pioneer plants needed to repair disturbance. This makes our grasslands vulnerable to destruction by cultivation; once ploughed they are invaded by alien and weedy pioneer plants. Although many grassland plants do produce seed, very little germinates, most being used as vital food for their rich rodent and insect fauna. Mpumalanga grasslands are mainly found in the highveld above 1,000m. These are cool, dry and open landscapes where rainfall exceeds 500mm per annum. Frost, hailstorms and lightning strikes are common. This natural occurrence of fire and other defoliating events favour grassland plants over woody species and help maintain the open treeless character of grasslands.

Shallow-rooted vegetation is typical of the grasslands with a limited growing season of about six months of the year. The non-growing seasons are characterised by cool and dry conditions, during which time most foliage is removed or killed by frost, and dies back to ground level.

Grassland species are particularly well adapted to being defoliated, whether by grazing, fire or frost. Repeated defoliation, within reason, does no real harm to such plants nor does it reduce productivity. The palatability of grass and its value as food for livestock increases with decreasing rainfall, which is also correlated with altitude. In grazing terms, this corresponds to Sourveld in the moist highveld and sweetveld in the dryer lowveld. This grass palatability gradient extends from grassland into savannas. Although sweetveld grasses produce less biomass than sourveld grasses, they have higher food value and lower fibre. This means the plant nutrients are more available in lower rainfall areas due to less leaching of the soil by high rainfall. The 650mm rainfall isoline approximately separates these two livestock zones. Fire is a characteristic feature of grassland (and savannas) and is a necessary component of good land management. Grassland plants depend on fire, they resprout annually from their root-stocks. Without frequent fire, grasslands eventually become invaded with woody species and some herbaceous plants disappear. Regular burning complements good grazing management and helps to prevent the increase of unpalatable species, including woody species that form bush encroachment.

A reason for concern is the extensive commercial forestation over large areas of land in the high rainfall eastern Escarpment area, a region of exceptionally high biodiversity, which contains 30% of the endemic and rare plant species of the former Transvaal Province. While it is too late to bring back the large migratory herds of grassland herbivores, it is imperative that the existing reserve network be maintained and expanded to conserve viable populations of South Africa's unique grassland species. The first step is to alert the South African public to the fact that a hitherto disregard heritage is slipping away. Warwick Tarboton, an eminent South African ornithologist, expressed it succinctly:

'If ever a biome needed a champion, it is the grassland'

7 THE BIOPHYSICAL ENVIRONMENT

7.1 Location

The preferred site is situated immediately south of the existing ashing facility of Majuba Power Station on the farm Witkoppies 81-HS. A general GPS point for this site is S27.1177° and E29.7489°. Majuba Power Station is situated in the southern part of Mpumalanga Province, approximately 14km southwest from Amersfoort. Amongst other, the use of this site will allow continuous ashing, without moving/ relocating existing infrastructure and services.

The regional location of the study area is illustrated in Figure 1. A composite Google Earth image is presented in Figure 2, reflecting a relatively high habitat fragmentation of the general region.

7.2 Land Cover & Land Use of the Region

Land cover categories are presented in Figure 3. For the purpose of this assessment, land cover are loosely categorised into classes that represent natural habitat and categories that contribute to habitat degradation and transformation on a local or regional scale. In terms of the importance for biodiversity, the assumption is that landscapes exhibiting high transformation levels are normally occupied by plant communities and faunal assemblages that do not necessarily reflect the original or pristine status. This is particularly important in the case of conservation important taxa as these plants and animals generally exhibit extremely low tolerance levels towards disturbances. This is one of the main reasons for the threatened status of these species. Changes in the natural environment available to these species are therefore likely to result in severe impacts on these species and, subsequently, their conservation status.

Three important aspects are associated with habitat changes that accompany certain land uses. Permanent transformation of natural habitat by land uses such as agriculture, mining and urbanisation results in the permanent decimation of available habitat as these areas will not recover to the original pristine status. A second aspect of habitat transformation or degradation is that it affects species directly, namely changes in species presence/ absence and –composition. This result from the exodus of species for which habitat conditions have become unfavourable, the decrease in abundance of certain species because of decreased habitat size, or an influx of species that are better adapted to the altered environment. While some, or most, of the new species that occupy an area might be indigenous, they are not necessarily endemic to the affected area. Lastly, a larger threat to the natural biodiversity of a region is represented by the influx of invasive exotic species that can effectively sterilise large tracts of remaining natural habitat.

The study area is situated within the Seme Municipality, which comprises a total of 522,723ha. The BGIS (2007) assessment indicates that approximately 88% of the municipality are currently considered untransformed. This figure is however regarded an overestimation of the true extent of remaining natural (pristine) grassland habitat in the region. This statement is based on the following:

- The current land cover, as presented in ENPAT does not accurately reflect the current land cover status in all instances; in particular, recent agricultural activities and localised stands of exotics are not captured within the existing data (pers. obs.); and
- It is well established that the status of much of the remaining portions of ‘natural grassland’ is not accurately summarized in the assessment. These ‘natural grasslands’ frequently comprehend poor

quality grassland or even pastures that exhibit severely altered species compositions and depleted diversity that does not reflect the natural grassland of the region (pers. obs.).

By inclusion of portions of other land cover categories, sub-climax grassland types in particular, within the category of 'Natural Grassland' a fallacious view is created of the extent of remaining natural habitat in the region. It is therefore extremely likely that remaining untransformed habitat within the municipality is much lower than initially anticipated. Ultimately, the greater region is characterised by high levels of habitat transformation, isolation and habitat fragmentation, resulting from persistent increases in mining and agricultural activities, urban developments, linear infrastructure and poor management practices.

The effects of commercial agriculture (maize production), infestation by alien invasive trees and recent increase in mining activities are evident from the mosaical appearance of land cover in the immediate region. Other noteworthy land transformation effects result from mining, industrial and urban development. Road and railway infrastructure in the region caused a moderate level of habitat fragmentation and isolation.

7.3 Declared Areas of Conservation

Although no formally declared area of conservation is present within the 12km radius, several areas of conservation are present in the general region, including the following (refer Figure 4):

- Protected areas:
  - Paardeplaats Nature Reserve (58km east, southeast);
  - Wakkerstroom Wetland Nature Reserve (31km southeast)
- Baltrasna Proposed Conservancy (19km northeast);
- Conservancies:
  - Amsterdam (80km northeast);
  - Bloukop (10km north);
  - Mhlangampisi (50km east);
  - Ngwempisi (40km northeast);
  - Reitvaal (10km north, northeast); and
- Maputuland – Pondoland Centre of Endemism (387km southeast).

Figure 1: Regional setting of the study area

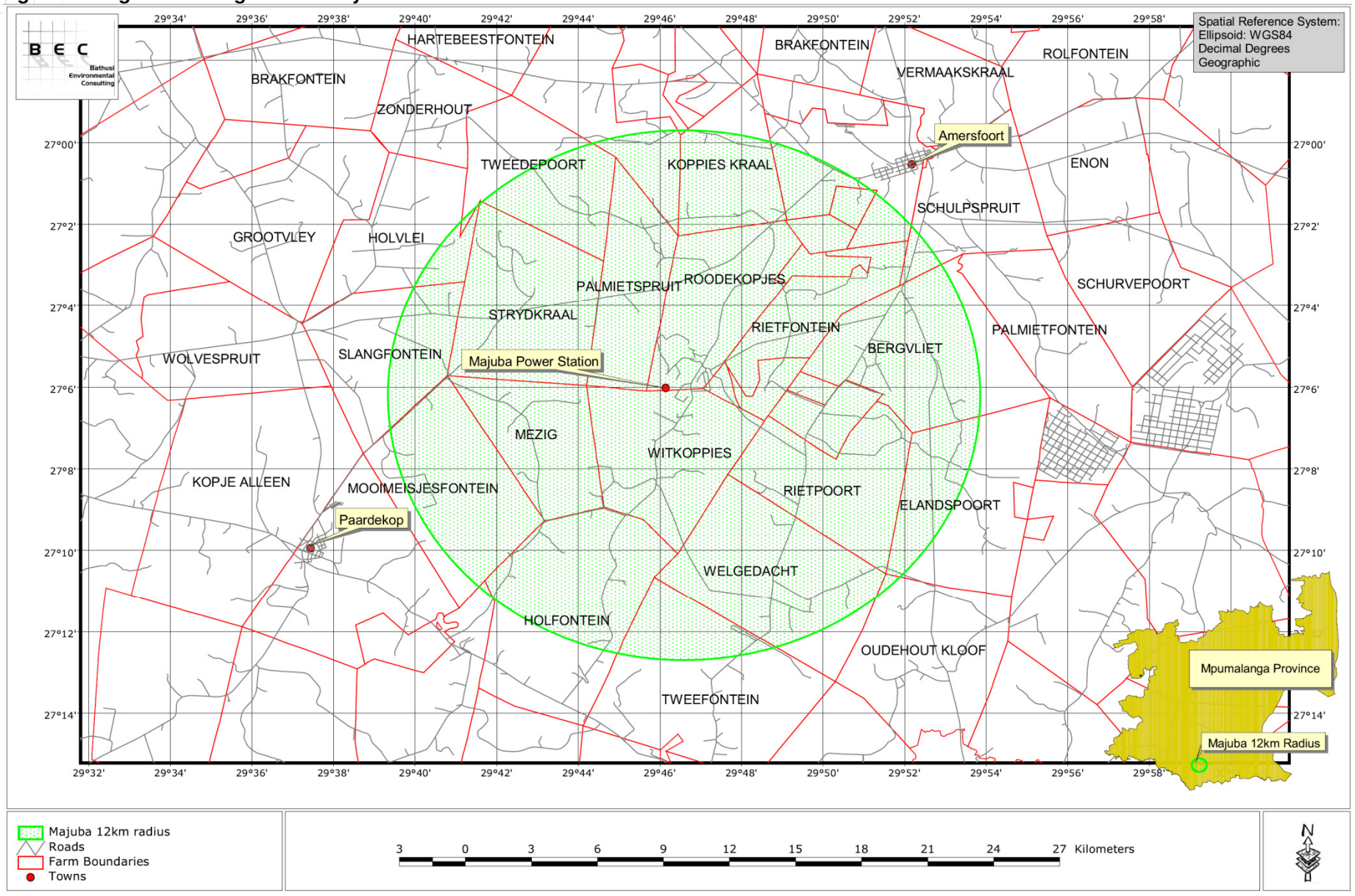


Figure 2: Composite aerial image of the study area (courtesy of www.googleearth.com)

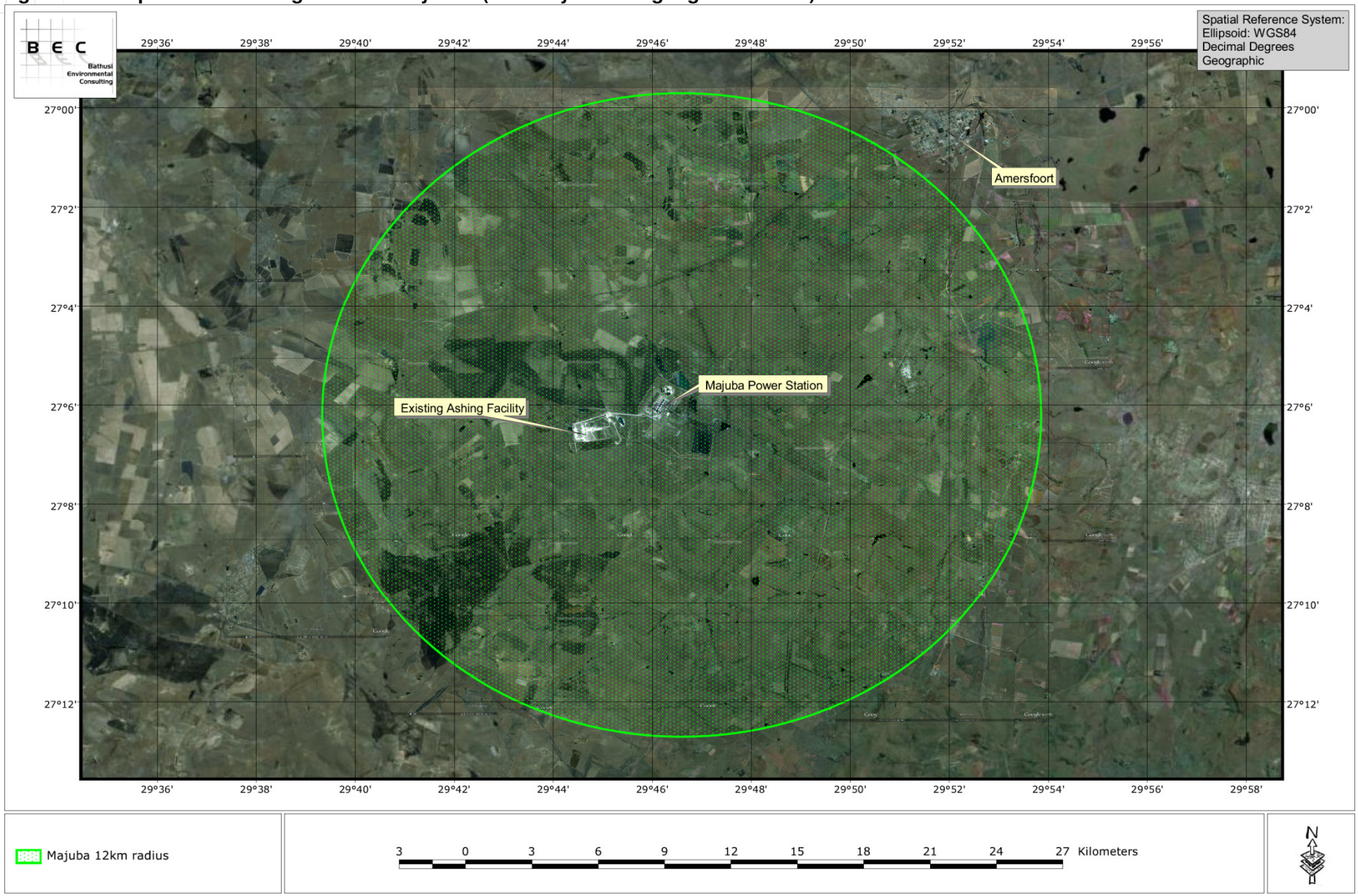


Figure 3: Land cover categories of the study area

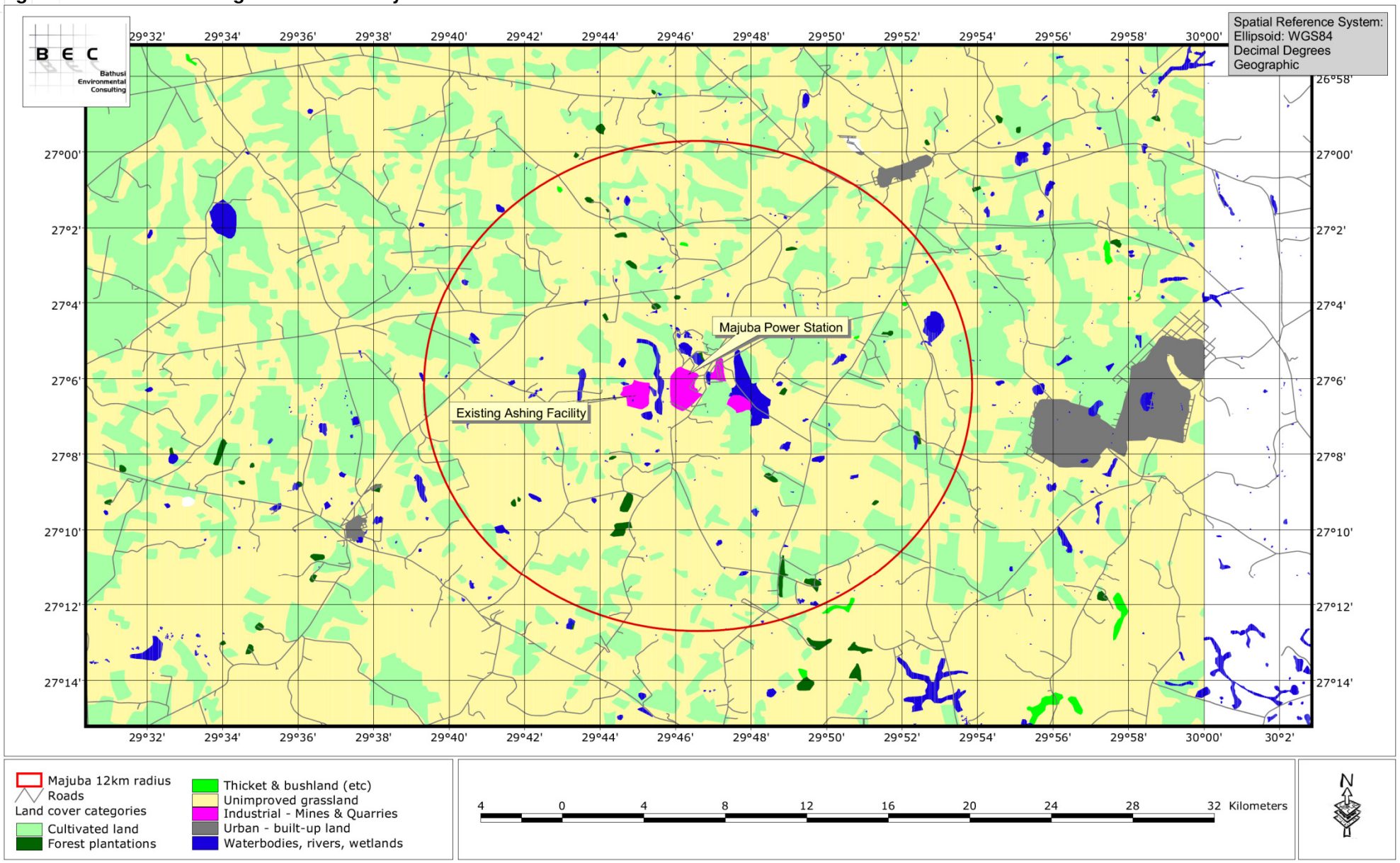
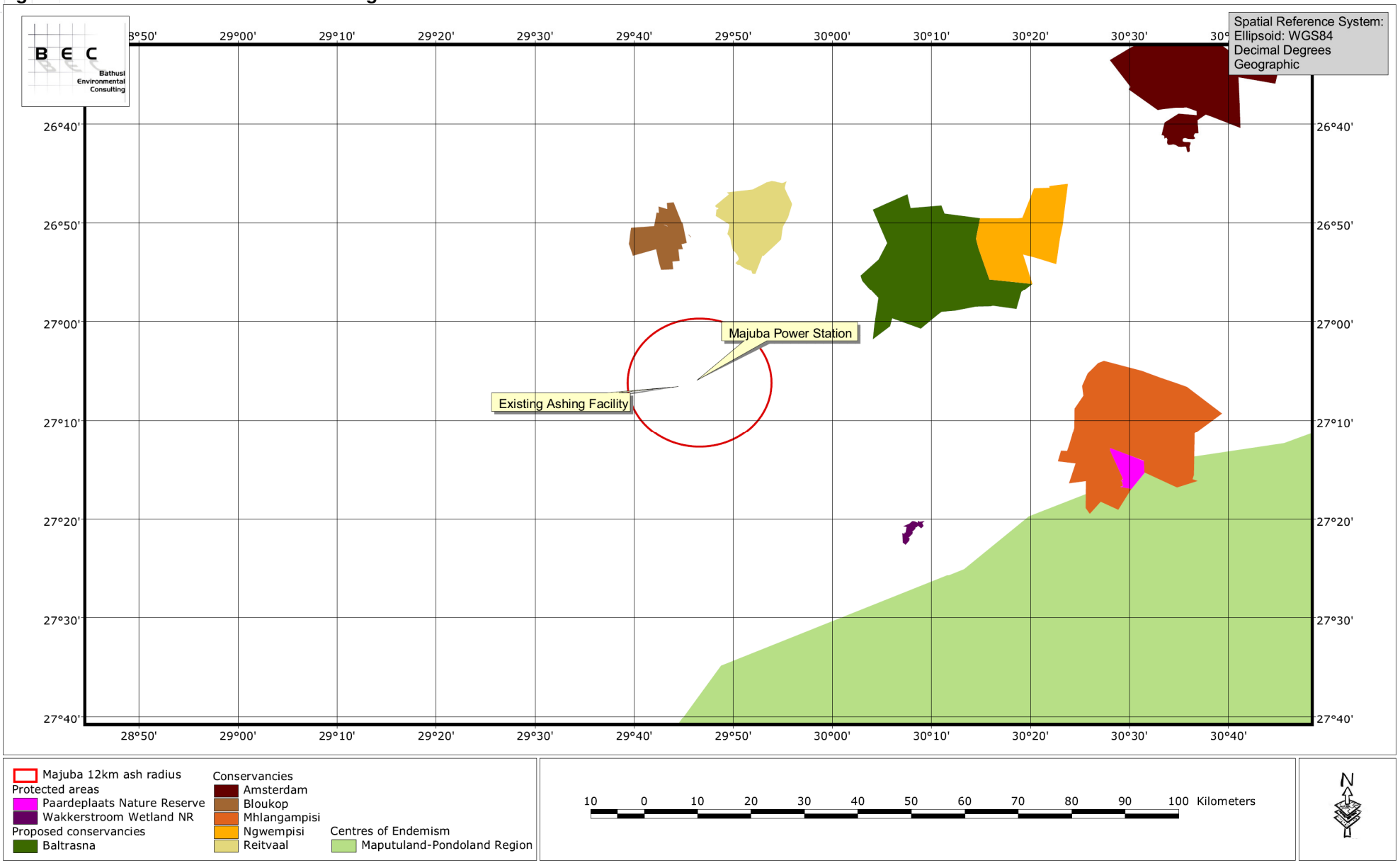


Figure 4: Areas of conservation in the region



7.1 Topography

The ENPAT (2003) database revealed no topographical heterogeneous areas are present (slopes exceeding 8%) in the study area. It should however be noted that the ENPAT database slope classes are based on a high contour interval (probably 100m). With the use of more detailed data, the identification of smaller areas of significant slopes is likely and various smaller and localised areas could be identified that are regarded important in this regard. During previous site investigations, several such areas were observed where localised and small outcrops and ridges occur within the study area. The topography of the study site comprises mostly, 'Strongly undulating plains', but portions of the site exhibit 'Slightly irregular undulating plains and hills' (east) and 'Strongly undulating irregular land' (southwest) (refer Figure 5). Altitude of the study area varies around 1,700m above sea level, from a maximum of 1,800 in the southwest, to a low 1,600 in the northwest, sloping in a northwestern direction.

Varied topography is recognised as a powerful influence contributing to the high biodiversity of southern Africa. Landscapes composed of spatially heterogeneous abiotic conditions provide a greater diversity of potential niches for plants and animals than do homogeneous landscapes. The species richness and biodiversity has been found to be significantly higher in areas of geomorphological heterogeneity.

Ridges and rocky outcrops are characterised by high spatial variability due to the range of differing aspects, slopes and altitudes all resulting in differing soil (e.g. depth, moisture, temperature, drainage, nutrient content), light and hydrological conditions. Temperature and humidity regimes of microsites vary on both a seasonal and daily basis. Moist cool aspects are more conducive to leaching of nutrients than warmer drier slopes. Variation in aspect, soil drainage and elevation/altitude has been found to be especially important predictors of biodiversity. It follows that ridges will be characterized by a particularly high biodiversity.

Many conservation important plants and animals occupy ridges. Due to their threatened status, Red Data species require priority conservation efforts in order to ensure their future survival. Ridges may have a direct effect on temperature/radiation, surface airflow/wind, humidity and soil types. Ridges also influence fire in the landscape, offering protection for those species that can be described as "fire-avoiders". Because of the influence of topography on rainfall, many streams originate on ridges and control water inputs into wetlands. The protection of the ridges in their natural state is therefore a first step in ensuring the normal functioning of ecosystem processes on a larger scale. In contrast, transformation of ridges will alter these major landscape processes. For example, water runoff into streams and wetlands will increase, causing erosion.

7.2 Surface Water[3]

Water, salt and processes linked to concentration of both are the major controls of the creation, maintenance and development of peculiar habitats. Habitats formed in and around flowing and stagnant freshwater bodies, experiences waterlogging (seasonal or permanent) and flooding (regular, irregular or catastrophic), leading to formation of special soil forms. Invariably, both waterlogged and salt-laden habitats appear as 'special', deviating strongly from the typical surrounding zonal vegetation. They are

[3] For a detailed illustration of the presence of areas of surface water within the study area, the reader is referred to the wetland report that is addressed separately to this assessment.

considered to be of azonal character (Mucina & Rutherford, 2006). Water, in conjunction with geology, soil, topography and climate, is responsible for the creation of remarkably many types of habitats. Water chemistry, temperature and temporary changes in both, together with the amount of water (depth of water column), timing of occurrence (regular tides or irregular floods) and speed of its movement (discharge, flow and stagnation) are the major factors shaping the ecology of biotic communities occupying such habitats (VEGMAP, 2006).

Areas of surface water contribute significantly towards the local and regional biodiversity due to atypical habitat that is present within ecotonal areas. Ecotones (areas or zones of transition between different habitat types) are occupied by species occurring in both the bordering habitats, and are generally rich in species due to the confluence of habitats. In addition to daily visitors that utilise the water sources on a frequent basis, some flora and fauna species are specifically adapted to exploit the temporal or seasonal fluctuation in moisture levels in these areas, exhibiting extremely low tolerance levels towards habitat variation. Ecotonal interface areas form narrow bands around areas of surface water and they constitute extremely small portions when calculated on a purely mathematical basis. However, considering the high species richness, these areas are extremely important on a local and regional scale. Rivers also represent important linear migration routes for a number of fauna species as well as a distribution method for plant seeds.

Areas of surface water are present in the study area in the form of rivers, perennial and non-perennial steams, artificial and natural impoundments and, to a lesser degree, moist grassland/ seepages. Larger rivers and streams include the Palmietspruit, Witbankspruit and Skulpspruit. The study area is situated within the Vaal Primary Catchment area.

7.3 Geology

The major geological formations of the region are illustrated in Figure 6.It would appear as if the underlying geological patterns have a significant effect on the vegetation development as particular patterns are observed that are likely to be resultant from geological boundaries. The following geological formations are represented in the study area:

- Vryheid Arenites - sedimentary rock composed of sand-sized fragments irrespective of composition, thick beds of yellowish to white cross-bedded sandstone and grit, which alternate with beds of soft, dark-grey, sandy shale and a few seams of coal
- Karoo Dolerite – a dark coloured crystalline igneous rock that abundantly intrudes the Karoo Sequence, giving rise to many characteristic flat-topped hills, therefore typically present in steep hills, mountains and escarpment landforms. Sills and dykes often exert structural control in the landscape, and may be seen as present on flat-topped hills, or as the crest of waterfalls.
- Adelaide & Estcourt Mudstones – essentially of greenish (or bluish) grey, and greyish-red mudstones and sandstones, manifesting as undulating to strongly undulating lowlands and hills with moderate slopes. Fossils occur fairly generally, and remains of reptiles, fish, insects and plants are known; and
- Volksrust Shales –exhibiting dark grey shale, siltstone and sandstone. Fossils are scarce and consist of fish scales and fragments of petrified wood.

Figure 5: Topographical variation of the region

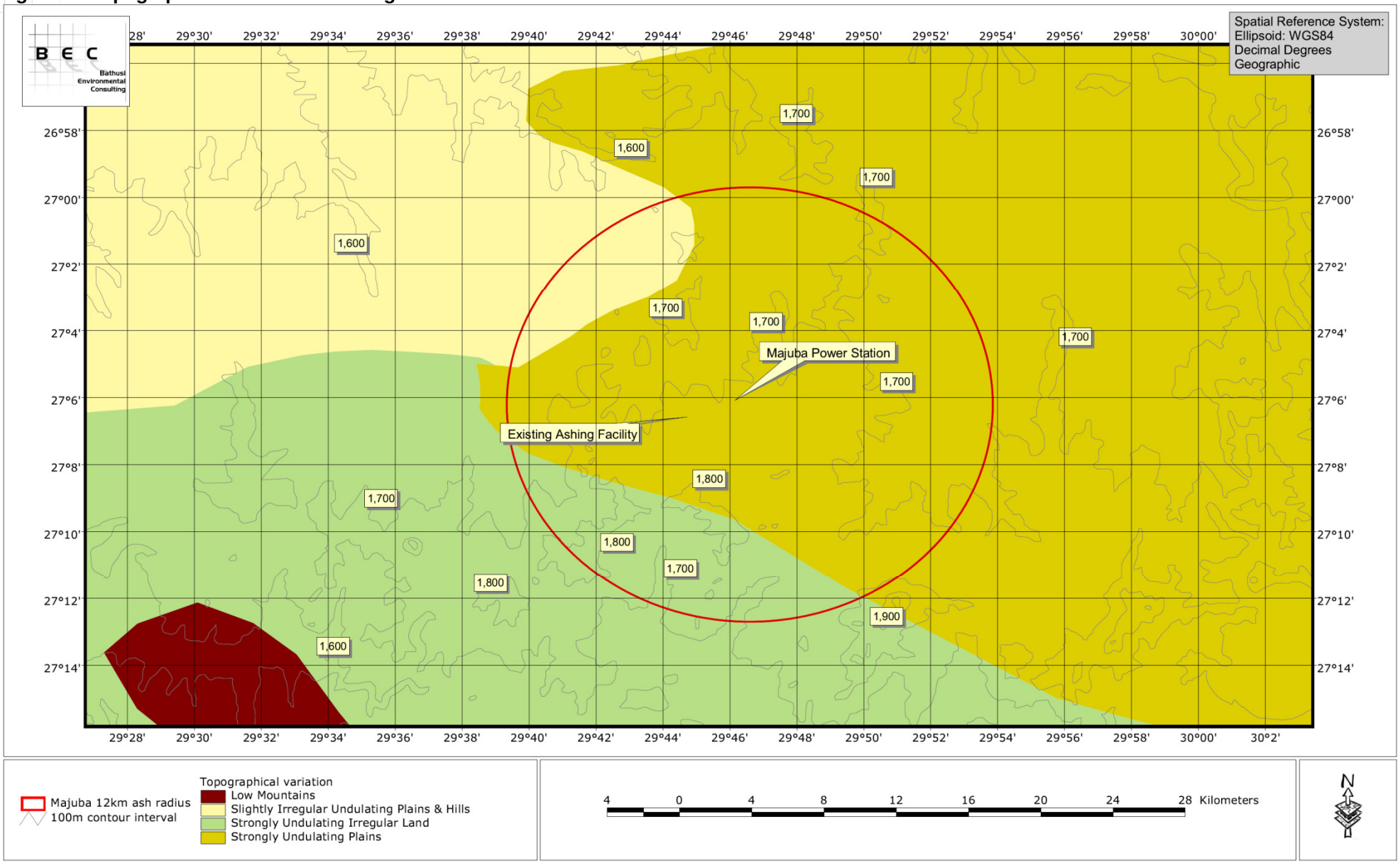
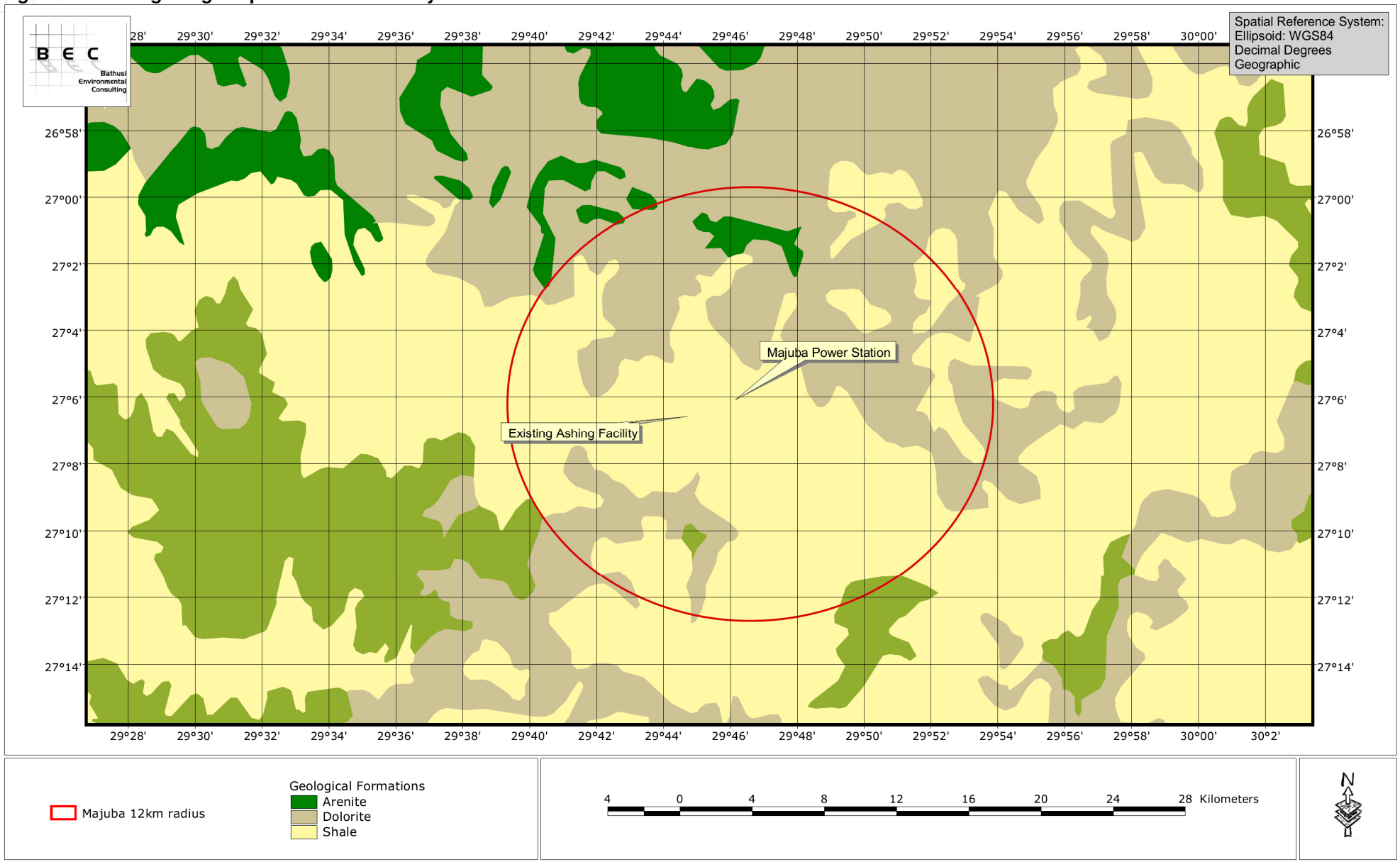


Figure 6: Broad geological patterns of the study area



7.4 Land Types

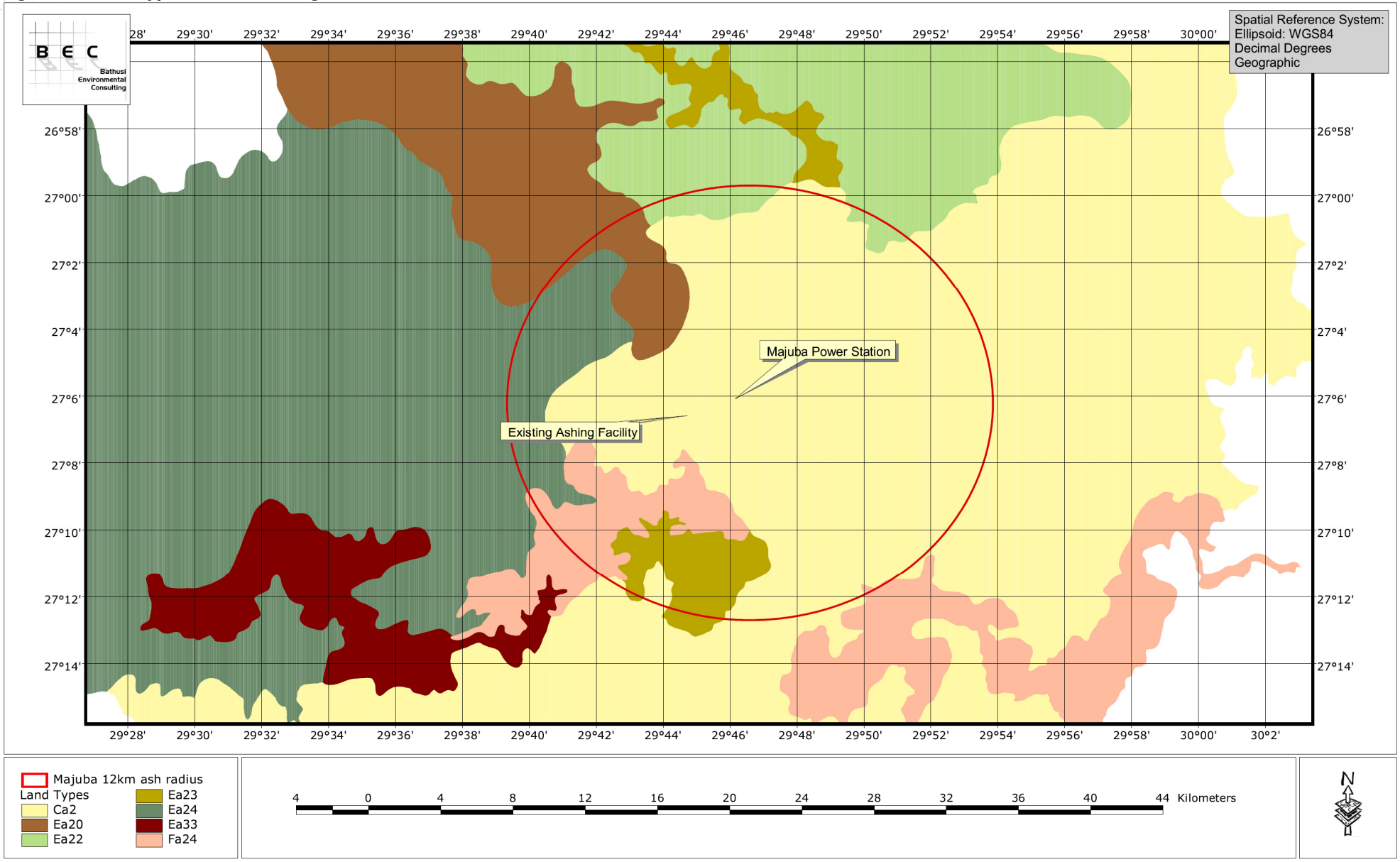
Although it is not in the scope of this report to present a detailed description of the soil types of the area, a basic description will suffice for this assessment as the association of habitat types and land types (soils) are typical of grassland vegetation.

The preferred site is situated within the Bd46 land type unit (refer Figure 7). Other land types represented within the 12km radius buffer zone include Ae252, Ah86, Bc44 and Bd44.

Map units Aa to Ai refer to yellow and red soils without water tables and belonging in one or more of the following soil form: Inanda, Kranskop, Magwa, Hutton, Griffin and Clovelly. The map units refer to land that does not qualify as a plinthic catena and in which one or more of the above soil forms occupy at least 40% of the area. In Ab (red, dystrophic and/ or mesotrophic), yellow soils occupy less than 10% of the area and /or mesotrophic soils occupy a larger area than high base status red-yellow apedal soils.

The B- group includes a large area of the South African interior that is occupied by a catena, which in its perfect form is represented by (in order from highest to lowest in the upland landscape) Hutton, Bainsvlei, Avalon and Longlands forms. The valley bottoms are occupied by one or other gley soil. Soils with hard plinthite are common over sandstones in the moist climate zones in the eastern part of the country. Depending on the extent to which water tables have been operative over a landscape, Longlands, Avalon and related grey and yellow soils may predominate, even to the exclusion of red soils. Where water tables have not extended beyond the valley bottoms, red soils may predominate with plinthic soils restricted to narrow strips of land around valley bottoms or pans. For inclusion into Bc and Bd plinthic soils must cover more than 10% of the area. Unit Bc indicates land in which yellow and/ or red apedal soils are eutrophic and red soils are widespread, while red soils are not widespread in unit Bd.

Figure 7: Land type units of the region



7.5 Mpumalanga Biodiversity Conservation Plan

7.5.1 Terrestrial Biodiversity Sensitivities on a Local Scale

The local and regional designation of Mpumalanga Terrestrial Biodiversity Conservation Categories (MBCP) is illustrated in Figure 8.

The mandate for conserving biodiversity lies with state agencies at national, provincial and local levels of government, forming part of a wider responsibility for the environment and the sustainable use of natural resources. Constitutional and national laws require these environmental issues to be dealt with in cooperative, participatory, transparent and integrated ways. The MBCP is the first spatial biodiversity plan for Mpumalanga that is based on scientifically determined and quantified biodiversity objectives. The purpose of the MBCP is to contribute to sustainable development in Mpumalanga.

The MBCP maps the distribution of Mpumalanga Province's known biodiversity into six categories (Lötter & Ferrar, 2006). These are ranked according to ecological and biodiversity importance and their contribution to meeting the quantitative targets set for each biodiversity feature. The categories are:

1 Protected areas - already protected and managed for conservation;
2 Irreplaceable areas - no other options available to meet targets—protection crucial;
3 Highly Significant areas - protection needed, very limited choice for meeting targets;
4 Important and Necessary areas - protection needed, greater choice in meeting targets;
5 Ecological Corridors – mixed natural and transformed areas, identified for long term connectivity and biological movement;
6 Areas of Least Concern – natural areas with most choices, including for development;
7 Areas with No Natural Habitat Remaining – transformed areas that do not contribute to meeting targets.

The study area comprises two of these categories (refer Figure 7), namely:

- Highly Significant;
- Important & Necessary;
- No Natural Habitat Remaining; and
- Least Concern.

Land included in the '**Highly Significant**' category should be maintained as natural vegetation cover. Permissible land uses should be limited to those that are least harmful to biodiversity, i.e. Land-Use Types 1 – 4. All cultivation-based agriculture and all urban/industrial development (Land-Use Types 5 – 15) should not be permitted. If development is unavoidable, it must be made sufficiently dispersed (sometimes clumped) and of the right scale to be as biodiversity friendly as possible. Specialist ecological advice will be required in such cases to reinforce standard EIA procedures[4].Biodiversity reinforced EIA procedures' require that a specialised biodiversity study be undertaken as part of the EIA. This requires a survey by an experienced and locally knowledgeable biodiversity expert. Destruction of biodiversity in HIGHLY SIGNIFICANT land may result in remaining areas being moved into the IRREPLACEABLE category.

[4]Undertake specialist studies according to MTPA's 'Requirements for Assessing and Mitigating Environmental Impacts of Development Applications' document.

The category of '**Important & Necessary**' is significantly important areas of natural vegetation that play an important role in meeting biodiversity targets. Their designation as IMPORTANT AND NECESSARY seeks to minimise conflict with competing land uses and represents the most efficient selection of areas to meet biodiversity targets. No significant increase in the occurrence of Land-Use Types 5 – 9, should be permitted (refer Footnote 3). Every opportunity to revert to economic options using natural land cover should be taken. Some agricultural land uses may be permitted but with best-practice guidelines made conditional and aimed at benefiting the biodiversity assets and reducing the vulnerability of each site.

Areas of '**No Natural Habitat Remaining**' comprise approximately 35.8% of the Province. This category has already lost most of its biodiversity and ecological functioning. In the remnants of natural habitat that occur between cultivated lands and along river lines and ridges, residual biodiversity features and ecological processes do survive, but these disconnected remnants are biologically impoverished, highly vulnerable to damage and have limited likelihood of being able to persist. The more transformed a landscape becomes; the more value is placed on these remnants of natural habitat. Areas with no natural habitat remaining are preferred sites for developments, taking the potential presence of lands with high agricultural potential into consideration.

Biodiversity assets in landscapes categorized as '**Least Concern**' contributes to natural ecosystem functioning, ensuring the maintenance of viable species populations and providing essential ecological and environmental goods and services across the landscape. This category comprises approximately 25.5% of the Mpumalanga Province and although these areas contribute the least to the achievement of biodiversity targets, they have significant environmental, aesthetic and social values and should not be viewed as wastelands or carte-blanche development zones. Development options are widest in these areas. At the broad scale, these areas and those where natural habitat has been lost serve as preferred sites for all forms of development. It is still required to consider other environmental factors such as socioeconomic efficiency, aesthetics and the sense-of-place in making decisions about development. Prime agricultural land should also be avoided for all non-agricultural land uses. Land-use and administrative options for positive biodiversity outcomes include:

- Where this category of land occurs close to areas of high biodiversity value, it may provide useful ecological connectivity or ecosystem services functions, e.g. ecological buffer zones and corridors or water production. Encouragement needs to be given to biodiversity-friendly forms of management and even restoration options where appropriate;
- Develop incentives to reverse lost biodiversity for selected parcels of land where buffer zones and connectivity are potentially important;
- Standard application of EIA and other planning procedures are required; and
- These areas might serve as preferred sites for all forms of urban and industrial development (Land-Use Types 10 – 15).

7.5.2 Development Restrictions in Terms of the MBCP

The MBCP suggests that 'Irreplaceable', 'Highly Significant' areas should remain unaltered and be managed for biodiversity by various means. Other categories incorporate increasing options for different types of land use that should be decided by the application of EIA procedures and negotiation between stakeholders. The MBCP also identifies that 35.8% of the Province is included in the category of 'No natural habitat remaining', which has very little biodiversity value.

The proposed development relates to 'Major Development Projects' (Land Use Type 15 – Surface Mining[5], Dumping & Dredging) and is included in the category 'Urban Industrial Land Uses' with the other development types of Urban & Business Development, Major Development Projects, Linear Engineering Structures and Water Projects & Transfers. These six land uses cause the greatest environmental impact and are almost completely destructive of natural vegetation and natural biodiversity. Where biodiversity persists, it is artificially maintained, generally supporting only opportunistic assemblages of plants and animals. Ecosystem processes are completely disrupted, heavily impacted or artificially maintained at high cost. These land uses not only produce the highest local impacts but also dominate the dispersed and cumulative impacts. They are the most destructive and wide-ranging, often spreading hundreds of kilometres from their source, especially along river systems. These land-use types also require special provision in land-use planning, impact assessment and mitigation.

Limitations for the proposed development of an ashing facility (included in Land Use Type 15) indicated by the MBCP comprise the 'Permitted' and 'Restricted' categories (refer Figure 9) in the 12km radius of the study area.

Extensive parts of the study area are situated within areas where major developments are restricted according to the Mpumalanga Biodiversity Conservation Plan (MBCP). This does not necessarily imply that any development will be denied, but rather that specialists studies clearly need to indicate that the proposed development will not adversely affect any sensitive floristic or faunal attributes that occur, or potentially could occur, within the study area or on a local and regional scale (refer Footnote 3). Specialist studies are furthermore required to show that the proposed development will not add to existing cumulative impacts, regional degradation and habitat transformation and the loss of biodiversity on a local or regional scale.

[5]Includes all strip and opencast mining excavations or quarrying, plus the visual, physical and chemical impacts of these activities, particularly on ground water reserves as well as all mine waste

Figure 8: Terrestrial and Biodiversity Conservation categories of the study area

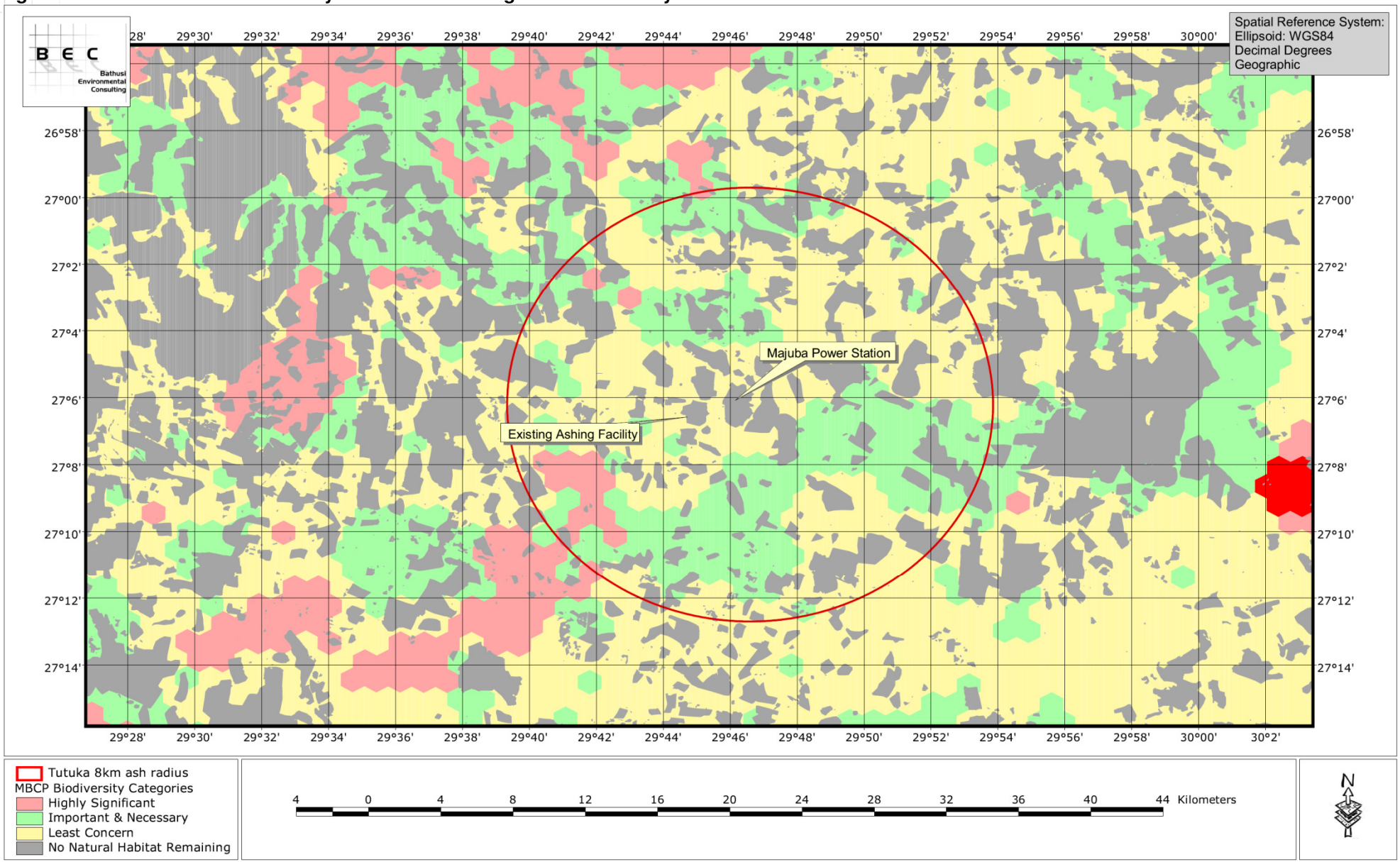
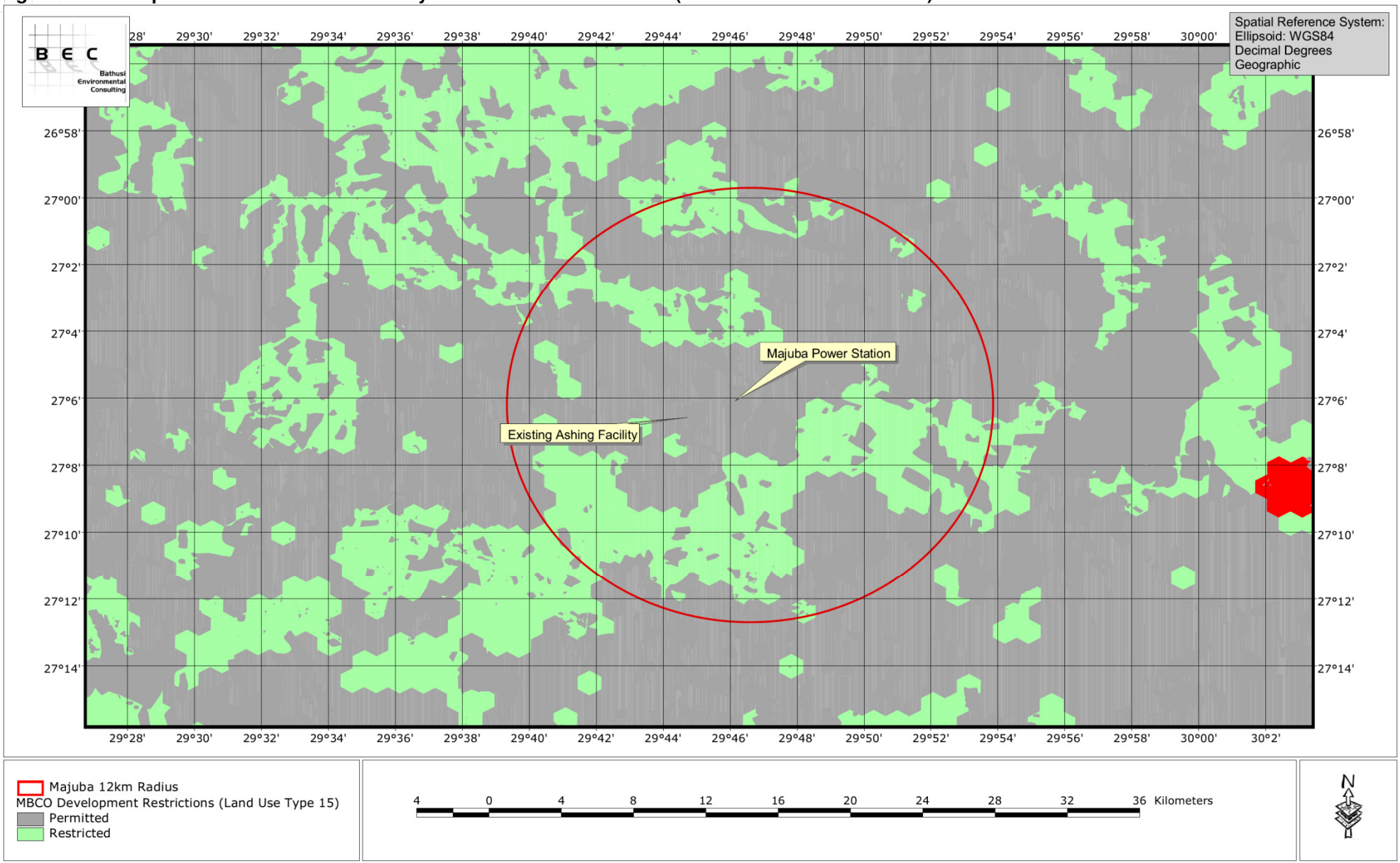


Figure 9: Development limitations for the study area in terms of the MBCP (Urban Industrial Land Uses)



8 BOTANICAL ASSESSMENT

8.1 Regional Floristic Traits

The study site corresponds to the Grassland Biome as defined by Mucina & Rutherford (VegMap, 2006). This unit is found in the eastern, precipitation-rich regions of the Highveld. Grasslands of these parts are regarded 'sour grasslands'. The following ecological types are represented within the 12km radius (refer Figure 10):

- Amersfoort Highveld Clay Grassland;
- Bloemfontein Karroid Shrubland;
- Eastern Temperate Freshwater Wetlands;
- Soweto Highveld Grassland; and
- Wakkerstroom Montane Grassland.

A map with the conservation status of respective vegetation types are presented in Figure 11.

8.1.1 Amersfoort Highveld Clay Grassland

This grassland comprises undulating plains, with small, scattered patches of dolerite outcrops. The vegetation comprises of short, closed grassland, largely dominated by a dense *Themeda triandra* sward, often severely grazed. Overgrazing leads to invasion of *Seriphium plumosum*. Parts of this unit were once cultivated and these transformed areas are not picked up by satellite for transformation coverage; the percentage of grasslands still in a natural state may therefore be underestimated.

The conservation status is regarded as '**Vulnerable**'; none is formally protected. Some 25% of this vegetation type is transformed, predominantly by cultivation (22%). The area is not suited to forestation. Silver and black wattle and *Salix babylonica* invade drainage areas.

8.1.2 Bloemfontein Karroid Shrubland

Vegetation of this unit comprehends plateaus or slightly sloping flanks of dolerite outcrops supporting low shrubland dominated by dwarf small-leaved karroid and succulent shrubs. Grasses are restricted to depressions and crevices filled with fine soils. Remarkable is the presence of abundant geophytic herbs. Solitary shrubs or small shrub groups with *Diospyros austro-africana, Euclea crisps* subsp. *ovata, Searsia burchelli S. ciliata* and *S. erosa* are occasionally present, especially in habitats where root penetration into deeper crevices is possible.

Some sites of this vegetation are exposed to considerable urban developmental pressures, especially within the borders of the Mangaung Municipality. None is conserved in statutory conservation areas, but small portions are found on the premises of the Free State National Botanical Garden in Bloemfontein; a '**Least Threatened**' status is currently afforded. About 10% is already transformed, mainly by cultivation. Potts & Tidmarsh (1937) were the first to describe this vegetation and to recognise the fact that it is a unique island of succulent-dominated karroid shrub community within the Grassland Biome. Although there is a strong affinity to the vegetation of the arid west, it also has a notable grass component. It is therefore suggested that the occurrence of karroid shrubland within highveld grasslands relates to physiological drought due to shallow soils, high runoff, high evaporation rates and impeded infiltration of

rainwater. These factors create soil-controlled microhabitat for vegetation that might be considered a relic of drier (and presumable colder) past climatic periods.

8.1.3 Eastern Temperate Freshwater Wetlands

This ecological type occurs around water bodies with stagnant water (lakes, pans, periodically flooded vleis and edges of calmly flowing rivers) and is embedded within the Grassland Biome. The landscape is generally flat, or shallow depressions filled with (temporary) water bodies supporting zoned systems of aquatic and hygrophilous vegetation of temporarily flooded grasslands and ephemeral herblands. The vleis from where flow of water is impeded by impermeable soils and/ or by erosion resistant features, such as dolerite intrusions. Many vleis and pans of this type of wetlands are inundated and/ or saturated only during the summer rainfall season and for some months after this into the middle of the dry winter season, but they may remain saturated all year round. About 5% is statutorily conserved in the Blesbokspruit, Hogsback, Marievale, Olifantsvlei, Seekoeivlei, Wakkerstroom Wetland, Umgeni Vlei and Pamula Park Nature Reserves. It is also protected in private nature reserves such as the Korsman Bird Sanctuary and Langfontein. A '**Vulnerable**' conservation status is ascribed to this unit. Some 15% has been transformed to cultivated land, urban areas or plantations.

8.1.4 Soweto Highveld Grassland

The Soweto Highveld Grassland comprises a gently to moderately undulating landscape on the Highveld plateau supporting short to medium-high, dense, tufted grassland dominated almost entirely by *Themeda triandra* and accompanied by a variety of other grasses such as *Elionurus muticus, Eragrostis racemosa, Heteropogon contortus* and *Tristachya leucothrix*. Only scattered small wetlands, narrow stream alluvia, pans and occasional ridges or rocky outcrops interrupt the continuous grassland cover in undisturbed areas. This vegetation type is regarded '**Endangered**' with a target of 24%. Only a handful of patches are statutorily conserved, including Wadrift, Krugersdorp, Leeuwkuil, Suikerboschrand and Rolfe's Pan Nature Reserve. Almost half of the area is already transformed by cultivation, urban sprawl, mining and building of road infrastructure. Some areas have been flooded by dams (Grootdraai, Leeukuil, Trichardtsfontein, Vaal, Willem Brummer). Erosion is generally very low.

8.1.5 Wakkerstroom Montane Grassland

A small portion of this ecological type is represented in the southeast of the 12km radius. Vegetation of this unit is a less obvious continuation of the Escarpment that links the southern and northern Drakensberg escarpments; it straddles this divide and comprises of low mountains and undulating plains. The vegetation comprises predominantly short montane grasslands on the plateaus and the relatively flat areas, with short forest and *Leucosidea* thickets occurring along steep, mainly east-facing slopes and drainage lines. *L. sericea* is the dominant woody pioneer species that invades areas as a result of grazing mismanagement. A status of '**Least Threatened**' is afforded to these parts; although less than 1% is statutorily conserved in the Paardeplaats Nature Reserve. There are 10 Natural Heritage Sites in this unit, although very little of it is formally protected. Land use pressures from agriculture are low, probable owing to the colder climate and shallower soils. The area is also suited to afforestation, with more than 1% under *Acacia mearnsii* and *Eucalyptus* plantations.

Figure 10: VEGMAP categories of the region

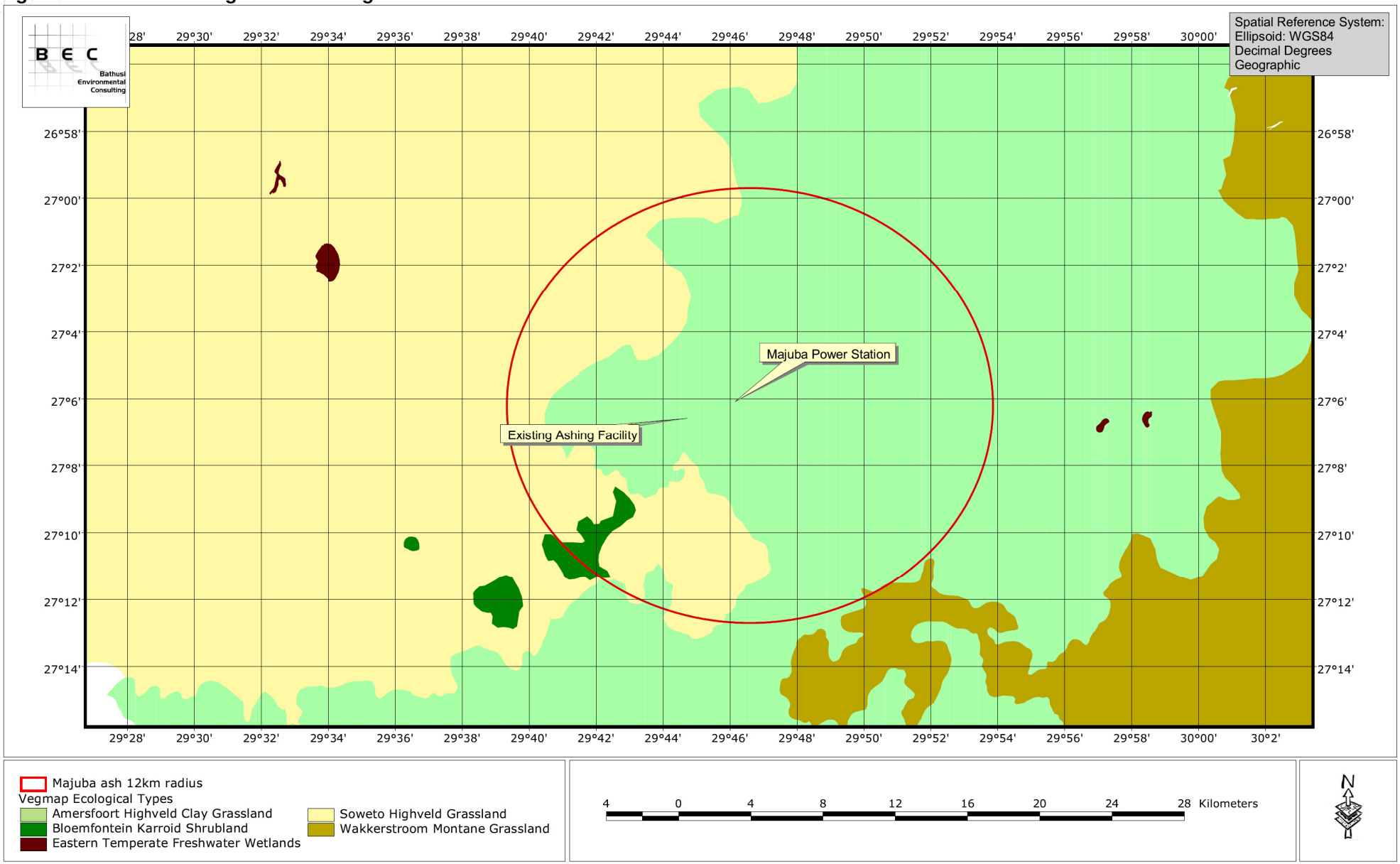
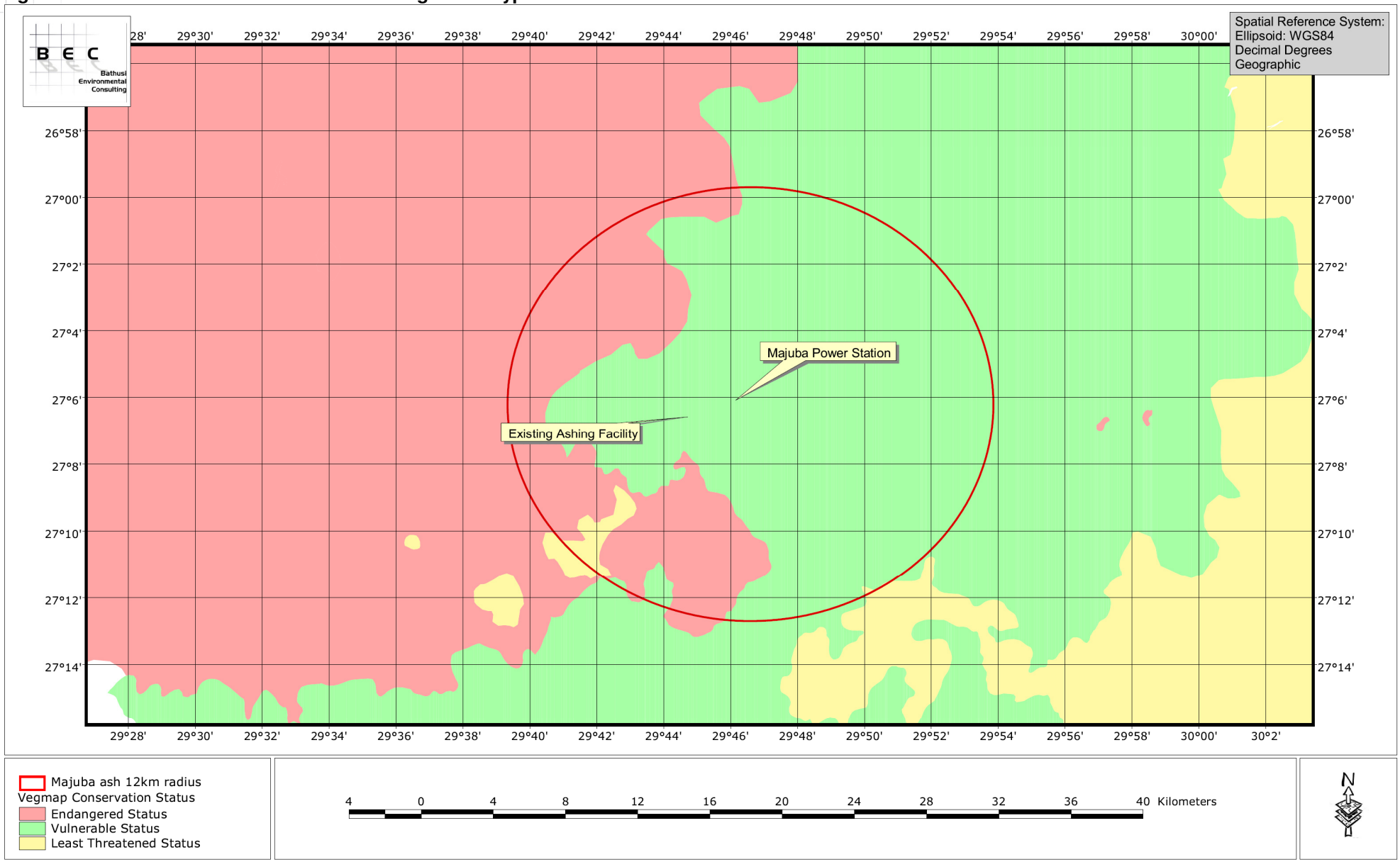


Figure 11: VEGMAP conservation status of vegetation types



8.2 Regional Diversity

Information obtained from the SANBI database (POSA, 2012) indicates the known presence of approximately 390 plant species within the ¼-degree grids that are spatially represented in the study area (2629DC, DD, 2729BA, BB)[6]. The high floristic diversity of the immediate region reflects the regional diversity context of the Grassland Biome. However, the paucity of accurate floristic species richness is indicated by the absence of some common plant taxa from the data records as well as the low species richness of certain ¼-degree grids.

An appraisal of the growth forms (Table 3) reflects the diverse grassland physiognomy with 189 herb species (48.5%), 74 grass species, (19.0%) and 45 geophyte species (11.5%). The physiognomical dominance of the grassland biome is also illustrated by the absence of large trees and low diversity of shrubs (15 species, 3.8%). This species richness also represents 66 plant families, typically dominated by Poaceae (19%), Asteraceae (66 species, 16.9%), Fabaceae (21 species, 5.4%) and Cyperaceae (21 species, 5.4%).

Table 3: Growth forms of the region

Growth Form	Number	Percentage
Bryophyte	5	1.3%
Carnivore	1	0.3%
Climber	7	1.8%
Cyperoid	21	5.4%
Dwarf shrub	12	3.1%
Fern	2	0.5%
Geophyte	45	11.5%
Graminoid	74	19.0%
Helophyte	3	0.8%
Herb	189	48.5%
Hydrophyte	3	0.8%
Parasite	3	0.8%
Shrub	15	3.8%
Succulent	7	1.8%
Suffrutex	3	0.8%
Bryophyte	5	1.3%
Total	**390**	

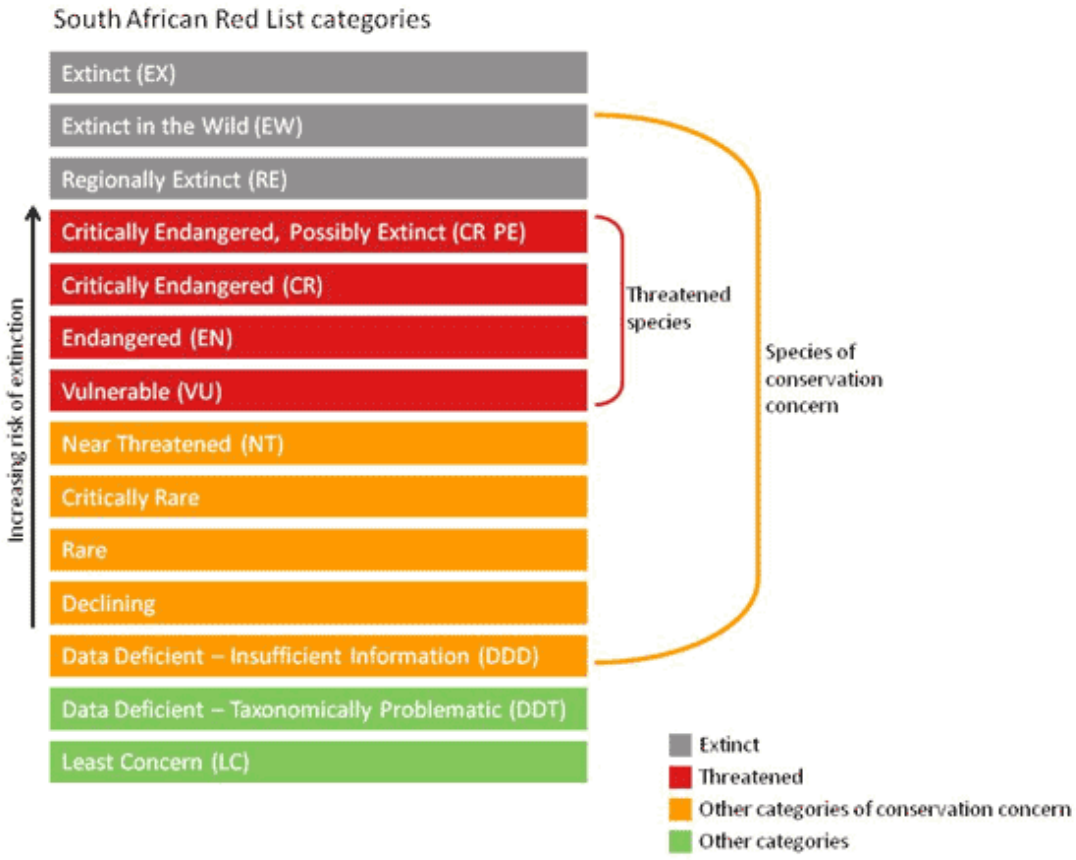
8.2.2 Flora species of Conservation Importance of the Region

South Africa's Red List system is based on the IUCN Red List Categories and Criteria Version 3.1 (finalized in 2001), amended to include additional categories to indicate species that are of local conservation concern. The IUCN Red List system is designed to detect risk of extinction. Species that are at risk of extinction, also known as threatened or endangered species are those that are classified in the categories Critically Endangered (CR), Endangered (EN) and Vulnerable (VU). Species included in these categories are presented in Table 4. Taking the habitat that is available as well as the status

[6] This list is not included in the report due to the size, but can be presented separately on request.

thereof into consideration, it is regarded likely that plant species included in the Threatened category might be present within the study areas.

Figure 12: South African Red List Categories (courtesy of SANBI)



- A species is Data Deficient when taxonomic problems hinder the distribution range and habitat from being well defined, so that an assessment of risk of extinction is not possible.
- A species is included in the Declining category when it does not meet or nearly meet any of the five IUCN criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened, but there are threatening processes causing a continuing decline of the species;
- A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
- A species is Rare when it meets at least one of four South African criteria for rarity, but is not exposed to any direct or plausible potential threat and does not qualify for a category of threat according to one of the five IUCN criteria.
- A species is Vulnerable when the best available evidence indicates that it meets at least one of the five IUCN criteria for Vulnerable, indicating that the species is facing a high risk of extinction.

Mpumalanga Province comprises 4,256 plant species of which 276 are included in the following conservation categories:

1 Extinct;

30 Endangered;

80 Vulnerable;
36 Near Threatened;
2 Critically Rare;
47 Rare;
25 Declining;
19 DDD; and
36 DDT.

Data records indicate the presence of a number of plant species of conservation importance within the ¼-degree grids that are sympatric to the study area (refer Table 4).

Table 4: Plant species of conservation importance within the region of the study area

Species Name	Family	Status
Acalypha caperonioides var. *caperonioides*	Euphorbiaceae	Data Deficient
Argyrolobium campicola	Fabaceae	Near Threatened
Crinum bulbispermum	Amaryllidaceae	Declining
Gladiolus robertsoniae	Iridaceae	Near Threatened
Ilex mitis	Aquifoliaceae	Declining
Khadia alticola	Mesembryanthemaceae	Rare
Kniphofia typhoides	Asphodelaceae	Near Threatened
Miraglossum davyi	Apocynaceae	Vulnerable
Nerine platypetala	Amaryllidaceae	Vulnerable
Stenostelma umbelluliferum	Apocynaceae	Near Threatened

In addition to the species currently captured in the SANBI infobase (POSA, 2011), the following provincially protected plants are known to occur within the region of the study area (Mpumalanga Nature Conservation Act No.10 of 1998) (Table 5).

Table 5: Protected plant species within the region of the study area

Species Name	Family	Status
Agapanthus inapertus subsp. *intermedius*	Agapanthaceae	Provincially protected
Aloe ecklonis	Asphodelaceae	Provincially protected
Corycium nigrescens	Orchidaceae	Provincially protected
Crinum bulbispermum	Amaryllidaceae	Provincially protected
Cyrtanthus breviflorus	Amaryllidaceae	Provincially protected
Cyrtanthus tuckii var. *transvaalensis*	Amaryllidaceae	Provincially protected
Cyrtanthus tuckii var. *tuckii*	Amaryllidaceae	Provincially protected
Eulophia foliosa	Orchidaceae	Provincially protected
Gladiolus crassifolius	Iridaceae	Provincially protected
Gladiolus dalenii subsp. *dalenii*	Iridaceae	Provincially protected
Gladiolus permeabilis subsp. *edulis*	Iridaceae	Provincially protected
Gladiolus robertsoniae	Iridaceae	Provincially protected
Gladiolus sericeovillosus subsp. *calvatus*	Iridaceae	Provincially protected
Gladiolus sericeovillosus subsp. *sericeovillosus*	Iridaceae	Provincially protected
Haemanthus montanus	Amaryllidaceae	Provincially protected
Kniphofia albescens	Asphodelaceae	Provincially protected
Kniphofia typhoides	Asphodelaceae	Provincially protected
Leucospermum cuneiforme	Proteaceae	Provincially protected
Satyrium neglectum subsp. *neglectum* var. *neglectum*	Orchidaceae	Provincially protected
Zantedeschia albomaculata subsp. *macrocarpa*	Araceae	Provincially protected

8.3 Macro Habitat Types

For the purpose of the sensitivity assessment, no distinction was made between various types of natural terrestrial grassland habitats, other than the regional grassland types (e.g. Amersfoort Highveld Clay Grassland and Soweto Highveld Grassland). The visual appearance of habitat units on aerial imagery was used as an indication of transformation; however, this could be deceiving in some instances, as cultivated pastures do resemble natural grassland in some cases. It should however be noted that numerous variations exist that are not addressed in this particular report. The designation of habitat types within the study area is illustrated in Figure 13.

8.3.1 Natural Terrestrial Grassland Habitat

Remaining natural terrestrial grassland are characterised by a short, low cover of herbaceous species, physiognomically dominated by grasses, but with a high diversity of forbs. The floristic status of these areas is determined by the intensity of grazing by livestock and the altered species composition that accompanies insowing in some parts. The phytosociological characteristics are determined by the interplay between moisture levels, topographical placement and status.

The conservation status of these grasslands, on a regional scale, is Endangered and Vulnerable. All natural grassland habitats within the study area where the species composition and floristic character approximates that of the regional vegetation type is therefore regarded sensitive. In addition to the conservation importance that is ascribed to these remaining portions of grassland, the ecological importance in terms of their contribution to the functionality of associated wetland habitat types cannot be overemphasised. The likelihood of encountering Red Data plant species within these areas is high because of high habitat suitability for Red Data plant species that are known to occur in the region. It is important to note that plant taxa of conservation importance are known to occur within the preferred site, associated with the ephemeral grasslands.

8.3.2 Linear infrastructure

Linear infrastructure within the 12km buffer zone, generally, limits the placement of the proposed ashing facility as a number of roads, power line servitudes, railways and conveyor facilities are present. While realignment of the major roads and power lines may be costly, it should remain an option in the event that only such a feature potentially prevents the selection of an otherwise suitable site. The presence of linear infrastructure should therefore not be considered a restriction to the proposed activity.

8.3.3 Transformed & Degraded Grassland Habitat

Commercial cultivation represents the major land transformation activity in the region resulting in a mosaical pattern of agricultural fields within a natural grassland environment, of which extremely little remains, hence the Endangered and Vulnerable conservation status ascribed to most of the remaining grassland types. Vegetation altered for agricultural practices is unlikely to recover to a state that approximates the natural regional vegetation, even with the application of rehabilitation and management programmes. The likelihood of encountering Red Data plant species within these areas is regarded low because of habitat transformation and degradation. A low floristic status is frequently ascribed to these parts.

The use of areas of obviously low ecological sensitivity for the proposed activity is strongly recommended, as it is unlikely that floristic attributes of conservation importance will be affected within these parts. The challenge is to identify areas of suitable size that will suffice in the requirements for the project, or select portions that are located in close proximity to other habitat types of lower sensitivity in order to curb potential and likely impacts in the natural environment largely. This is particularly important in light of the presence of several plant and animal taxa of conservation importance that are present within the preferred locality. It is important to note that, similar to remaining portions of natural grassland habitat, wetland related habitat types (streams, ephemeral grasslands, etc.) are generally situated in close proximity to these areas. Therefore, while the sensitivity of these parts is indicated to be low, their importance in terms of the contribution to nearby sensitive areas should not be underestimated.

8.3.4 Wetland Vegetation

Vegetation associated with aquatic habitat types are regarded highly sensitive and all impacts should ideally be avoided within, and near to, these features.

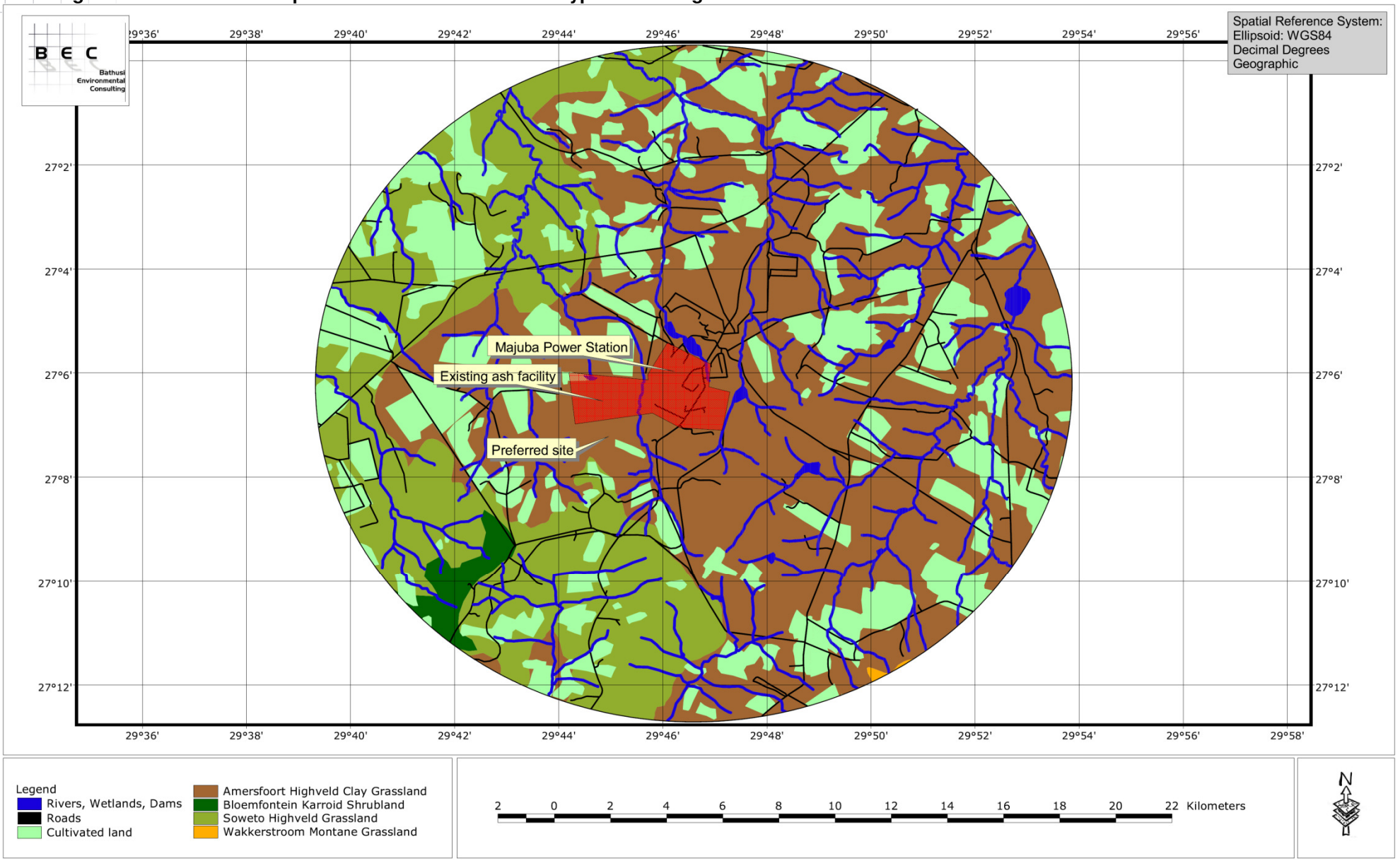
A wide variety of these habitat types feature in the study area, including perennial and non-perennial streams, rivers, small drainage lines, wetland marshes, hillslope seepages, artificial impoundments and unchannelled valley bottoms[7]. It is also important to note that these habitat types are frequently encountered in close proximity to existing land transformation activities, agricultural areas in particular. Several artificial impoundments of significant sizes are situated near to Majuba Power Station. The high sensitivity ascribed to these habitat types is mainly a result of high biodiversity associated with them, not only during periods when water is present within the system, but also during the austral winter period.

These areas are furthermore frequently colonised by plant taxa of conservation importance. Considering the significant increase in recent impacts in the grassland biome (past 20 years), their persistence in a natural environment is strongly dependent on the effective ecological functioning, with emphasis on an uninterrupted status of the linear nature. Also of particular importance is the ecological dependency that wetland features have with surrounding grassland catchments.

Inherent and constant interaction with nearby and downstream areas is characteristic of riparian wetland systems. Impacts therefore are not only reflected on the actual site, but are also 'exported' downstream, resulting in cumulative impacts with large footprints. These types of cumulative impacts are evident in most of South Africa's larger rivers.

[7] Please note that hillslope seepage were not included in the mapping exercise, for an illustration thereof, the reader is referred to the wetland report. The true of wetlands within the study area is therefore likely to higher than indicated on the accompanying map

Figure 13: Probabilistic representation of macro habitat types of the region



9 FAUNALASSESSMENT

9.1 Regional Faunal Diversity

It is important to view the study area on an ecologically relevant scale; consequently, all sensitive animal species (specific faunal groups) known from Mpumalanga are included in this assessment (except for the avifauna which focuses on the Q-grids of the study area). Data on all faunal groups are lacking (notably for most of the invertebrate groups), as a result, only data sets on specific faunal groups allow for habitat sensitivity analyses based on the presence/absence of sensitive faunal species (red data species) and their specific habitat requirements. At present, the following faunal groups are included in these analyses:

- Butterflies (Invertebrata: Insecta: Lepidoptera – Nymphalidae, Lycaenidae, Hesperiidae, Pieridae andPapilionidae). References used include the IUCN Red List (2012) – http://www.iucnredlist.organd the South African Butterfly Conservation Assessment (SABCA, 2012) – http://sabca.adu.org.za;
- Frogs (Amphibia: Anura). References used include the Atlas and Red Data Book of the South Africa, Lesotho and Swaziland, the Giant Bullfrog Conservation Group (2012) – http://www.up.ac.za/bullfrog and a Complete Guide to the Frogs of Southern Africa (du Preez & Carruthers, 2009);
- Reptiles (Reptilia: Testudines and Squamata). References used include the IUCN Red List (2012) and the South African Reptile Conservation Assessment (SARCA, 2012) – http://sarca.adu.org.za;
- Birds: All bird groups (Roberts VII Multimedia: Birds of Southern Africa, PC Edition); and
- Terrestrial Mammals (Mammalia: Insectivora, Chiroptera, Primates, Lagomorpha, Pholidota, Rodentia, Carnivora, Tubulidentata, Proboscidea, Hyracoidea, Perissodactyla and Artiodactyla). References used include the Red Data Book of the Mammals of South Africa: A Conservation Assessment (Endangered Wildlife Trust - 2004).

As more data become available, additional faunal groups are likely to be added to these assessments. Dragonflies and Damselflies (Invertebrata: Insecta: Odonata) are some examples of future inclusions.

9.2 Red Data Fauna Assessment

In order to assess the probability of occurrence (PoC) of Red Data species not recorded in the study area during the field assessment, the following criteria were employed:

- the size of the study area;
- the location and connectivity of the study area with regards to other natural faunal habitats; and,
- the presence/absence, status and diversity of natural faunal habitats within the study area.

These criteria were used in conjunction with the known distribution of Red Data species as well as their known habitat requirements to estimate their likelihood of occurring in the study area.

A total of 115 Red Data species from five categories (IUCN) are known to occur in the Mpumalanga Province (Invertebrates, Reptiles, Frogs and Mammals) and the Q-grids 2729BA and 2729BB (birds), included in the following conservation categories:

- 23 species are listed as Data Deficient (DD);
- 42 species are listed as Near Threatened (NT);
- 34 species are listed as Vulnerable (VU);
- 11 species are listed as Endangered (EN); and
- 5 species are listed as Critically Endangered (CR).

Estimations for the PoC for Red Data fauna taxa for the study area yielded the following results (Table 6):

- 41 species have a low PoC;
- 14 species have a moderate-low PoC;
- 31 species have a moderate PoC;
- 7 species have a moderate-high PoC; and
- 15 species have a high PoC.

Seven Red Data species have been recorded, or are known to occur, in the study area.

Table 6: Red Data assessment for the study area

Species Details			Probability Assessment
Biological Name	**English Name**	**RD**	
Butterflies			
Aloeides barbarae	Barbara's Copper	Endangered	low
Aloeides merces	Wakkerstroom Copper	Vulnerable	high
Aloeides nubilus	Cloud Copper	Endangered	low
Aloeides rossouwi	Rossouw's Copper	Endangered	low
Chrysoritis aureus	Heidelberg Opal	Vulnerable	low
Chrysoritis phosphor borealis	Scarce Scarlet	Data Deficient	moderate-low
Lepidochrysops irvingi	Irving's Blue	Vulnerable	low
Lepidochrysops jefferyi	Jeffrey's Blue	Endangered	low
Lepidochrysops swanepoeli	Swanepoel's Blue	Vulnerable	low
Metisella meninx	Marsh Sylph	Vulnerable	moderate
Frogs			
Breviceps sopranus	Whistling Rain Frog	Data Deficient	low

Hemisus guttatus	Spotted Shovel-nosed Frog	Vulnerable	moderate
Pyxicephalus adspersus	Giant Bullfrog	Near Threatened	moderate
Strongylopus wageri	Plain Stream Frog	Near Threatened	low
Reptiles			
Acontias breviceps	Short-headed Legless Skink	Near Threatened	moderate
Afroedura major	Swazi Flat Gecko	Near Threatened	low
Chamaesaura aenea	Coppery Grass Lizard	Near Threatened	moderate
Chamaesaura macrolepis	Large-scaled Grass Lizard	Near Threatened	low
Homoroselaps dorsalis	Striped Harlequin Snake	Near Threatened	moderate-low
Kininyx natalensis	Natal Hinged Tortoise	Near Threatened	low
Lamprophis fuscus	Yellow-bellied House Snake	Near Threatened	moderate
Smaug giganteus	**Giant Girdled Lizard**	**Vulnerable**	**confirmed**
Tetradactylus breyeri	Breyer's Long-tailed Seps	Vulnerable	moderate-low
Birds			
Phoenicopterus roseus	**Greater Flamingo**	**Near Threatened**	**confirmed**
Phoenicopterus minor	Lesser Flamingo	Near Threatened	moderate-high
Mycteria ibis	Yellow-billed Stork	Near Threatened	moderate-low
Ciconia nigra	Black Stork	Near Threatened	moderate
Leptoptilos crumeniferus	Marabou Stork	Near Threatened	moderate-low
Geronticus calvus	**Southern Bald Ibis**	**Vulnerable**	**confirmed**
Botaurus stellaris	Eurasian Bittern	Critically Rare	moderate
Sagittarius serpentarius	**Secretarybird**	**Near Threatened**	**confirmed**
Gyps coprotheres	Cape Vulture	Vulnerable	moderate
Circus ranivorus	African Marsh Harrier	Vulnerable	high
Circus maurus	**Black Harrier**	**Vulnerable**	**confirmed**
Circus macrourus	Pallid Harrier	Near Threatened	high
Polemaetus bellicosus	Martial Eagle	Vulnerable	moderate-high
Stephanoaetus coronatus	Crowned Eagle	Near Threatened	low
Falco naumanni	Lesser Kestrel	Vulnerable	high
Falco biarmicus	Lanner Falcon	Near Threatened	high
Neotis denhami	Denham's Bustard	Vulnerable	moderate
Eupodotis caerulescens	**Blue Korhaan**	**Near Threatened**	**confirmed**
Lissotis melanogaster	Black-bellied Bustard	Near Threatened	moderate
Sarothrura affinis	Striped Flufftail	Vulnerable	moderate
Crex crex	Corn Crake	Vulnerable	moderate
Balearica regulorum	Grey Crowned Crane	Vulnerable	high
Anthropoides paradisea	**Blue Crane**	**Vulnerable**	**confirmed**
Bugeranus carunculatus	Wattled Crane	Critically Rare	high
Vanellus melanopterus	Black-winged Lapwing	Near Threatened	moderate-high
Rostratula benghalensis	Greater Painted-snipe	Near Threatened	moderate-low
Glareola nordmanni	Black-winged Pratincole	Near Threatened	moderate
Hydroprogne caspia	Caspian Tern	Near Threatened	moderate-low
Tyto capensis	African Grass-owl	Vulnerable	high
Alcedo semitorquata	Half-collared Kingfisher	Near Threatened	moderate
Heteromirafra ruddi	Rudd's Lark	Critically Rare	moderate-low
Spizocorys fringillaris	Botha's Lark	Endangered	moderate
Lioptilus nigricapillus	Bush Blackcap	Near Threatened	moderate-low
Anthus brachyurus	Short-tailed Pipit	Vulnerable	moderate
Anthus chloris	Yellow-breasted Pipit	Vulnerable	moderate
Mammals			
Chrysospalax villosus	Rough-haired Golden Mole	Critically Rare	moderate-low
Amblysomus hottentotus	Hottentot's Golden Mole	Data Deficient	moderate-low
Amblysomus robustus	Robust Golden Mole	Endangered	low
Amblysomus septentrionalis	Highveld Golden Mole	Near Threatened	high

Neamblysomus julianae	Juliana's Golden Mole	Vulnerable	low
Atelerix frontalis	South African Hedgehog	Near Threatened	moderate
Elephantulus brachyrhynchus	Short-snouted Elephant-shrew	Data Deficient	low
Myosorex cafer	Dark-footed Forest Shrew	Data Deficient	moderate-low
Myosorex varius	Forest Shrew	Data Deficient	high
Crocidura cyanea	Reddish-grey Musk Shrew	Data Deficient	high
Crocidura flavescens	Greater Musk Shrew	Data Deficient	moderate-high
Crocidura fuscomurina	Tiny Musk Shrew	Data Deficient	moderate
Crocidura hirta	Lesser Red Musk Shrew	Data Deficient	moderate
Crocidura maquassiensis	Maquassie Musk Shrew	Vulnerable	low
Crocidura mariquensis	Swamp Musk Shrew	Data Deficient	high
Crocidura silacea	Lesser Grey-brown Musk Shrew	Data Deficient	moderate-high
Suncus infinitesimus	Least Dwarf Shrew	Data Deficient	moderate
Suncus lixus	Greater Dwarf Shrew	Data Deficient	low
Suncus varilla	Lesser Dwarf Shrew	Data Deficient	moderate
Cloeotis percivali	Percival's Short-eared Trident Bat	Vulnerable	moderate-low
Rhinolophus blasii	Blasius's Horseshoe Bat	Near Threatened	moderate
Rhinolophus swinnyi	Swinny's Horseshoe Bat	Near Threatened	moderate-low
Miniopterus natalensis	Natal Long-fingered Bat	Near Threatened	moderate-high
Scotophilus nigrita	Giant Yellow House Bat	Near Threatened	low
Cercopithecus mitis	Samango Monkey	Vulnerable	low
Cercopithecus mitis labiatus	Samango Monkey	Endangered	low
Manis temminckii	Ground Pangolin	Vulnerable	low
Graphiurus platyops	Rock Dormouse	Data Deficient	low
Mystromys albicaudatus	White-tailed Rat	Endangered	moderate
Tatera leucogaster	Bushveld Gerbil	Data Deficient	low
Lemniscomys rosalia	Single-striped Mouse	Data Deficient	moderate
Dasymys incomtus	Water Rat	Near Threatened	moderate
Grammomys dolichurus	Woodland Mouse	Data Deficient	low
Otomys slogetti	Sloggett's Rat	Data Deficient	moderate
Panthera pardus	Leopard	Near Threatened	moderate
Panthera leo	Lion	Vulnerable	low
Leptailurus serval	Serval	Near Threatened	high
Acinonyx jubatus	Cheetah	Vulnerable	low
Felis nigripes	Black-footed Cat	Vulnerable	low
Crocuta crocuta	Spotted Hyaena	Near Threatened	low
Parahyaena brunnea	Brown Hyaena	Near Threatened	high
Paracynictis selousi	Selous's Mongoose	Data Deficient	low
Rhynchogale melleri	Meller's Mongoose	Data Deficient	low
Canis adustus	Side-striped Jackal	Near Threatened	low
Lycaon pictus	African Wild Dog	Endangered	low
Mellivora capensis	Honey Badger	Near Threatened	moderate-high
Poecilogale albinucha	African Striped Weasel	Data Deficient	moderate
Hydrictis maculicollis	Spotted-necked Otter	Near Threatened	moderate
Loxodonta africana	African Savanna Elephant	Vulnerable	low
Diceros bicornis	Black Rhinoceros	Critically Rare	low
Ceratotherium simum	White Rhinoceros	Near Threatened	low
Hippopotamus amphibius	Common Hippopotamus	Vulnerable	low
Raphicerus sharpei	Sharpe's Grysbok	Near Threatened	low
Ourebia ourebi	Southern Oribi	Endangered	high
Hippotragus equinus	Roan Antelope	Vulnerable	low
Hippotragus niger	Southern Sable Antelope	Vulnerable	low
Damaliscus lunatus	Western Tsessebe	Endangered	low

9.3 Protected Faunal Taxa

Mpumalanga includes 31 provincially listed protected species (www.speciesstatus.sanbi.org – NEMBA status, refer Table 7).

Table 7: Protected species of Mpumalanga

Species Details			Probability Assessment
Biological Name	**English Name**	**NEMBA status**	
Aonyx capensis	African Clawless Otter	protected	high
Atelerix frontalis	South African Hedgehog	protected	moderate
Bucorvus leadbeateri	Southern Ground-Hornbill	protected	low
Ceratogyrus bechuanicus	Starbust Horned Baboon Spider	protected	moderate-low
Ceratotherium simum	White Rhinoceros	protected	low
Circus ranivorus	African Marsh Harrier	protected	high
Connachaetus gnou	Black Wildebeest	protected	low
Crocuta crocuta	Spotted Hyaena	protected	low
Dromica species	Flightless Tiger Beetle species	protected	moderate-low
Felis nigripes	Black-footed Cat	protected	low
Graphipterus assimilis	Velvet Ground Beetle	protected	moderate-low
Harpactira gigas	Transvaal Banded Baboon Spider	protected	moderate-low
Hydrictis maculicollis	Spotted-necked Otter	protected	moderate
Leptailurus serval	Serval	protected	high
Loxodonta africana	African Savanna Elephant	protected	low
Manticora species	Monster Tiger Beetle species	protected	moderate-low
Megacephala asperata	Tiger Beetle	protected	moderate-low
Megacephala regalis	Tiger Beetle	protected	moderate-low
Neotis denhami	Denham's Bustard	protected	moderate
Nigidius auriculatus	Stag Beetle	protected	moderate-low
Oonotus adspersus	Stag Beetle	protected	moderate-low
Oonotus interioris	Stag Beetle	protected	moderate-low
Oonotus rex	Stag Beetle	protected	moderate-low
Oonotus sericeus	Stag Beetle	protected	moderate-low
Parahyaena brunnea	Brown Hyaena	protected	high
Prosopocoilus petitclerci	Stag Beetle	protected	moderate-low
Prothyma guttipennis	Tiger Beetle	protected	moderate-low
Pterinochilus breyeri	Malelane Golden-brown Baboon Spider	protected	moderate-low
Pterinochilus nigrofulvus	Transvaal Golden Baboon Spider	protected	moderate-low
Raphicerus sharpei	Sharpe's Grysbok	protected	low
Redunca arundinum	Southern Reedbuck	protected	low

It is estimated that three of the eight species listed in Table 7 are unlikely to occur in the study area (low) and 16 species moderately unlikely (moderate-low). Three species are considered at least moderately likely (moderate) and four species highly likely to occur in the study area (high).

10 ECOLOGICAL SENSITIVITY& PREFERENCE RANKING OF HABITAT FRAGMENTS

10.1 Sensitivity Criteria & Categorisation

The ecological importance ascribed to existing protected areas and species are simple and self-explanatory. Outside of protected areas, but within areas of clear biodiversity value, the evaluation of importance or sensitivity is more complex and vague. The absence of protected status should never be interpreted as low biodiversity importance; many areas of international biodiversity importance lie outside of protected areas.

For this particular screening assessment, the degree of transformation was used as a primary decision tool in determining the level of sensitivity of a particular land parcel. A secondary decision was made based on the level of conservation importance ascribed to the regional vegetation type. Lastly, historic sampling records of conservation important flora and fauna taxa within the region were implemented to ascribe a level of importance/ sensitivity to a particular site. The ecological sensitivity of areas characterised by natural habitat was assessed using the application of the following criteria:

- The presence of Threatened and/or Protected:
  - plant species**(YES)**;
  - animal species**(YES)**;
  - ecosystems**(YES)**;
- The presence of Critical conservation areas, including:
  - areas of high biodiversity**(YES)**;
  - centres of endemism**(NO)**;
- The presence of Important Ecological Processes, including:
  - Corridors**(NO)**;
  - Mega-conservancy networks**(NO)**;
  - Rivers and wetlands**(YES)**; and
  - Important topographical features**(NO)**.

Estimated ecological sensitivity values are presented in Figure 14 and are categorised as follows:

Low (1) No natural habitat remaining; represented by developed/ transformed areas, nodal & linear infrastructure, areas of agriculture or cultivation, areas where exotic species dominate exclusively, mining land (particularly surface mining), etc. The possibility of these areas reverting to a natural state is impossible, even with the application of detailed and expensive rehabilitation activities. Similarly, the likelihood of plant species of conservation importance occurring in these areas is regarded negligent.

Medium (2) Indigenous natural habitat that comprehend habitat with a high diversity, but characterised by moderate to high levels of degradation, fragmentation and habitat isolation. This category also includes areas where flora species of conservation importance could potentially occur, but habitat is regarded marginal;

High (3) Indigenous natural vegetation that comprehends a combination of the following attributes:

- The presence of plant species of conservation importance, particularly threatened categories (Critically Endangered, Endangered, Vulnerable);
- Areas where 'threatened' plants are known to occur, or habitat that is highly suitable for the presence of these species;

- Regional vegetation types that are included in the 'threatened' categories (Critically Endangered, Endangered, Vulnerable), particularly prime examples of these vegetation types;
- Habitat types are protected by national or provincial legislation (Lake Areas Act, National Forest Act, draft Ecosystem List of NEMBA, Mountain Catchment Areas Act, Ridges Development Guideline, Integrated Coastal Zone Management Act, etc.);
- Areas that have an intrinsic high floristic diversity (species richness, unique ecosystems), with particular reference to Centres of Endemism;

These areas are also characterised by low transformation and habitat isolation levels and contribute significantly on a local and regional scale in the ecological functionality of nearby and dependent ecosystems, with particular reference to catchment areas, pollination and migration corridors, genetic resources. A major reason for the high conservation status of these areas is the low ability to respond to disturbances (low plasticity and elasticity characteristics).

Not Assessed (6) Areas not included in the assessment within the 12km radius due to unsuitability for the proposed project include the following:

- Majuba Power Station and associated infrastructure;
- Areas where mining related activities are currently taking place;
- Residential areas in the northern part of the study area; and
- The farm Roodekopjes (proposed UCG project).

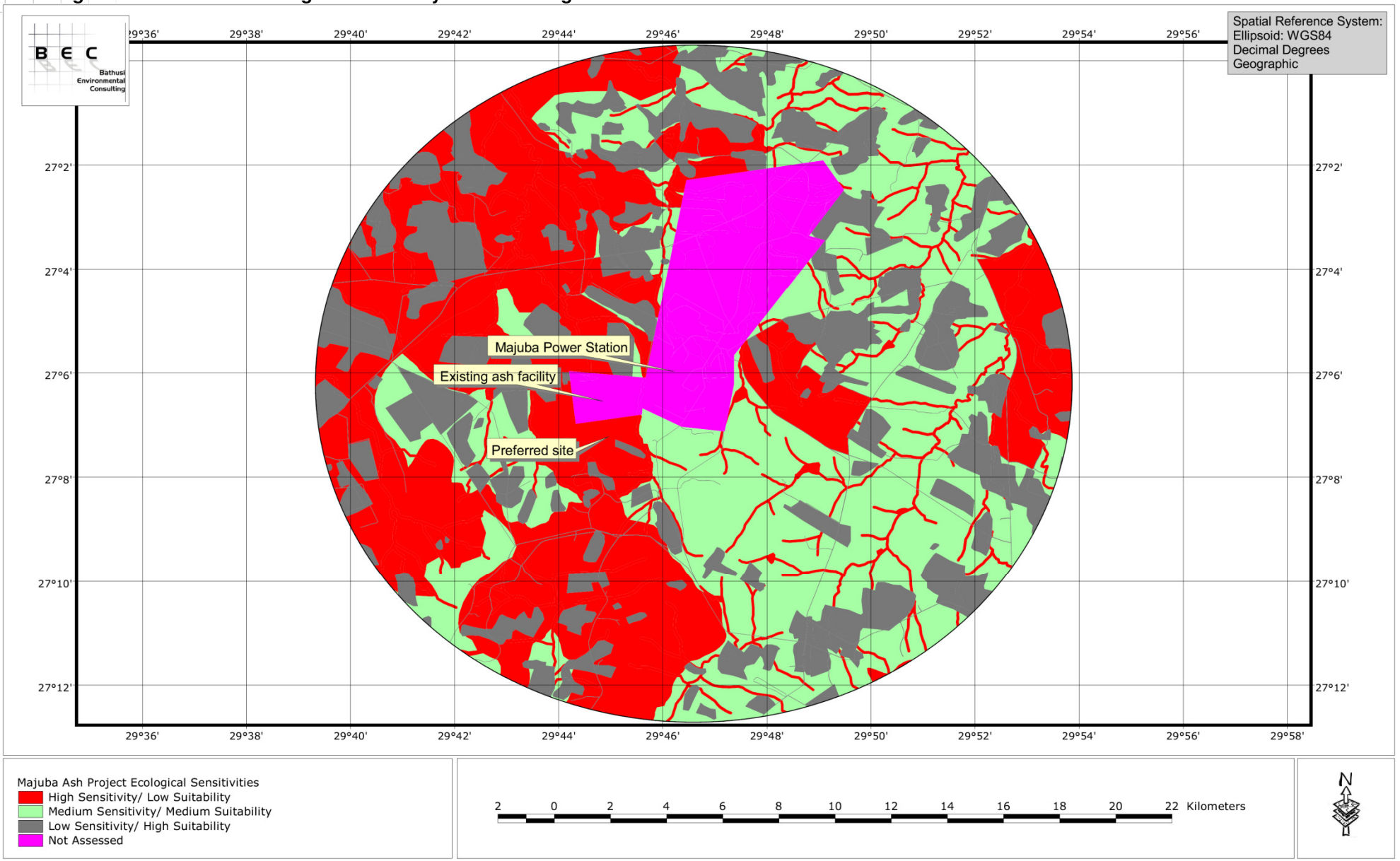
10.2 Discussion & Recommendations

From a biodiversity point of view, it is evident from the sensitivity analysis that remaining natural habitat in the western part of the study area is regarded less suitable for the proposed development. Noteworthy aspects that contribute to the high ecological sensitivity of the western parts include presence of the regionally Endangered Soweto Highveld Grassland. While the preferred site is situated in the Amersfoort Highveld Clay Grassland, which has a Vulnerable conservation status, the known and confirmed presence of several conservation important flora and fauna taxa within a pristine wetland habitat, renders this area particularly sensitive. Expected impacts from the proposed development on the biodiversity component are therefore expected to be significant and severe. It is regarded possible, and strongly recommended, to identify another suitable site where potential impacts will be lower in significance.

The presence of conservation important species is a confluence of numerous biological and biophysical characteristics, resulting in a habitat type to which they are adapted. Of even greater importance is the fact that surrounding losses of habitat (agriculture and industrial developments), compounds the sustained pressure on the habitat of these plants and animals and these losses are usually irreversible. Even though a relocation programme (*ex situ* conservation) might be successful, the *in situ* conservation of plants and animals should be a priority. The fact that a number of conservation important species co-exist within this particular site strongly suggests the importance of this area in terms of biodiversity attributes. Various surveys in the local region have failed to indicate the presence of such a high diversity of conservation important species within a single land parcel.

It is therefore strongly recommended that a suitable area be selected from the eastern part of the study area, even though it might imply the relocation of linear appurtenant infrastructure.

Figure 14: Estimated ecological sensitivity of habitat fragments



11 IDENTIFICATION & DESCRIPTIONS OF POTENTIAL & LIKELY IMPACTS

11.1 Identification of Impacts

No impacts were identified that could lead to a beneficial impact on the biological environment since the proposed development is largely destructive, involving the alteration of natural habitat.

Impacts resulting from the proposed development on ecological attributes are largely restricted to the physical effects. Direct impacts include any effect on populations of individual species of conservation importance and on overall species richness. This includes impacts on genetic variability, population dynamics, overall species existence or health and on habitats important for species of conservation consideration. In addition, impacts on sensitive or protected habitat are included in this category, but only on a local scale. These impacts are mostly measurable and easy to assess, as the effects thereof are immediately visible and can be determined to an acceptable level of certainty.

In contrast, indirect impacts are not immediately evident and can consequently not be measured at a specific moment in time; the extent of the effect is frequently at a scale that is larger than the actual site of impact. A measure of estimation, or extrapolation, is therefore necessary in order to evaluate the importance of these impacts. Lastly, impacts of a cumulative nature places direct and indirect impacts of this projects into a regional and national context, particularly in view of similar or resultant developments and activities.

A list of potential and likely impacts was compiled from a generic list of impacts derived from previous projects of this nature and from a literature review of the potential impacts of this type of development on the natural environment. The following impacts were identified:

- Direct impacts on threatened flora species;
- Direct impacts on protected flora species;
- Direct impacts on threatened faunal taxa;
- Direct impacts on common fauna species/ faunal assemblages (including migration patterns, corridors, etc.);
- Human - Animal conflicts;
- Loss or degradation of natural vegetation/ pristine habitat (including ecosystem functioning);
- Loss/ degradation of surrounding habitat;
- Impacts on SA's conservation obligations & targets;
- Increase in local and regional fragmentation/ isolation of habitat; and
- Increase in environmental degradation, pollution (air, soils, surface water).

11.2 Nature of Impacts

11.2.1 Direct Impacts on Threatened Flora Species

This direct impact results in physical damage or destruction of Red Data species/ communities, areas where these species are known to occur or areas that are considered particularly suitable for these species. Threatened plant species, in most cases, do not contribute significantly to the species richness of an area in terms of sheer numbers, as there are generally few of them, but a high ecological value is placed on the presence of such species in an area as they represent an indication of pristine habitat conditions. Conversely, the presence of pristine habitat conditions can frequently be accepted as an indication of the potential presence of species of conservation importance, particularly in moist habitat conditions.

Red Data species are particularly sensitive to changes in their environment, having adapted to a narrow range of specific habitat requirements. Changes in habitat conditions resulting from human activities is one of the greatest reasons for these species having a threatened status. Surface transformation/ degradation activities within habitat types that are occupied by flora species of conservation importance will ultimately result in significant impacts on these species and their population dynamics. Effects of this type of impact are usually permanent and recovery or mitigation is generally not perceived as possible.

One of the greatest limitations in terms of mitigating or preventing this particular impact, is the paucity of species specific information that describe their presence, distribution patterns, population dynamics and habitat requirements. To allow for an accurate assessment, it is usually necessary to assess the presence/ distribution, habitats requirements, etc. associated with these species in detail and over prolonged periods; something that is generally not possible during EIA investigation such as this. However, by applying ecosystem conservation principles to this impact assessment and subsequent planning and development phases, potential impacts will largely be limited.

The likelihood of Red Data flora species occurring within the study area is relatively high and the conservation of these areas is likely to provide protection of plant species of conservation importance.

11.2.2 Direct Impacts on Protected Flora Species

Results of the preliminary investigation revealed the presence of numerous protected trees within the respective alternative sites and it in inevitable that a number of protected tree species will be impacted on during the construction phase. However, a relative low diversity and abundance of protected trees were indicated on the preferred option. Similar to Red Data plants, these species do not contribute significantly towards the local and regional species richness, but their presence indicates a relatively pristine status of the habitat. Preservation of these species is a social obligation in light of increasing pressure on these species that causes a continuous decline and an eventual inclusion in conservation categories.

11.2.3 *Direct Impacts on Threatened Fauna Taxa*

The presence of Red Data fauna species has been confirmed and any disturbance therefore represents a direct and significant impact on these species. While some species are highly mobile and will ultimately be able to avoid impacts that result from the proposed development, some will not be able to avoid effects of microhabitat destruction. A direct approach, which is likely to be hugely costly, can be implemented in order to capture and relocate some animals to adjacent suitable habitat. Similar to Red Data plants, the presence of Red Data animal species is seen as a significant attribute to the biodiversity of an area. Any impact is therefore viewed as significant. Additional aspects that will be affected include migration patterns and suitable habitat for breeding and foraging purposes.

11.2.4 *Direct impacts on Common Fauna Species/ Faunal Assemblages*

The presence of diverse faunal assemblages in most areas is accepted. Considering the moderate levels of habitat transformation and degradation on a local scale, animal species are likely to evacuate towards adjacent areas of natural habitat during periods of high impact. While the tolerance levels of most animal species is generally of such a nature that surrounding areas will suffice in their habitat requirements, some species are not able to relocate, such as ground living and small species. The proposed activity will therefore result in severe impacts on these species.

In light of the moderate fragmentation and habitat isolation levels of the region, it is reasonable to assume that the animals utilising habitat within the proposed areas will also migrate extensively across the region for various reasons. Foraging, available water, food sources, breeding patterns and seasonal climate changes include some of the more obvious explanations for migration of animals.

While most of the larger mammal species (ungulates) are restricted in their movement by fences, small and medium sized animals, that include predators, burrowing species, small mammals, invertebrate species, reptiles, amphibians, etc. utilises all available natural habitat as either corridors or habitat. The loss of an area as large, as this property, will affect the migration and daily movement patterns of a number of species that are present in the immediate region.

11.2.5 *Human / Animal conflict*

While animals generally avoid contact with human structures, they do grow accustomed to structures after a period. While the structures are visible, injuries and death of animals could potentially occur because of accidental contact. An aspect that is of concern is the presence of vehicles on access and infrastructure roads, leading to road kills, particularly amongst nocturnal animals that abound in the study area.

The presence of personnel within the development area during construction and maintenance periods will inevitably result in limited, contact with animals. While most of the larger animal species are likely to move away from humans, encounters with snakes, spiders, scorpions and even predators remain likely. Similarly, the presence of humans within areas of natural habitat could potentially result in killing of animals by means of snaring, poaching, poisoning, trapping, etc.

Furthermore, the creation of artificial habitat and the abundance of litter and spoils that are associated with any construction and development site will attract prey species such as rodents, exotic birds and

pets (feral cats and dogs). Strongly associated with the presence of these animals are predators that include venomous snakes, larger raptors, wildcat species (Serval, Leopard, Caracal, etc.), Jackal, Hyaena, Honey Badger, etc. These species are frequently regarded with false beliefs and killed for little reason.

While most of the significant impacts are associated with habitat clearance that precede the actual development and operational phases, this impact is also particularly relevant during the period when construction activity peaks and worker numbers are high.

11.2.6 Loss or Degradation of Natural Vegetation/ Sensitive Habitat

The loss or degradation of natural/ pristine vegetation represents a potential loss of habitat and biodiversity on a local and regional scale. Sensitive habitat types might include mountains, ridges, koppies, wetlands, rivers, streams, pans and localised habitat types of significant physiognomic variation and unique species composition. These areas represent centres of atypical habitat and contain biological attributes that are not frequently encountered in the greater surrounds. A high conservation value is generally ascribed to floristic communities and faunal assemblages that occupy these areas as they contribute significantly to the biodiversity of a region.

The vegetation is indicated to be highly representative of the regional vegetation type and is, for most parts, in a pristine condition, implying that the species composition, structure and other floristic attributes does not indicate variance on a local or regional scale.

The larger region is furthermore characterised by relative low transformation and fragmentation factors. Therefore, the existing ecological connectivity is significant in the functioning of the regional and local ecological processes. Indirect effects resulting from construction and operational activities on processes or factors that maintain ecosystem health and character, including the following:

- Disruption of nutrient-flow dynamics;
- Introduction of chemicals into the ground- and surface water through leaching;
- Impedance of movement of material or water;
- Habitat fragmentation;
- Changes to abiotic environmental conditions;
- Changes to disturbance regimes, e.g. increased or decreased incidence of fire;
- Changes to successional processes;
- Effects on pollinators; and
- Increased invasion by plants and animals not endemic to the area.

Changes to factors such as these may lead to a reduction in the resilience of ecological communities and ecosystems or loss or changes in ecosystem function.

11.2.7 *Impacts on Surrounding Habitat/ Species & Ecosystem Functioning*

Surrounding areas and species present in the direct vicinity of the study area could potentially be affected by indirect impacts resulting from construction and operational activities. This indirect impact also includes adverse effects on any processes or factors that maintain ecosystem health and character, including the following:

- Disruption of nutrient-flow dynamics;
- Introduction of chemicals into the ground- and surface water through leaching;
- Impedance of movement of material or water;
- Habitat fragmentation;
- Changes to abiotic environmental conditions;
- Changes to disturbance regimes, e.g. increased or decreased incidence of fire;
- Changes to successional processes;
- Effects on pollinators; and
- Increased invasion by plants and animals not endemic to the area.

Changes to factors such as these may lead to a reduction in the resilience of ecological communities and ecosystems or loss or changes in ecosystem function. Furthermore, regional ecological processes, particularly aquatic processes that is dependent on the status and proper functioning of the drainage line, is regarded important. It is well known that the status of a catchment is largely determined by the status of the upper reaches of the rivers. Small drainage lines might be insignificant on a regional scale, but the combined status of numerous such small drainage lines will determine the quality of larger rivers further downstream.

11.2.8 *Impacts on SA's Conservation Obligations & Targets*

This impact is regarded a cumulative impact since it affects the status of conservation strategies and targets on a local as well as national level and is viewed in conjunction with other types of local and regional impacts that affects conservation areas or threatened areas. The importance of vegetation types is based on the conservation status ascribed to regional vegetation types (VEGMAP, 2006) and therefore impacts that result in irreversible transformation of natural habitat is regarded significant.

11.2.9 *Increase in Local & Regional Fragmentation/ Isolation of Habitat*

Uninterrupted habitat is a precious commodity for biological attributes in modern times, particularly in areas that are characterised by moderate and high levels of transformation. The loss of natural habitat, even small areas, implies that biological attributes have permanently lost that ability of occupying that space, effectively meaning that a higher premium is placed on available food, water and habitat resources in the immediate surrounds. This, in some instances might mean that the viable population of plants or animals in a region will decrease proportionally with the loss of habitat, eventually decreasing beyond a viable population size.

The danger in this type of cumulative impact is that effects are not known or is not visible with immediate effect and normally when these effects become visible, they are usually beyond repair. Impacts on linear areas of natural habitat affect the migratory success of animals in particular.

The general region is characterised by moderate levels of transformation and habitat fragmentation. However, a high degree of connectivity is still present outside development areas. This connectivity is critical in the preservation of pollinator species that provide important ecological services. The isolation of parcels of natural habitat is likely to contribute to loss of genetic variability, decrease in diversity and accentuated impacts from surrounding land uses.

11.2.10 Cumulative Increase in Environmental Degradation, Pollution

Cumulative impacts associated with this type of development could lead to initial, incremental or augmentation of existing types of environmental degradation, including impacts on the air, soil and water present within available habitat. Pollution of these elements might not always be immediately visible or readily quantifiable, but incremental or fractional increases might rise to levels where biological attributes could be affected adversely on a local or regional scale. In most cases, these effects are not bound and is dispersed, or diluted over an area that is much larger than the actual footprint of the causal factor. Similarly, developments in untransformed and pristine areas are usually not characterised by visibly significant environmental degradation and these impacts are usually most prevalent in areas where continuous and long-term impacts have been experienced.

The nature of the development is such that pollution and degradation of the immediate surrounds is reasonably expected.

12 EIA RECOMMENDATIONS

In order to address existing information gaps and satisfy legal requirements of EIA investigations, it is suggested that an over-arching approach be followed to allow for the capture of maximum data and adequate subsequent analysis thereof. The approach suggested here is based on separate austral winter and summer surveys during which a scientific approach to data assimilation will be followed. Botanical and faunal data will ultimately be captured in point samples (releveès) placed in a stratified random mean across the entire study area. Acquired data will be holistically analysed to illustrate the ecological interaction of plants and animals. Data analysis will be performed by PC-ORD for Windows, Version 6.07 (2011), allowing for an analysis through TWINSPAN, DECORANA, etc.

12.1 Botanical Impact Assessment

12.1.1 Sampling Approach

The number of sample plots to be distributed in a given area depends on various factors, such as the scale of the classification, environmental heterogeneity and the accuracy required for the classification (Bredenkamp 1982).

Stratification of sample plots will be based on visual observations made during the initial site investigation as well as aerial imagery. The Zurich-Montpellier approach of phytosociology (Braun-Blanquet 1964) will be followed. This is a standardised and widely used sampling technique for general vegetation surveying in South Africa. During the surveys, all plant species in the sample plots and the cover and/or abundance of each species will be estimated according to the following Braun-Blanquet cover abundance scale:

+ infrequent, with less than one percent cover of total sample plot area
1 frequent, with low cover, or infrequent but with higher cover, 1-5% cover of the total sample plot area
2 abundant, with 5-25% cover of total sample plot area
2A - >5-12%
2B - >12-25%
3 >25-50% cover of the total sample plot area, irrespective of the number of individuals
4 >50- 75% cover of the total sample plot area, irrespective of the number of individuals
5 >75% cover of the total sample plot area, irrespective of the number of individuals.

In addition, a relevant selection of the following biophysical attributes will be recorded within each relevè:

- Altitude- and longitude positions for each relevè - obtained from a GPS;
- Soil characteristics, including colour, clay content, etc.;
- Topography (crests, scarps, midslopes, footslopes, valley bottoms, floodplains or drainage lines);
- Altitude, slope and aspect;
- Rockiness, estimated as a percentage;
- Rock size; and
- General observations (including the extent of erosion, utilisation, disturbances of the vegetation management practices, etc.).

In addition to species captured within the sample plots, general observations will be made in order to compile a comprehensive species list that will include taxa that, because of low abundance levels, are

unlikely to be captured within the sample areas. Particular reference is made to Red Data plants, which normally do not occur at great densities.

12.1.2 Data Processing

The combined floristic and faunal data sets will be subjected to the Two- Way Indicator Species Analysis technique (TWINSPAN) (Hill 1979) and subsequently refined by Braun-Blanquet procedures. TWINSPAN will be applied to derive a first approximation of the vegetation units. These classifications will be further refined by the application of Braun-Blanquet procedures to determine the plant communities.

A phytosociological table showing the vegetation lines will be used to compile a synoptic table of the datasets. A synoptic table summarises and confirm the vegetation types/ habitat types and variations. Relevant descriptions will follow from the data analysis, based on the presence/ absence and abundance of taxa.

12.2 Faunal Impact Assessment

Field investigations commonly employed for EIA studies are normally limited by time and budget and scientific approaches generally have to be adapted to allow for these limitations. Ecology and biodiversity are growing fields of science and much is still unknown. As always, information on the herpetofauna and invertebrates of the region and farms is lacking in detail and significant information gaps exist in this regard.

It is therefore strongly recommended that the following EIA study methods be implemented to gain an ecological understanding of the study area as well as the biodiversity contribution of the study area within a regional and provincial context.

12.2.1 Invertebrates

Invertebrates are by far the most important animals present anywhere. They are very useful bio-indicators and include meaningful surrogates, flagships and diversity indicators. The invertebrate studies will be twofold:

Firstly, sweep samples and pitfall samples of invertebrates would be used to compare sample plots in terms of species richness (number of species) and species diversity (relative abundances between species groups). Species recorder in these sampling bouts will also be included in the species inventory. Secondly, a species inventory of the study area/s will be compiled using above-mentioned methods as well as active searches for scorpions (under rocks and using UV-lights), for butterflies (using a hand-held net) and beetles (under rocks, bark hand-netting etc.)

12.2.2 *Herpetofauna*

Frogs will be sampled using species-specific calls of males as identification; also, active searches for active adults during early evenings. Snakes, lizards and other reptiles will be sampled by active searches in likely habitats (under rocks, in inactive termitaria etc.)

12.2.3 *Birds*

It is important to note that a separate avifaunal study has been commissioned by Eskom. However, an avifaunal component is included in the faunal study as it forms an important aspect of biodiversity in general. The aims and objectives of the separate avifaunal investigation will therefore be entirely different to this particular assessment. Assessing avifaunal diversity of an area includes three components:

- Visual sightings
- Audio observations
- Habitat assessments

A large number of bird species are highly visible and easily identifiable using visual observations. Binoculars are used to assist the observer in identifying smaller and more cryptic species. Many bird species are cryptically coloured and can only be identified using sound; calls of many cryptic bird species are species-specific and very useful in compiling a species inventory list of the area under investigation.

Ideally, various field assessments during all seasons of the year are needed to start to create an "avifauna image" of the study area that supports the reality of bird communities in the area. Since this is never accomplished in reality, habitat assessments are used to create a "model" of the bird communities likely to be found in the area investigated. Fortunately, much data is available on the birds of Southern Africa; distribution records, habitat requirements etc. By assessing the available habitat within the study area (with focus on habitat characteristics available and diversity and quality of habitats present), all bird species (including Red Data birds) are assessed in terms of likelihood of occurring within the study area. The final stage of the avifaunal study is using the image created of the avifaunal communities of the study area in assessing the impacts of the proposed project on the avifauna of the study area. Impacts are weighed and mitigations measures proposed where possible.

12.2.4 *Mammals*

Visual sightings as well as ecological indicators such as tracks, dung, calls and diggings will be used to compile a species inventory of the mammals of the study area. Additionally, small mammal live traps will be used to sample for rodents and insectivores. Baited camera traps will used to assess the area in terms of the presence/absence of the medium and large carnivores.

12.2.5 *Ecology*

Species inventory lists and indications of species richness and -diversity recorded with the aid of above-mentioned methods will be used to interpret the relative ecological status of the study area/s and to compare areas and variations in faunal habitats present. These comparisons are done in liaison with the vegetation characteristic in order to gain an ecological understanding of the study area and the potential impacts of the study area/s.

13 PHOTOGRAPHIC RECORDS

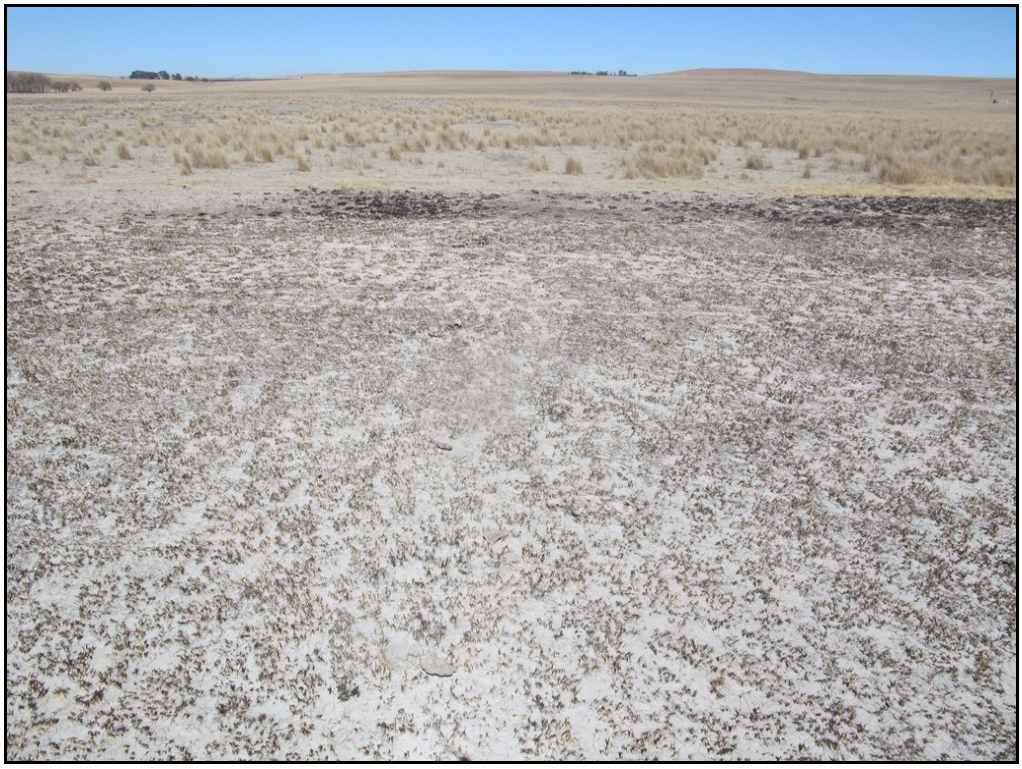


Photo 1: Preferred site, photo taken from adjacent to the existing ash facility. Not effect of windblown ash into natural habitat.

Photo 2: Edge of existing ash facility

Photo 3: The threatened species *Smaug giganteus* has been confirmed for the study area during previous projects within the study area (*pers. obs.*).

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