environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/ or 12/9/11/L
NEAS Reference Number:	DEAT/EIA
Date Received:	

Application for integrated environmental authorisation and waste management licence in terms of the-

(1) National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2010; and

(2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 718, 2009

PROJECT TITLE

Proposed 30-year Ash Disposal Facility at Kendal Power Station, Mpumalanga

Specialist:	Golder Associates Africa (Pty) Ltd		
Contact person:	Andrew Zinn		
Postal address:	PO Box 6001, Halfway House		
Postal code:	1685	Cell:	083 361 0373
Telephone:	(011) 254 4800	Fax:	(011) 672 0008
E-mail:	azinn@golder.co.za		
Professional affiliation(s) (if any)	SACNASP (400687/15)		

Project Consultant:	Zitholele Consulting (Pty) Ltd		
Contact person:	Tania Oosthuizen		
Postal address:	PO Box 6002, Halfway House		
Postal code:	1682	Cell:	083 504 9881
Telephone:	011 207 2060	Fax:	086 676 9950
E-mail:	taniao@zitholele.co.za		

4.2 The specialist appointed in terms of the Regulations_

I, Andrew Zinn , declare that --

General declaration:

I act as the independent specialist in this application;
I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
I declare that there are no circumstances that may compromise my objectivity in performing such work;
I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
I will comply with the Act, Regulations and all other applicable legislation;
I have no, and will not engage in, conflicting interests in the undertaking of the activity;
I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
all the particulars furnished by me in this form are true and correct; and
I realise that a false declaration is an offence in terms of regulation 71 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

Golder Associates Africa (Pty)

Name of company (if applicable):

23/5/2016

Date:

June 2016

ZITHOLELE CONSULTING (PTY) LTD

Terrestrial Ecosystems Assessment for the proposed Kendal 30 Year Ash Dump Project for Eskom Holdings (Revision 1)

Submitted to:
Zitholele Consulting Pty (Ltd)

Report Number: 13615277-12416-2 (Rev1)
Distribution:

1 x electronic copy Zitholele Consulting (Pty) Ltd
1 x electronic copy e-Library
1 x electronic copy project folder

REPORT

Golder Associates

Table of Contents

TABLES

FIGURES

APPENDICES

Arthropoda recorded in the study area and surrounding land

APPENDIX G
Document Limitations

1.0 INTRODUCTION

Zitholele Consulting (Pty) Ltd. (Zitholele) appointed Golder Associates Africa (Pty) Ltd (Golder) to conduct a terrestrial ecosystems assessment of the site alternatives proposed for the 30 year Ash Disposal Facility (ADF), for Kendal Power Station, in Mpumalanga Province, South Africa. The study was conducted in two parts:

- **Part A: Scoping Phase**: Focused on characterising the baseline terrestrial ecology of all the proposed sites and conveyor corridor alternatives, with a view on identifying potential ecological sensitivities. This informed the selection of a ópreferred alternativeô from a terrestrial ecosystems perspective; and
- **Part B: EIA Phase**: Comprises an impact assessment focused on the preferred ADF site, as determined by combined analysis of the **all** environmental disciplines associated with the Kendal 30 years ADF Project, in conjunction with engineering and financial considerations. Part B also provides a suite of proposed mitigation measures for inclusion in the projects overall environmental management programme.

This report presents the findings of both Part A and Part B.

1.1 Site Location

Kendal Power Station is located approximately 8 km south-west of Ogies, in the Nkangala District of Mpumalanga. Nearby towns include Delmas and eMalahleni, which are situated 30 km south-west and 33 km north-east of Kendal, respectively (Figure 1).

Four proposed ADF site alternatives were identified within a 10 km radius of Kendal Power Station. These are collectively referred to as the ósite areaô and are shown in Figure 1.

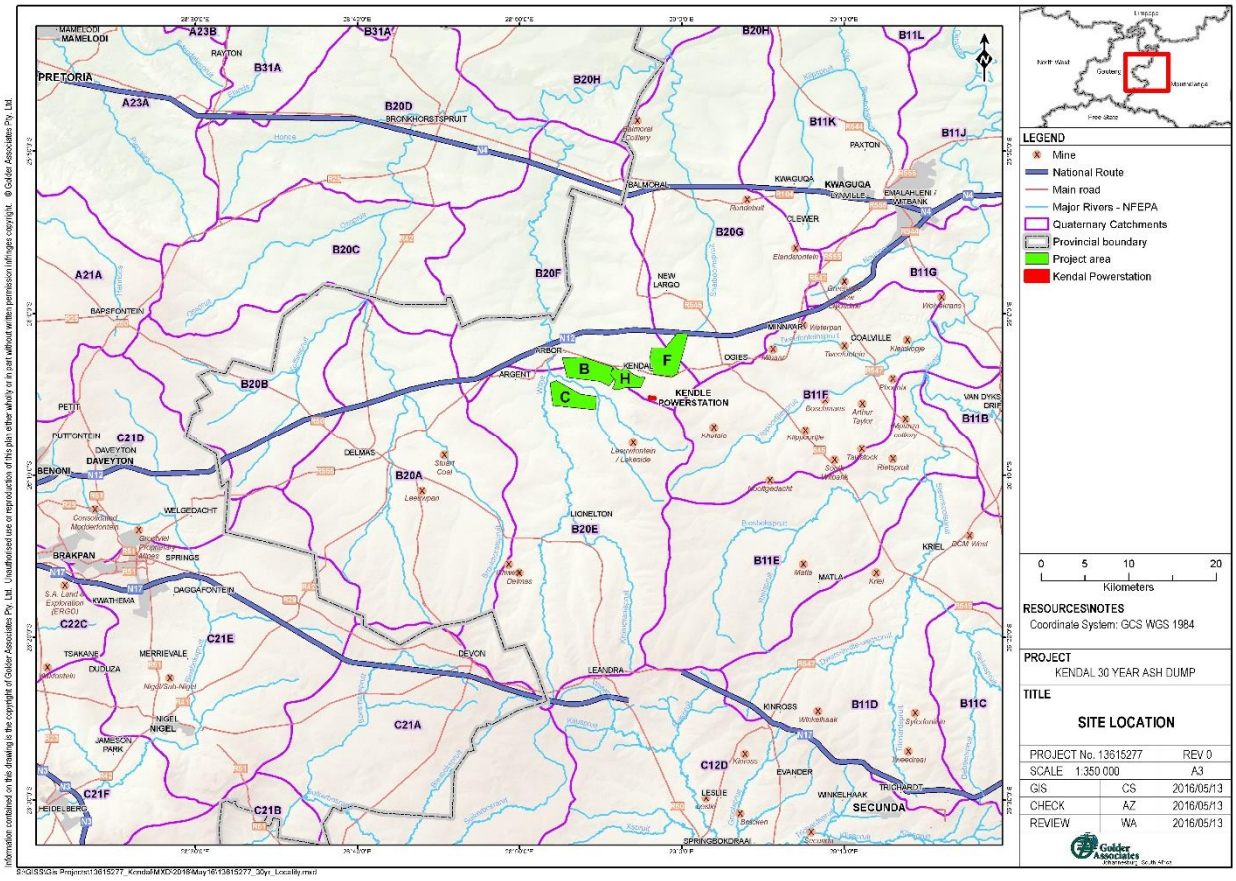

Figure 1: Regional location of Kendal Power Station and the three proposed ADF site alternatives

PART A: BASELINE ECOLOGICAL CHARACTERISATION

2.0 PART A OBJECTIVES

The core objectives of the terrestrial ecosystems assessments are to:

- Present a description of the study areaôs existing flora and fauna characteristics;
- Identify sites/areas and species of conservation importance that occur, or potentially occur, in the study area; and
- Identify a preferred site alternative from a terrestrial ecosystems perspective.

3.0 METHODOLOGY

The methodology used during the baseline characterisation phase of the terrestrial ecosystems assessment comprises a literature review and field survey component. These are briefly summarised below:

- Literature review ï A literature review of existing reports, scientific studies, databases, reference works, guidelines and legislation relevant to the study area, was conducted to establish a historical baseline condition of the siteôs ecology. Species lists of potential flora and fauna occurring in the study area, with specific emphasis on Red Data and protected species, were also compiled and broad-scale vegetation units were identified and delineated at a desk top level (Refer to APPENDIX A for detailed methodology);
- Field survey ï The field surveys aimed to determine the general ecological characteristics and flora and fauna composition of the study area. Two surveys were conducted; a dry season survey (9th - 13th Sept 2013) and a wet season survey (4th - 7th Feb 2014). Vegetation was sampled using point transects at representative sites in the identified vegetation communities. Fauna were sampled at specific sampling sites located throughout the study area. Both passive sampling (active searches, spot counts and observations) and active sampling using an array of traps, were conducted (Refer to APPENDIX A for detailed methodology); and
- Based on the findings of the field survey, the ecological integrity, suitability as habitat for Red data and protected species and conservation importance of each vegetation community was determined and used to inform the identification of a preferred site alternative.

Applicable legislation

The following national and provincial legislation were consulted during the terrestrial ecosystems assessment:

- The Constitution Act (Act No. 108 of 1996) ï Section 24;
- National Environmental Management Act (Act No. 107 of 1998) (NEMA);
- National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEMBA);
- Environmental Conservation Act (CARA) (Act No. 73 of 1989);
- Mpumalanga Nature Conservation Act (Act No. 10 of 1998); and
- National Forests Act (Act No. 84 of 1998).

4.0 ECOLOGICAL BASELINE CONDITIONS

4.1 General Biophysical Environment

The study area is located in the Rand Highveld Grassland vegetation type on the border with the Eastern Highveld Grasslands in the grassland biome (Mucina & Rutherford, 2006) (Figure 2). The associated characteristics of the grassland biome and Rand Highveld Grasslands and Eastern Highveld Grasslands are discussed below:

4.1.1 Grassland biome

The grassland biome covers approximately 28% of South Africa and is the dominant biome on the central plateau and inland regions of the eastern subcontinent (Manning, 2009). Grasslands are situated in moist, summer rainfall regions, which experience between 400 mm and 2 000 mm of rainfall per year. Vegetation consists of a dominant ground layer, comprising grasses and herbaceous perennials. Little or no woody plant species are present.

According to Tainton (1999) the study area falls within "fire climax grassland of potential savannah". As this description suggests, the vegetation of the region would probably succeed to savanna (co-dominance of woody and grass species), but is maintained in a grassland state by frequent, often human-induced veld fires.

4.1.2 Eastern Highveld Grassland

A broad band of Eastern Highveld Grassland extends to the south of Rand Highveld Grassland from Johannesburg in the east through to Bethel, Ermelo and Piet Retief in the west (Mucina & Rutherford, 2006). Approximately 1 214 467 ha of Mpumalanga was originally covered by Eastern Highveld Grassland (Ferrar & Lötter 2007). The following notes sourced from Mucina & Rutherford (2006) summarise the characteristics of this vegetation type.

Vegetation and Landscape features

Eastern Highveld Grasslands are found on slightly- to moderately undulating plains, low hills and wetland depressions. Grasses are typical Highveld species from the genera *Aristida*, *Digitaria*, *Eragrostis,* and *Tristachya*. Woody species are commonly found in rocky areas and include *Acacia caffra, Celtis africana, Protea caffra, Protea welwitschii, Diospyros lycioides* and *Rhus magalismontana* (Mucina & Rutherford, 2006).

Important Plant Taxa

Based on Mucina & Rutherford's (2006) vegetation classification, important plant taxa are those species that have a high abundance, a frequent occurrence (not being particularly abundant) or are prominent in the landscape within a particular vegetation type. They note the following species are important taxa in the Eastern Highveld Grassland vegetation type:

- **Shrubs**: *Anthospermum rigidum* and *Seriphium plumosum;*
- **Graminiodes***: Aristida aequiglumis, Aristida congesta, Aristida junciformis, Cynodon dactylon, Digitaria monodactyla, Eragrostis chloromelas, Eragrostis curvula, Eragrostis plana, Eragrostis racemosa, Heteropogon contortus, Loudetia simplex, Setaria sphacelata, Sporobolus africanus, Themeda triandra, Alloteropsis semialata and Monocymbium ceresiiforme*, *inter alia*;
- **Herbs**: *Berkheya setifera, Haplocarpha scaposa, Euryops gilfillanii, Euryops transvaalensis, Justicia anagalloides, Acalypha angusta, Chamaecrista mimosoides, Dicoma anomala, Kohautia amatymbica, Lactuca inermis, Gladiolus crassifolius, Haemanthus humilis* and *Selago densiflora*; and
- **Endemic Taxon**: The geophytic herbs *Agapanthus inapertus, Eucomis vandermerwei* and the succulent herb *Huernia insigniflora* are endemic to this region.

Conservation

Mucina & Rutherford (2006) classify Eastern Highveld Grassland at a regional scale as **Endangered**. According to Ferrar & Lötter (2007) within Mpumalanga this vegetation type has an ecological status of Endangered-high. Only a small fraction is currently conserved in statutory reserves such as Nooitgedacht Dam and Jericho Dam Nature Reserves. Approximately 44% of the Eastern Highveld Grassland has already been transformed by cultivation, plantations, mines and urbanisation. Erosion of this vegetation type is low. (Mucina & Rutherford, 2006).

4.1.3 Rand Highveld Grassland

Rand Highveld Grassland extends in an east-west band from Stoffberg in Mpumalanga to the outskirts of Pretoria in Gauteng. According to Ferrar & Lötter (2007) this vegetation type originally covered 589 365 ha of Mpumalanga Province.

Vegetation and Landscape features

Rand Highveld Grasslands are found in highly variable landscapes, comprising elevated slopes and ridges and undulating grass plains. Vegetation ranges from species-rich sour grassland to sour shrub-land (Mucina & Rutherford, 2006). Common taxa include grass species from the genera *Themeda, Eragrostis, Heteropogon* and *Elionurus* and herbs belonging to *Asteraceae*. Rocky areas are dominated by open woodlands of *Protea caffra, Protea welwitschii*, *Acacia caffra, Celtis africana* and *Searsia magalismontana* (Mucina & Rutherford, 2006).

Important Plant Taxa

Mucina & Rutherford's (2006) note the following species as important taxa in the Rand Highveld Grassland vegetation type:

- **Shrubs**: *Anthospermum rigidum, Indigofera comosa, Rhus magalismontana* and *Seriphium plumosum;*
- **Graminiodes**: *Ctenium concinnum, Cynodon dactylon, Digitaria monodactyla, Diheteropogon amplectens, Eragrostis chloromelas, Heteropogon contortus, Loudetia simplex, Themeda triandra, Aristida aequiglumis, Aristida congesta* and *Monocymbium ceresiiforme*, *inter alia*;
- **Herbs**: *Acanthospermum australe, Justicia anagalloides, Acalypha angusta, Chamaecrista mimosoides, Dicoma anomala, Kohautia amatymbica, Lactuca inermis* and *Selago densiflora*; and
- **Endemic Taxon**: The geophytic herbs *Agapanthus inapertus*, *Eucomis vandermaerwei* and the succulent herb *Huernia insigniflora* are endemic to this region.

Conservation

Based on Mucina & Rutherford (2006) the Rand Highveld Grassland vegetation type is classified as **Endangered** at a regional level. Within Mpumalanga, Ferrar & Lötter (2007) categorise Rand Highveld Grassland as having an ecological status of Endangered-low.

Although the target for conservation is 24%, only 1% of this vegetation type is currently under statutory conservation in reserves such as Kwaggavoetpad, Van Riebeck Park and Boskop Dam Nature Reserves. Cultivation, plantations and urbanisation have resulted in the transformation of large parts of Rand Highveld Grassland. Exotic invasive plants, particularly *Acacia mearnsii* are present (Mucina & Rutherford, 2006).

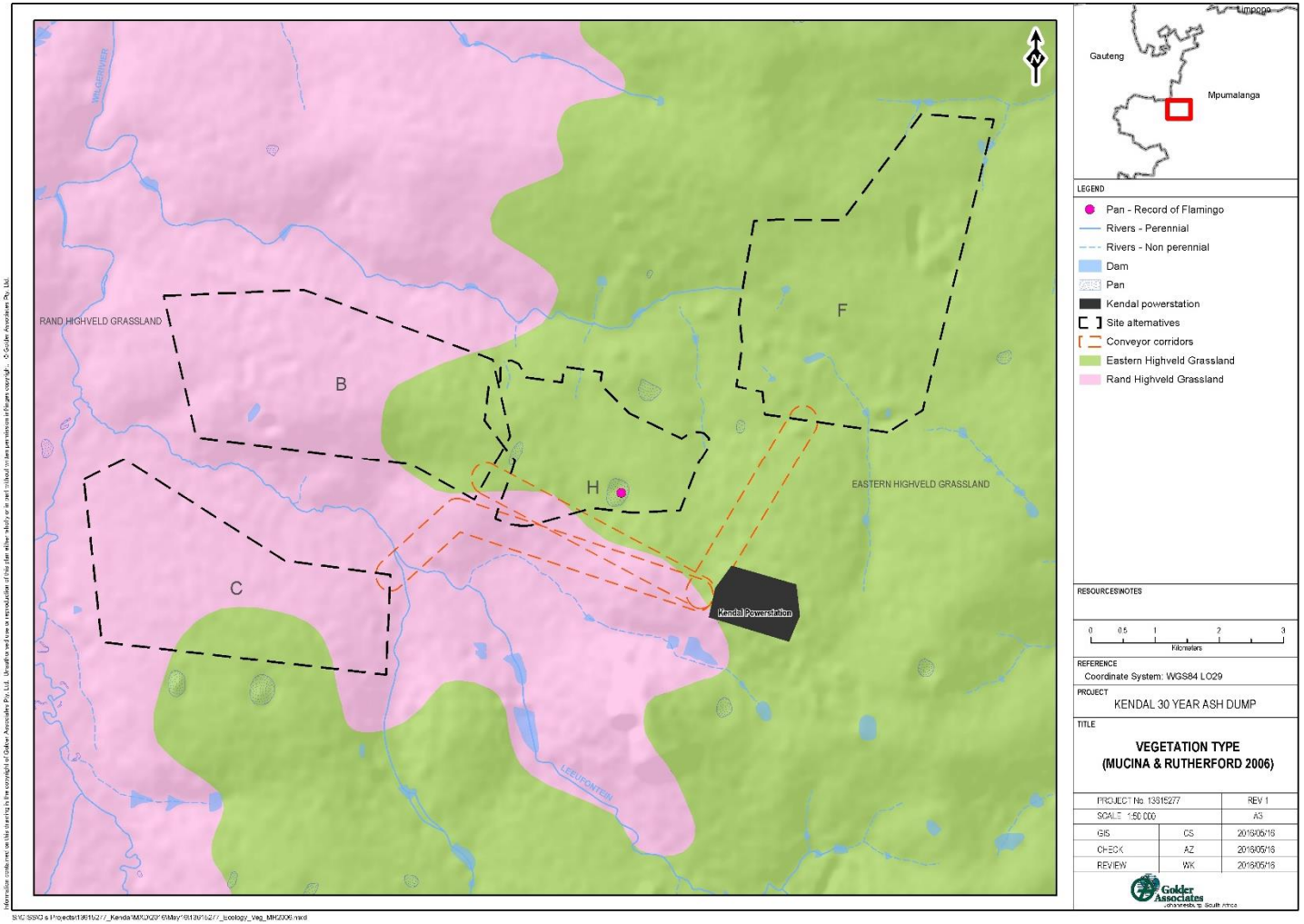

Figure 2: Locality of study area in relation to the regional vegetation types, as described by Mucina & Rutherford (2006)

4.2 Mpumalanga Biodiversity Sector Plan

According to the Mpumalanga Biodiversity Sector Plan (MBCP) (2013) the study area consists of four of the provinceôs biodiversity categories. These are listed and summarised in Table 1 and their distribution shown in Figure 3.

Table 1: Categories of the Mpumalanga Biodiversity Sector Plan (2013)

Category	Description and Motivation
Modified	Modified areas are those that have undergone a significant and often irreparable degree of transformation that has led to a near-complete loss of biodiversity and ecological functioning. Common agents of modification include mining, arable agriculture and infrastructure development.
Modified ï Old lands	This sub-category of Modified relates to areas that have been altered by cultivation and other activities within the last 80 years and subsequently abandoned. The biodiversity and ecological functioning in such areas is compromised but may still play a role in the provision of ecosystem services.
Other natural areas	These are areas that have not been selected to meet biodiversity conservation targets, yet they are likely to provide habitat for flora and fauna species and a range of ecosystem services.
Critical Biodiversity Area (CBA) - Optimal	CBA ï Optimal are areas selected to optimally meet biodiversity targets. Although these areas have a lower irreplaceability value than the CBA ï Irreplaceable category, collectively they reflect the smallest area required to meet biodiversity conservation targets.

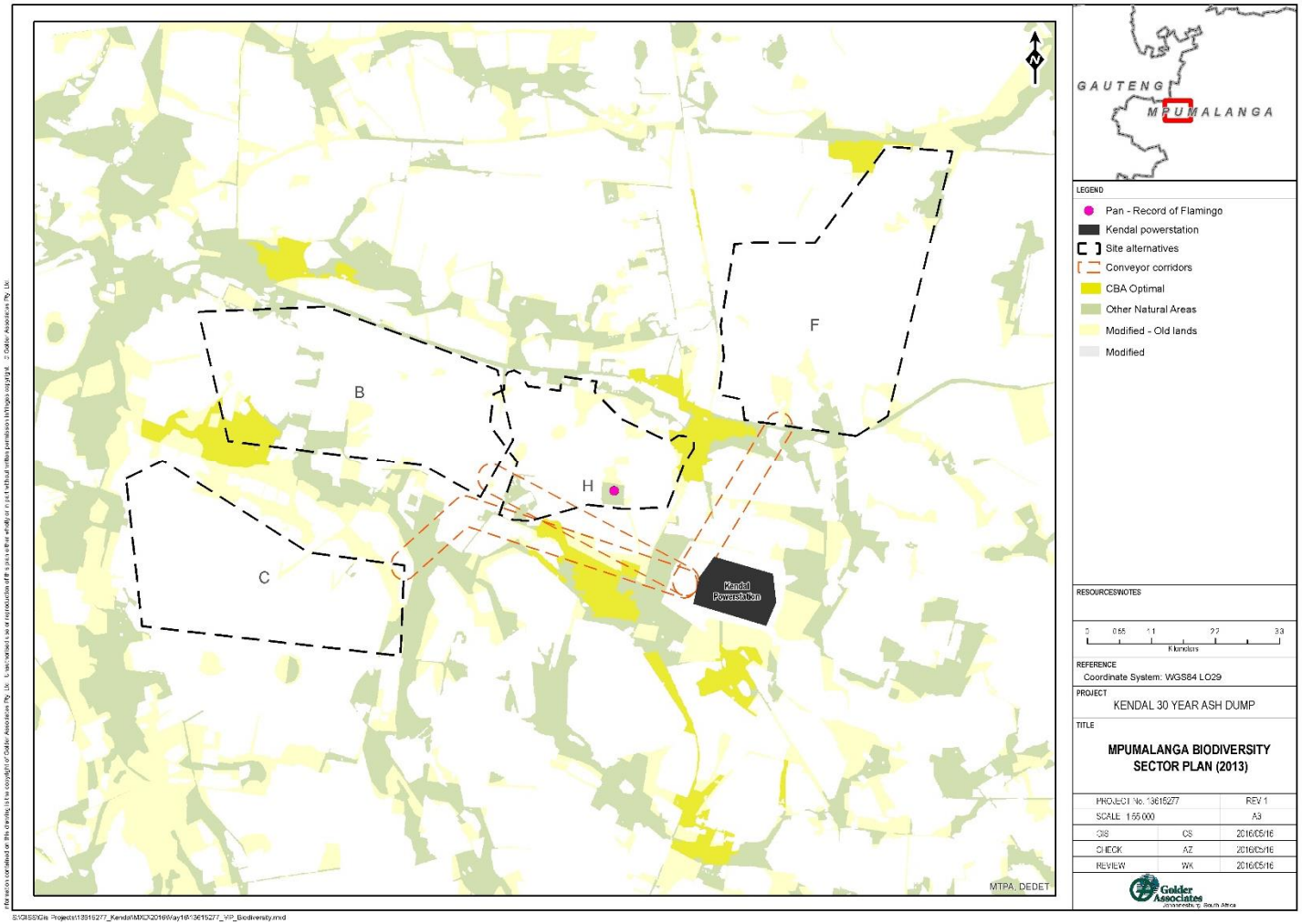

Figure 3: Study area in relation to the Mpumalanga Biodiversity Sector Plan (2013)

4.3 Flora Assessment

4.3.1 Landscape matrix

The study areas landscape matrix is highly variable, with prominent land-uses comprising, *inter alia*, agriculture, livestock grazing, coal mining, and activities related to the Kendal Power Station. The landscape is also traversed by railway tracks, numerous arterial and access roads, and is bordered to the north by the N12 Highway. Consequently, the immediate landscape is fragmented and much of the surface area is either completely transformed or highly disturbed.

Patches of semi-natural and natural grassland do occur and are generally associated with drainage features or rocky hillsides. As habitat refuges and movement corridors, these natural areas are critically important in sustaining indigenous fauna and flora populations and landscape-scale ecological processes. In a local context, the Leeufontein stream, which flows on an east-west bearing between Sites B and C, and the Wilge River which flows on a south-north bearing to the west of Sites B and C, and a number of natural pans and artificial dams scattered around the broader study area, are of ecological importance.

4.3.2 Study area characteristics

Six vegetation communities or land units were identified within the proposed ADF and conveyor corridors footprints. These were recognised based on physiognomy, moisture regime, slope, species composition and disturbance characteristics:

- Transformed land;
- Cultivated land (current and former);
- Exotic woodlot;
- Eragrostis pasture;
- Dry mixed grassland, includes *Hyparrhenia* dominated form; and
- Moist grass and sedge community.

Large sections of the study area have been completely transformed or severely degraded by coal mining, and rural and peri-urban developments. These sites have collectively been categorised as Transformed land, and were noted but subject to no further investigation.

The characteristics of the remaining vegetation communities are detailed in sections 4.3.2.1 to 4.3.2.5. Refer to Figure 4 for a map of the vegetation types.

Table 2: Approximate area of the vegetation communities at site alternatives in the study area

Vegetation Community	Approximate area (ha)			
	Site B	Site C	Site F	Site H
Transformed land	309	230	933	12
Cultivated land (current and former)	534	664	182	509
Exotic woodlots	11	0.7	32	8
Eragrostis pastures	77	0	0	23
Dry mixed grassland	73	18	46	45
Dry mixed grassland ï *Hyparrhenia* dominated	102	0	22	11
Moist grass and sedge community	18	26	11	60

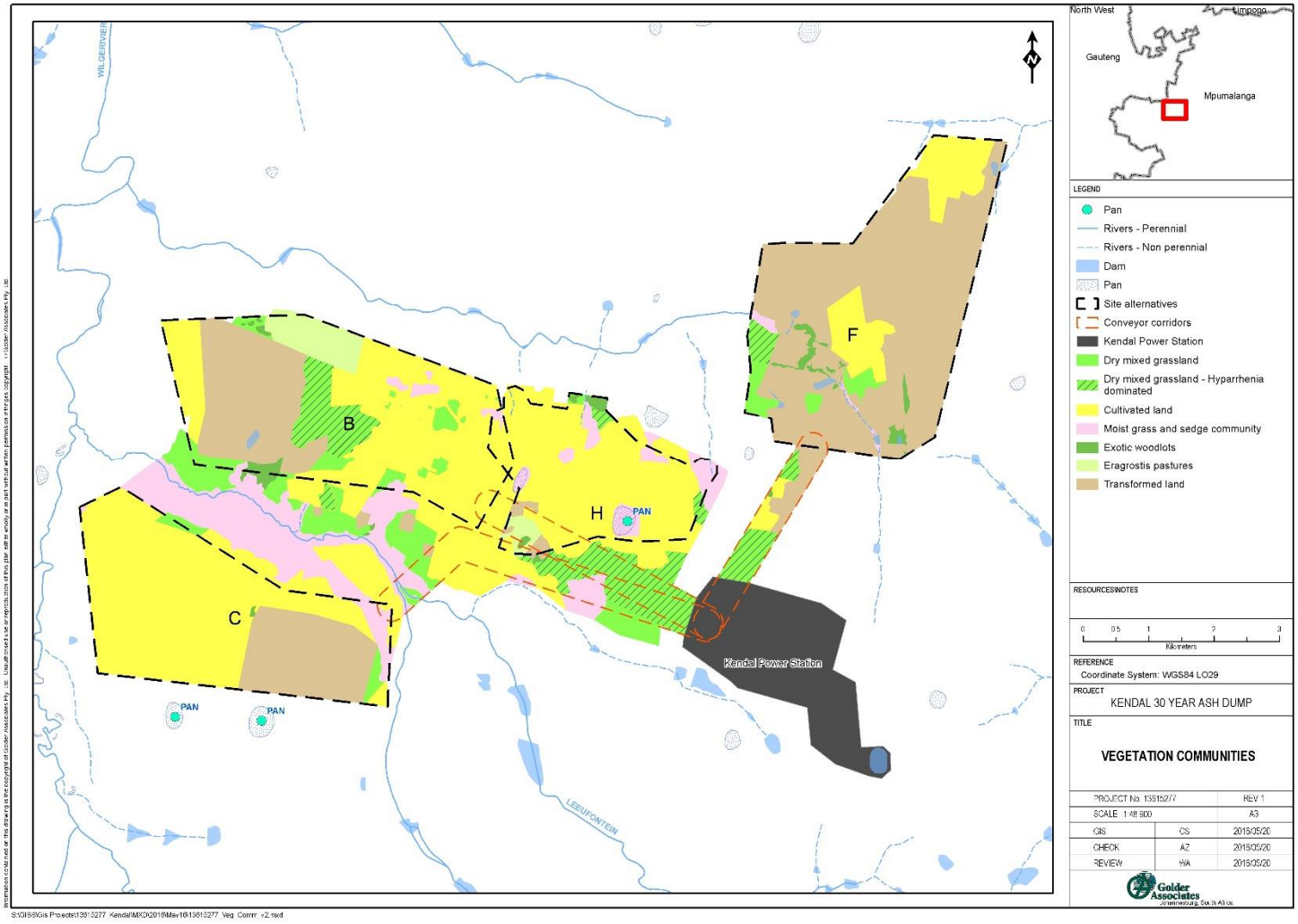

Figure 4: Vegetation communities associated with the site alternatives and conveyor corridors in the study area

4.3.2.1 Cultivated land (current and former)

The majority of Site B, C and H comprise cultivated land. During the dry season these were lying fallow, but were under maize or potato production during the wet season survey. Non-crop plants recorded in or on the edges of the cultivated lands include the exotic, often invasive plants such as *Argemone ochroleuca*, *Argemone* spp., *Bidens pilosa, Chenopodium* spp., *Conyza bonariensis, Cosmos bipinnata, Cyperus esculentus, Tagetes minuta* and *Verbena bonariensis* and grasses *Eleusine coracana, Melinis repens, Panicum maximum* and *Urochloa mosambicensis* (see Figure 5).

Figure 5: Recently ploughed cultivated field- note presence of highly invasive Argemone species

Sensitivity Aspects

Cultivated lands are transformed and accordingly are considered to have low ecological integrity. No endemic, Red Data or protected species were recorded and the probability of such species occurring in this vegetation community is considered low. The conservation importance of cultivated land is considered low (refer to Figure 13 and Figure 14).

4.3.2.2 Eragrostis pastures

This anthropogenically maintained grass community was recorded in discrete fields in Site B and H (Figure 6). *Eragrostis* pastures are actively managed for livestock production and are typically artificially seeded, fertilised and often baled by farmers to provide dry season forage for livestock. Their anthropogenic origins and continued management results in *Eragrostis* pastures having low flora species richness, with the grasses *Eragrostis curvula* and *Digitaria eriantha* being dominant. Recorded forbs include *Gomphrena celosioides**, *Hypochaeris radicata, Richardia brasiliensis** and *Schkuhria pinnata** (* indicates exotic species).

Sensitivity Aspects

This vegetation community is artificial and subject to active management, including mowing and often the application of fertiliser. Such areas have low floristic diversity and ecological integrity. Furthermore, the probability of endemic, Red Data or protected species occurring in this community is considered low.

That said, *Eragrostis* pastures do present a form of grassland habitat in a highly transformed landscape, and accordingly have a moderate conservation importance (refer to Figure 13 and Figure 14).

Figure 6: Eragrostis pastures, comprising almost solely of Eragrostis curvula and Digitaria eriantha

4.3.2.3 Dry mixed grassland

Dry mixed grasslands occur on rocky and shallow soils where ploughing and cultivation is precluded. These areas are mainly confined to scattered pockets amongst cultivated fields and on certain untransformed hill slopes and crests.

Undisturbed areas of Dry mixed grassland are characterised by a rich diversity of grass and forb species, and are often dominated by the grass *Themeda triandra*. Conversely, areas that have been disturbed by *inter alia* historic cultivation, overgrazing or a combination thereof, are dominated by the thatching grass *Hyparrhenia hirta* (Figure 8).

Grass species recorded in undisturbed Dry mixed grassland areas include *Alloteropsis semialata*, *Aristida congesta* subsp. *congesta, Aristida congesta* subsp. *barbicollis, Aristida diffusa, Aristida* sp., *Bewsia biflora, Brachiaria* sp., *Cymbopogon excavatus, Cynodon dactylon, Digitaria argyrograpta, Digitaria eriantha, Digitaria monodactyla, Diheteropogon amplectens, Hyparrhenia hirta, Eragrostis capensis, Eragrostis chloromelas, Eragrostis cilianensis, Eragrostis curvula, Eragrostis gummiflua, Eragrostis racemosa, Eragrostis superba, Harpochloa falx, Hyparrhenia hirta, Melinis repens, Monocymbium ceresiiforme, Panicum ecklonii, Panicum maximum, Panicum natalense, Paspalum urvillei, Perotis patens, Pogonarthria squarrosa, Schizachyrium sanguineum, Setaria sphacelata, Sporobolus africana, Sporobolus ludwigii, Themeda triandra, Trachypogon spicatus, Trichoneura grandiglumis, Tristachya leucothrix, Urelytrum agropyroides* and *Urochloa mosambicensis*.

Herbs and forbs recorded in undisturbed areas of this community include *Acalypha villicaulus, Alectra sessiliflora, Albuca* species, *Athrixia elata, Becium angustifolium, Berkheya radula, Berkheya setifera, Bidens pilosa, Boophone disticha, Bulbine favosa, Campuloclinium macrocephalum*, Callilepis leptophylla, Chamaecrista comosa, Cleome maculata, Clerodendrum triphyllum, Commelina africana, Crabbea angustifolia, Crassula capitella, Cucumis hirsutus*, *Cucumis zeyheri, Datura stramonium*, Dicoma zeyheri, Dimorphotheca spectabilis, Erica drakensbergensis*, Eriosema cordatum, *Euphorbia striata, Gazania krebsiana, Geigeria burkei, Gerbera viridifolia, Gladiolus* spp[1]*., Gnidia kraussiana, Haplocarpha lyrata, Haplocarpha scaposa, Helichrysum acutatum, Helichrysum argyrosphaerum, Helichrysum dasymallum, Helichrysum harveyanum, Helichrysum nudifolium, Helichrysum pilosellum, Helichrysum rugulosum, Helichrysum setosum, Heliotropium amplexicaule*, Hermannia depressa, Hermannia transvaalensis, Hypoxis argentea, Hypoxis iridifolia Hypoxis multiceps, Hypoxis rigidula*, *Indigofera hilaris, Indigofera melanadenia, Indigofera oxytropis, Ipomoea crassipes, Ipomoea ficifolia, Ledebouria ovatifolia, Ledebouria revoluta, Melolobium wilmsii, Moraea thomsonii*, *Nemesia fruticans, Neorautanenia ficifolius, Oldenlandia*

[1] Not flowering at the time of the field surveys

herbacea, *Oxalis obliquifolia*, *Papaver aculeatum, Pelargonium dolomiticum, Pentanisia angustifolia, Pentanisia prunelloides, Pollichia campestris, Polygala hottentotta, Polygala uncinata*,

Richardia brasiliensis, Schkuhria pinnata*, Senecio coronatus, Senecio inornatus, Senecio venosus, Seriphium plumosum, Sphenostylis angustifolia, Striga elegans, Tephrosia capensis, Tribulus terrestris*, Trichodesma physaloides, Turbina oblongata, Vernonia galpinii, Vernonia natalensis, Wahlenbergia caledonica, Walafrida densiflora, Walafrida tenuifolia* and *Zornia* sp. (* indicates exotic species).

Few other plants are able to establish and survive among the tall, ceaspitose *Hyparrhenia* swards and consequently disturbed Dry mixed grasslands are species poor. Forbs and other grasses recorded in disturbed, *Hyparrhenia* dominated Dry mixed grassland areas are typically ruderal or exotic species, such as *Cosmos bipinnatus*, Conyza bonariensis*, Conyza podocephala, Gomphocarpus fruticosus, Helichrysum rugulosum, Indigofera daleoides, Melinis repens, Oldenlandia herbacea, Pogonarthria squarrosa, Pollichia campestris, Pseudognaphalium luteo-album, Schkuhria pinnata*, Seriphium plumosum, Tagetes minuta** and *Verbena bonariensis** and *Wahlenbergia caledonica.*

Scattered woody species were noted along rocky outcrops in the study area. These include *Asparagus* spp.*, Diospyros austro-africana, Elephantorrhiza elephantina*, *Eucalyptus* spp.*, *Rhus dentata, Rhus pyroides* and *Ziziphus zeyheriana*.

Sensitivity Aspects

The condition of this vegetation community varies considerably. In close proximity to farm dwellings and exotic woodlots high levels of disturbance are evident, while along rocky outcrops generally moderate to low levels of disturbance were recorded. Overall, the ecological integrity of Dry mixed grasslands is moderate-high.

Red Data and/or protected plant species recorded in this community include *Boophone disticha, Callilepis leptophylla* and *Gladiolus* spp.*,* and its suitability as habitat for other Red Data and/or protected plants is high. Dry mixed grasslands are important habitat for fauna, some of which are also Red Data and/or protected species.

The conservation importance of large, connected areas of Dry mixed grasslands is thus high, while that of small isolated patches, is considered moderate (refer to Figure 13 and Figure 14).

Figure 7: Undisturbed Dry mixed grassland, dominated by Themeda triandra

Figure 8: Disturbed Dry mixed grassland, dominated by Hyparrhenia hirta

4.3.2.4 Exotic woodlots

Pockets of exotic invasive woody species were noted on all site alternatives. Woodlots are dominated by *Acacia mearnsii* but may include *Eucalyptus* and *Populus* species. Little indigenous flora was recorded, with the herbaceous layer largely absent or comprised of ruderal species.

Populus x canescens infestations were noted on the moist seeps of Site B and H. *Populus x canescens* is a sterile, hybrid poplar species that coppices readily when cut and regenerates easily from root suckers (Bromilow, 2010). This species is a particular threat to biodiversity along river banks and in wetland areas.

Sensitivity aspects

Exotic woodlots are regarded as a disturbed, exotic vegetation community with low ecological integrity. The probability of endemic, Red Data or protected flora species occurring in this community is also considered low.

Woodlots do however, contribute to landscape heterogeneity and provide roosting and nesting sites for birds and habitat refuges for larger, persecuted mammals (e.g. Black-backed jackal and Serval). This notwithstanding, the conservation importance of the Exotic woodlots is considered low (refer to Figure 13 and Figure 14).

Figure 9: The exotic Populus x canescens establishes in moist areas

Figure 10: Exotic woodlot dominated by the invasive Acacia mearnsii

4.3.2.5 Moist grass and sedge vegetation community

This broad vegetation community is associated with wetland habitats in the study area, and occurs along stream channels, artificial dams, pans and seep zones (see Figure 11).

Depending on the degree of soil moisture, vegetation composition comprises a mixture hydrophilic and terrestrial species. In areas of very high or permanent soil moisture tall reeds and various sedges and grasses dominate. These include *Agrostis eriantha, Agrostis lachnantha, Andropogon eucomus, Andropogon huillensis, Arundinella nepalensis,* Aristida junciformis, *Cynodon dactylon, Cyperus species Eleocharis acutangula Eragrostis gummiflua, Eragrostis plana, Imperata cylindrica, Juncus effusus,* Juncus lomatophyllus, *Juncus punctorius, Leersia hexandra, Paspalum dilatatum, Paspalum urvillei, Persicaria lapathifolia, Phragmites australis, Pycreus* spp., *Schoenoplectus brachyceras, Schoenoplectus corymbosus*, *Setaria* species and *Typha capensis.*

Other grass species recorded in this community include *Eragrostis curvula, Sporobolus africana, Hyparrhenia tamba, Hyparrhenia hirta, Eragrostis capensis, Panicum natalense, Themeda triandra, Andropogon appendiculatus, Hemarthria altissima, Schizachyrium sanguineum, Cymbopogon plurinodis, Eragrostis chloromelas, Eragrostis racemosa* and *Eragrostis cilianensis;* while recorded forbs include *inter alia Amaranthus hybridus*, Berkheya maritima, Berkheya radula, Berkheya setifera, Bidens pilosa*, Campuloclinium macrocephalum*, Chamaecrista comosa, Cirsium vulgare*, Commelina africana, Conyza bonariensis*, Cosmos bipinnatus*, Crepis hypochoeridea, Datura stramonium*, Gomphocarpus fruticosa, Haplocarpha scaposa, Helichrysum aureonitens, Helichrysum cooperi, Helichrysum harveyanum, Helichrysum kraussii, Helichrysum pilosellum, Helichrysum nudifolium, Helichrysum rugulosum, Helichrysum setosum, Homeria pallida, Hypochaeris radicata, Kyllinga* spp.*, Lobelia erinus, Monopsis decipiens, Moraea thomsonii, Nemesia fruticans, Nidorella anomala, Pelargonium luridum, Plantago lanceolata*, Plantago major, Protasparagus cooperi, Pseudognaphalium luteo-album, Ranunculus meyeri, Rumex* spp.**, Schkuhria*

pinnata, Senecio inornatus, Seriphium plumosa, Sopubia cana, Tagetes minuta*, Trifolium repens, Verbena bonariensis*, Wahlenbergia caledonica, Xanthium strumarium** and *Xysmalobium undulatum* (* indicates exotic species).

The invasive *Verbena bonariensis* is abundant in disturbed areas of the Moist grass and sedge community. The presence of this species indicates suitable habitat for the highly invasive *Campuloclinium macrocephalum* ï an exotic species that was also recorded in the study area and that can cause severe habitat degradation and biodiversity loss if uncontrolled (Bromilow, 2010).

Of ecological importance are the small to large patches of *Imperata cylindrica* observed in this vegetation community in the study area. *Imperata cylindrica* is a creeping grass that spreads with long rhizomes and forms almost mono-specific stands (Figure 12). Dense stands of this species are important nesting habitat for the vulnerable Grass owl (*Tyto capensis*) (pers. comm. M. Pretorius, EWT) (refer to section 4.4: Fauna assessment).

Exotic woody plants have also established or encroached into parts of this community. Mature stands or scattered individual *Salix babylonica* trees were noted, as were dense infestations of *Populus x canescens* (refer to section 4.3.2.4) ï both species are listed as problem invaders under the Conservation of Agricultural Resources Act (Act No. 43 of 1983).

Sensitivity Aspects

Areas of the Moist grass and sedge community are disturbed to varying degrees. Common disturbance agents are ploughing, fences, cattle grazing and trampling, and exotic species encroachment. Overall the ecological integrity of this community thus ranges from moderate to high (Figure 13).

The value of this community as fauna and flora habitat is considerable, with longitudinal stretches providing important movement and dispersal corridors. Indeed, the persistence of many sensitive fauna species (Serval *Leptailurus serval*, Marsh sylph *Metisella meninx* & Grass owl *Tyto capensis*) is dependent on the continued maintenance of this communityôs ecological integrity and functioning.

A number of Red Data and/or protected flora were recorded in this community, including *Crinum bulbispermum, Gladiolus* spp.*, Kniphofia* sp., and *Disa woodii*, and the probability of additional species being present is high.

The conservation importance of large, connect areas of the moist grass and sedge community is therefore high, while that of small, isolated patches is moderate (Figure 14).

Figure 11: Moist grass and sedge community

Figure 12: Large stands of Imperata cylindrica are a favoured nesting habitat for the Grass owl (Tyto capensis)

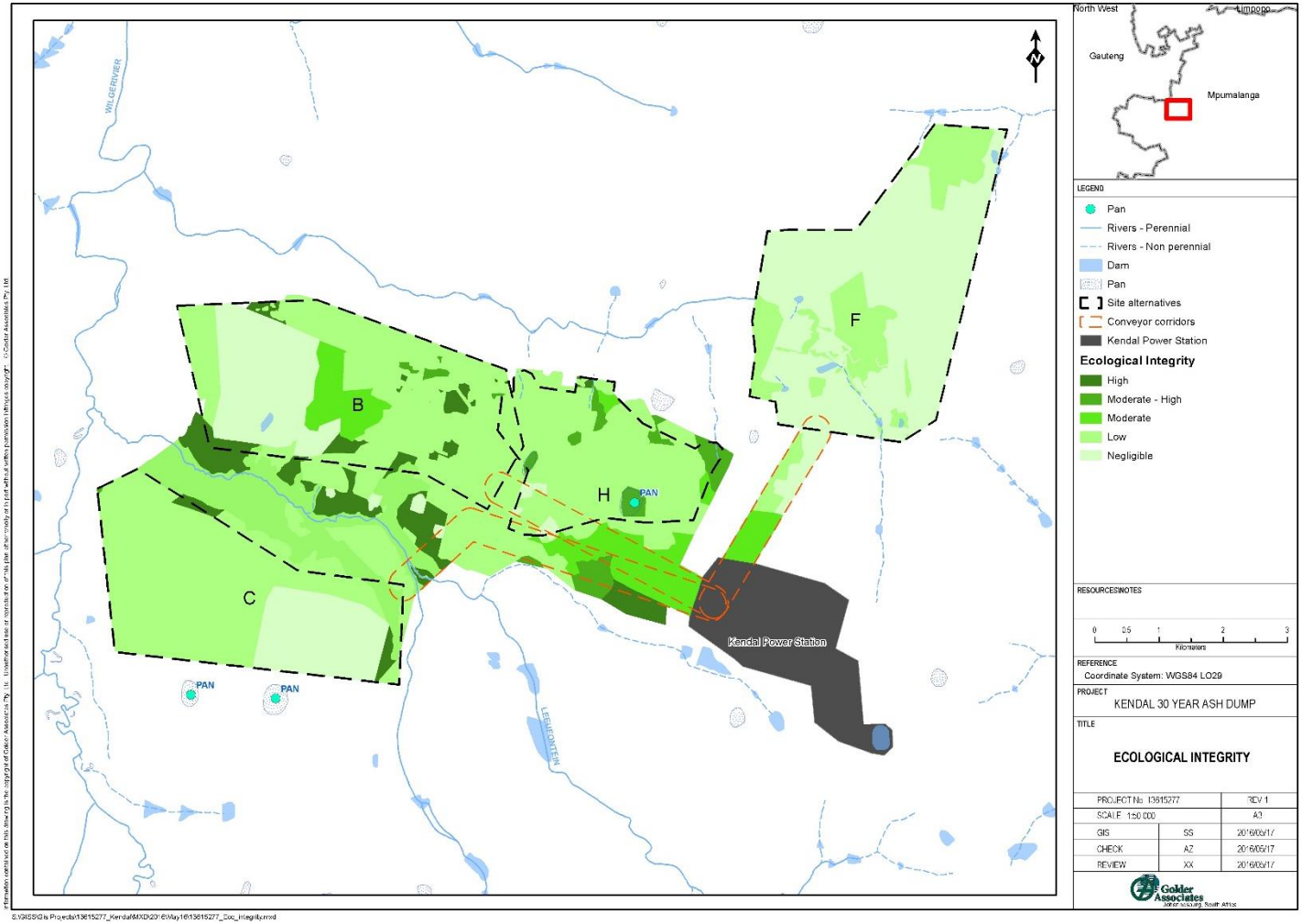

Figure 13: Ecological integrity of the study area

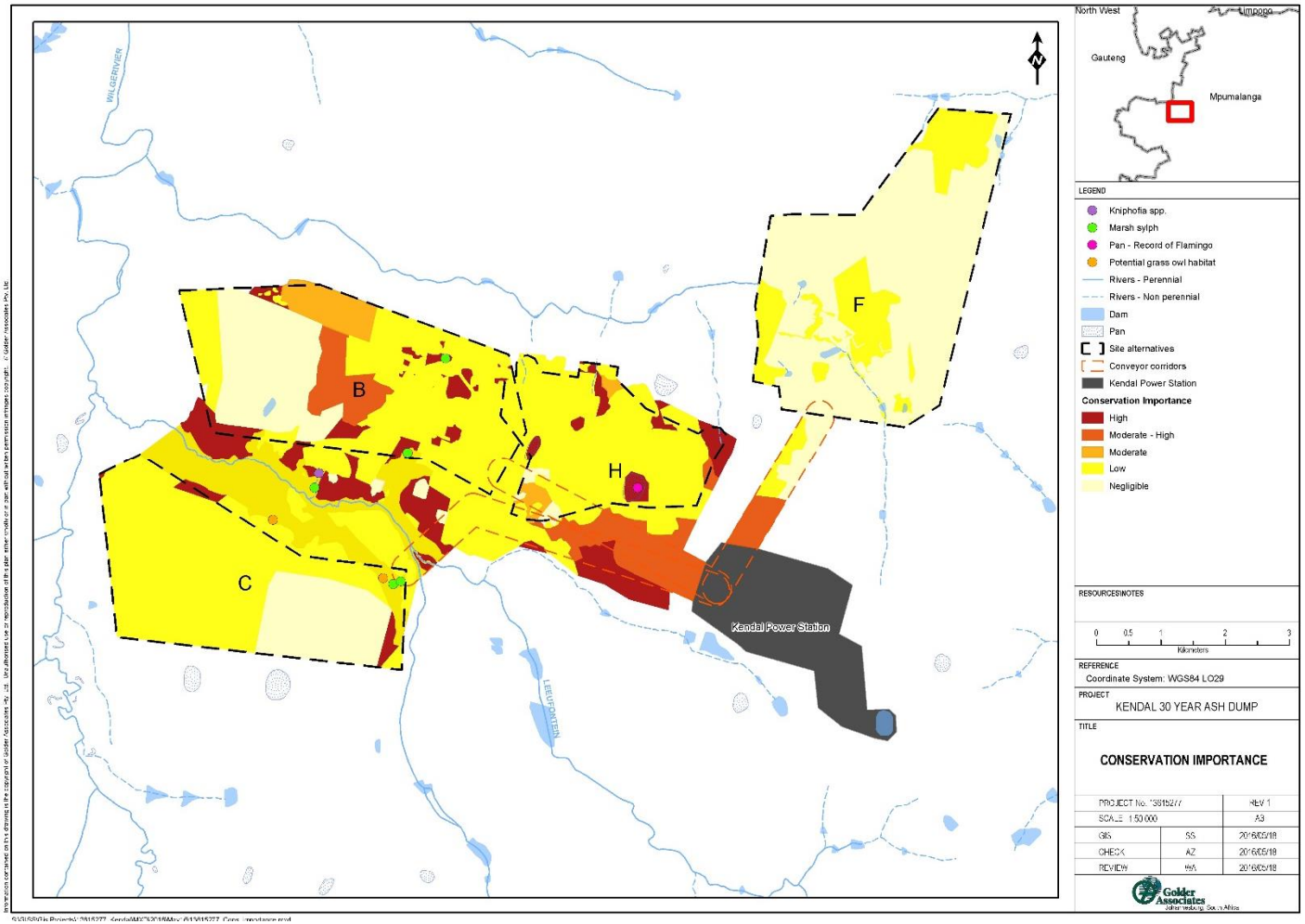

Figure 14: Conservation importance and sensitive features in the study area

4.3.3 Flora species of conservation importance

Red Data and/or protected plant species recorded in, or in close proximity to the study area include *Boophane disticha, Callilepis leptophylla, Crinum bulbispermum, Disa woodii, Eucomis autumnalis, Gladiolus* spp. and *Kniphofia* sp.

An additional 28 Red Data and/or protected plant species have previously been recorded in the quarter degree square (2628BB) in which the study area is located, as per the SANBI SIBIS database and data received from the Mpumalanga Tourism and Parks Agency. These species are primarily from the families IRIDACEAE (6 species), AMARYLLIDACEAE (5 species) and MESEMBRYANTHEMACEAE (6 species). All have a high probability of occurring in the study area. Refer to Table 4 for a list of Red Data and/or protected plant species.

Refer to APPENDIX B for a full list of flora species recorded in the 26285BB as per the SANBI's SIBIS database.

Table 3: Location of recorded plant species of conservation importance

Species	Co-ordinates
Boophane disticha	S26 03.483 E28 55.242
	S26 03.584 E28 55.237
	S26 03.495 E28 55.246
	S26 03.919 E28 55.183
	S26 03.940 E28 55.224
	S26 03.960 E28 55.214
	S26 05.108 E28 56.530
Callilepis leptophylla	S26 03.444 E28 55.234
	S26 03.478 E28 55.241
	S26 03.492 E28 55.241
	S26 03.413 E28 55.336
	S26 05.019 E28 56.378
	S26 05.068 E28 56.461
	S26 05.066 E28 57.028
Gladiolus spp.	S26 03.492 E28 55.241
	S26 04.381 E28 53.872
	S26 05.201 E28 54.623
Crinum bulbispermum	S26 04.040 E28 54.807
	S26 04.381 E28 53.872
	S26 04.960 E28 54.983
	S26 04.976 E28 54.831
	S26 04.950 E28 54.803
	S26 04.977 E28 54.815
	S26 04.302 E28 57.516
	S26 04.307 E28 57.547
Kniphofia sp.	S26 04.275 E28 53.930
Eucomis autumnalis	S26 05.591 E28 56.671

Table 4: Red Data and protected plant species potentially occurring in study area

Family	Scientific name	Status		
		IUCN (2013.1)	NEMBA TOPS List (2013)	Mpumalanga Protected Species (1998)
AMARYLLIDACEAE	*Boophone disticha*	Declining	-	Protected
AMARYLLIDACEAE	*Crinum bulbispermum*	Declining	-	Protected
AMARYLLIDACEAE	*Crinum graminicola*	-	-	Protected
AMARYLLIDACEAE	*Cyrtanthus breviflorus*	-	-	Protected
AMARYLLIDACEAE	*Nerine gracilis*	Near Threatened	-	
AQUIFOLIACEAE	*Ilex mitis*	Declining	-	-
ASPHODELACEAE	*Aloe ecklonis*			Protected
ASTERACEAE	*Callilepis leptophylla*	Declining		
EUPHORBIACEAE	*Euphorbia clavarioides*	-	-	-
FABACEAE	*Melolobium subspicatum*	Vulnerable	-	-
HYACINTHACEAE	*Eucomis autumnalis*	Declining	-	Protected
HYPOXIDACEAE	*Hypoxis hemerocallidea*	Declining	-	Protected
IRIDACEAE	*Gladiolus crassifolius*	-	-	Protected
IRIDACEAE	*Gladiolus elliotii*	-	-	Protected
IRIDACEAE	*Gladiolus permeabilis*	-	-	Protected
IRIDACEAE	*Gladiolus vinosomaculatus*	-	-	Protected
IRIDACEAE	*Gladiolus papilio*	-	-	Protected
IRIDACEAE	*Watsonia bella*	-	-	Protected
ISOETACEAE	*Isoetes transvaalensis*	Near Threatened	-	-
LILIACEAE	*Kniphofia ensifolia*	Endangered	-	-
LILIACEAE	*Drimia intricata*	-	-	Highly utilised species
MESEMBRYANTHEMACEAE	*Delosperma gautengense*	Vulnerable	-	-
MESEMBRYANTHEMACEAE	*Delosperma macellum*	Endangered	-	-

Family	Scientific name	Status		
		IUCN (2013.1)	NEMBA TOPS List (2013)	Mpumalanga Protected Species (1998)
MESEMBRYANTHEMACEAE	*Frithia humilis*	Vulnerable	-	Protected
MESEMBRYANTHEMACEAE	*Frithia pulchra*	Rare	-	-
MESEMBRYANTHEMACEAE	*Khadia beswickii*	Vulnerable	-	-
MESEMBRYANTHEMACEAE	*Lithops lesliei*	Near Threatened	-	Near Threatened
ORCHIDACEAE	*Eulophia coddii*	Vulnerable	-	Protected
ORCHIDACEAE	*Habenaria clavata*	-	-	Protected
ORCHIDACEAE	*Habenaria mossii*	Endangered	-	Protected
PROTEACEAE	*Protea welwitschii*	-	-	Protected
ZAMIACEAE	*Encephalartos lanatus*	Vulnerable	Protected	Protected
ZAMIACEAE	*Encephalartos middelburgensis*	Critically Endangered	Critically Endangered	Protected

4.3.4 Declared weeds and invader plants

South Africa legislation concerning exotic and invasive species includes Regulations 15 and 16 of the Conservation of Agricultural Resources Act (CARA) (Act No. 43 of 1983) as amended, and Regulations 507 and 508 of the National Environmental Management: Biodiversity Act (NEMBA) (Act No. 10 of 2004), as released in Government Gazette No. 36683 on the 19 July 2013.

In has been indicated that species listed under NEMBA exclude all species listed under the CARA, with the process of consolidating the CARA listed species under the NEMBA being underway and due for finalisation by April 2014. As such both sets of regulations are currently applicable.

The CARA recognises three categories of invasive plant, namely: Category 1 - declared weeds, Category 2 - declared invader plants with a commercial or utility value, and Category 3 - ornamental plants. The NEMBA regulations categories species as being either invasive species (Category 1a or 1b) (R507) or prohibited alien species (R. 508). Where they occur outside biological control reserves and demarcated areas plants listed under CARA and NEMBA must be controlled.

The plants listed in Table 5 were recorded in the study area and are declared weeds or invasive plants according to the CARA and the NEMBA.

Table 5: Declared exotic invasive species recorded in the study area

Scientific name	Common name	CARA Category	NEMBA Category (Listed or Proposed)	Community where recorded
Acacia mearnsii	Wattle	2	2	Exotic woodlot Dry mixed grassland
Agave americana	American aloe	2	1b	Exotic woodlot
Argemone mexicana/ochroleuca	Mexican poppy	1	1b	Cultivated land
Cirsium vulgare	Scottish thistle	1	1b	Moist grass and sedge community Dry mixed grassland
Datura stramonium	Large thorn apple	1	1b	Cultivated land Dry mixed grassland
Populus x canescens	Grey poplar	2	2	Exotic woodlot Dry mixed grassland Moist grass and sedge community
Eucalyptus spp.	Gum	2	1b	Exotic woodlot
Salix babylonica	Weeping willow	2	-	Moist grass and sedge community
Verbena bonariensis	Wild verbena	-	1b	Dry mixed grassland Moist grass and sedge community
Xanthium strumarium	Large cocklebur	1	1b	Cultivated land

4.4 Fauna Assessment

4.4.1 Mammals

Fourteen mammal species were recorded in the study area. These are the Scrub Hare (*Lepus saxatilis),* Multimammate Mouse (*Mastomys* sp.), Striped Mouse (*Rhabdomys pumilio*), Slender Mongoose (*Galerella sanguinea*), Water Mongoose (*Atilax paludonosus*), Large -spotted Genet (*Genetta tigrina*), Porcupine (*Hystrix africaeaustralis*), Serval (*Leptailurus serval*), Black-backed Jackal (*Canis mesomelas*), Cape Clawless Otter (*Aonyx capensis*), Warthog (*Phacochoerus africanus*), Bushpig (*Potamochoerus larvatus*), Steenbok (*Raphicerus campestris*) and Common Duiker (*Sylvicapra grimmia*).

Figure 15 to Figure 18 show several mammal species recorded on a single camera trap placed along the Wilge River to the west of Site C (Co-ordinates: 26º 4.803'S, 28º 51.619'E).

Previous studies conducted in areas surrounding Kendal Power Station and the nearby Kusile Power Station have recorded an additional seven mammal species - Table 6 (refer to Golder 2007 Report no. 10613-5792-1, Golder 2013 Report no. 13614949-11847-1, Golder 2013 Report no. 13614982-11971-1 & Du Preez 2006). These range from small rodents to medium-sized ungulates, the majority of which are fairly-common to common, with widespread distributions and are highly likely to occur in the natural habitats of the study area.

Based on historic distributions, a further 47 species are known to occur in the region. These are listed in APPENDIX C.

Table 6: Additional mammals previously recorded in the Kendal/Kusile Power Station areas

Scientific name	Common name
Crocidura hirta	Lesser Red Musk Shrew
Cynictis penicillata	Yellow Mongoose
Damaliscus dorcas phillipsi	Blesbok
Dendromys mystacalis	Chestnut Climbing Mouse
Crocidura cyanea	Reddish-grey Musk Shrew
Orycteropus afer	Aardvark
Otomys angoniensis	Angoni Vlei Rat

Figure 15: Large Spotted Genet (Genetta tigrina)

Figure 16: Porcupine (Hystrix africaeaustralis)

Figure 17: Serval (Leptailurus serval) – Red Data species

Figure 18: Water Mongoose (Atilax paludonosus)

Red Data and protected mammals

Three mammals species recorded in the study area are of conservation importance; Serval (*Leptailurus serval*), Steenbok (*Raphicerus campestris*) and Cape Clawless Otter (*Aonyx capensis*). The conservation status and biology of these are briefly discussed below:

- The Steenbok is a relatively common, widespread small antelope (IUCN 2013.3) and is accordingly not considered threatened or rare. Be that as it may, it is listed as protected according to the Mpumalanga Nature Conservation Act (Act No. 10 of 1998) and for this reason has been included as a mammal of conservation importance;
- Serval are listed as protected on the NEMBA TOPS list (2013) and near threatened according to the IUCN (2013.1). They are solitary and mainly nocturnal, preferring grassland and wetland habitats where they prey upon small mammals, birds, reptile and insects (Stuart & Stuart 2007). Like many threatened fauna, habitat loss and persecution are the main threats to this species; and
- The Cape Clawless Otter is protected in terms of Schedule 2 of the Mpumalanga Nature Conservation Act (Act No. 10 of 1998) and the NEMBA TOPS list (2013). Cape Clawless Otters are found near permanent water where they feed on a mixture of fish, amphibians and crustaceans (Estes, 1991). Threats to otter include habitat loss and habitat degradation mainly in the form of pollution, increased siltation and agricultural run-off. Additionally, otters are hunted for their pelt and for medicinal purposes (IUCN Otter Specialist Group, 2012, internet). Otters frequent the stream channels and artificial dams in the study area and environs.

An additional sixteen Red Data and/or protected mammal species potentially occur in the study area. These, along with a probability of occurrence, are listed in Table 7.

Table 7: Red Data and protected mammals potentially occurring in the study area

Scientific name	Common name	Status			Probability of occurrence
		IUCN (2013.1)	NEMBA TOPS List (2013)	Mpumalanga Protected Species (1998)	
Chrysospalax villosus	Rough-haired Golden Mole	Critically Endangered	-	-	Moderate

Scientific name	Common name	Status			Probability of occurrence
		IUCN (2013.1)	NEMBA TOPS List (2013)	Mpumalanga Protected Species (1998)	
Amblysomus robustus	Robust Golden Mole	Vulnerable	Endangered	-	Moderate
Amblysomus septentrionalis	Highveld Golden Mole	Near Threatened	-	-	High
Miniopterus schreibersii	SchreibersôLong-fingered Bat	Near Threatened	-	-	Low
Dasymys incomtus	Water Rat	Near Threatened	-	-	High
Vulpes chama	Cape Fox	-	Protected	-	Low
Aonyx capensis	Cape-clawless Otter	-	Protected	Protected	Recorded
Leptailurus serval	Serval	Near Threatened	Protected		Recorded
Proteles cristatus	Aardwolf	-	-	Protected	High
Panthera pardus	Leopard	Near Threatened	Protected	Protected	Recorded
Hyaena burnea	Brown Hyaena	Near Threatened	Protected	-	Low
Mellivora capensis	Honey Badger	Near Threatened	-	Protected	Moderate
Ourebia ourebi	Oribi	-	Endangered	Protected	High
Raphicerus campestris	Steenbok	-	-	Protected	Recorded
Pelea capreolus	Grey Rhebok	-	-	Protected	High
Lutra maculicollis	Spotted-necked Otter	Near Threatened	-	Protected	High
Felis nigripes	Black-footed Cat	-	Protected	Protected	High
Atelerix frontalis	South African Hedgehog	Near Threatened	-	Protected	High
Orycteropus afer	Aardvark	-	Protected	Protected	High
Redunca fulvorufula	Mountain Reedbuck	-	-	Protected	High

4.4.2 Birds

Seventy one bird species were recorded in and adjacent to the study area (Table 8). Most species were observed in the wetland and grassland habitats surrounding the proposed ADF sites. Recorded species are generally widespread in their range and are common in the grassland and wetland habitats of Mpumalanga. Refer to APPENDIX D for a list of birds species potentially occurring in the study area.

Table 8: Birds recorded in the study area during the 2013 dry season survey (listed alphabetically by scientific name)

Scientific name	Common Name
Alcdeo cristata	Malachite Kingfisher
Alopochen aegyptiacus	Egyptian Goose
Anas erythrorhyncha	Redbilled Teal

Scientific name	Common Name
Anas sparsa	African Black Duck
Anas undulata	Yellow-billed Duck
Anhinga rufa	Darter
Ardea melanocephala	Black-headed Heron
Ardea purpurea	Purple Heron
Asio capensis	Marsh Owl
Bostrychia hagedash	Hadeda Ibis
Bradypterus baboecala	African Sedge Warbler
Bubulcus ibis	Cattle Egret
Burhinus capensis	Spotted Thick Knee
Buteo vulpinus	Steppe Buzzard
Calandrella cinerea	Red-capped Lark
Centropus burchellii	Burchellôs Coucal
Charadrius tricollaris	Three-banded Plover
Chlidonias hybridus	Whiskered Tern
Chrysococcyx caprius	Dideric Cuckoo
Columba guinea	Rock Pigeon
Corvus albus	Pied Crow
Cossypha caffra	Cape Robin
Dendrocygna viduata	White-faced Duck
Egretta garzetta	Little Egret
Elanus caeruleus	Black-shouldered Kite
Euplectes afer	Golden Bishop
Euplectes orix	Red Bishop
Euplectus progne	Long-tailed Widow
Francolinus swainsonii	Swainsonôs Francolin
Fulica cristata	Red-knobbed Coot
Gallinago nigripennis	African Snipe
Haliaeetus vocifer	African Fish Eagle
Himantopus himantopus	Black-winged Stilt
Hirundo albigularis	White-throated Swallow
Hirundo cucullata	Greater-striped Swallow
Hirundo rustica	European Swallow
Lamprotornis nitens	Glossy Starling
Larus cirrocephalus	Grey-headed Gull
Macronyx capensis	Orange-throated Longclaw
Milvus aegyptius	Yellow-billed Kite
Mirafra sabota	Sabota Lark
Motacilla capensis	Cape Wagtail
Myrmecocich formicivora	Anteating Chat
Numida meleagris	Helmeted Guineafowl
Oena capensis	Namaqua Dove

Scientific name	Common Name
Oenanthe pileata	Capped Wheatear
Passer melanurus	Cape Sparrow
Phalacrocarax capensis	Reed Comorant
Philomachus pugnax	Ruff
Phoenicopterus sp.	Flamingo sp.
Plectropterus gambensis	Spurwinged Goose
Plegadis falcinellus	Glossy Ibis
Ploceus velatus	Masked Weaver
Quelea quelea	Red-billed Quelea
Sagittarius serpentarius	Secretarybird
Saxicola torquata	African Stone Chat
Lanius collaris	Common Fiscal
Scopus umbretta	Hammerkop
Spreo bicolor	African Pied Starling
Streptopelia capicola	Cape Turtle Dove
Streptopelia semitorquata	Red-eyed Dove
Streptopelia senegalensis	Laughing Dove
Tachybaptus ruficollis	Little Crebe
Tadorna cana	South African Shelduck
Threskiornis aethiopicus	Sacred Ibis
Vanellus armatus	Blacksmith Lapwing
Vanellus coronatus	Crowned Lapwing
Vanellus senegallus	African Wattled Lapwing
Vidua macroura	Pin-tailed Whydah

Red Data and protected birds

Bird species of conservation importance include Secretarybirds (*Sagittarius serpentarius*), Sacred Ibis (*Threskiornis aethiopicus*) and Greater Flamingo (*Phoenicopterus ruber*):

- Two species of Flamingo occur in southern Africa; the Greater Flamingo and Lesser Flamingo (*Phoenicopterus minor*). Both species are listed as Near Threatened by the IUCN (2013.1) and are protected according to the NEMBA TOPS list (2013) and Schedule 2 of the Mpumalanga Nature Conservation Act (Act No. 10 of 1998). Flamingos inhabit shallow water bodies, such as pans and lakes, where they feed on *inter alia*, small fish, aquatic insects and crustaceans. Greater Flamingo have been recorded at the pan in the south-east corner of Site H (Co-ordinates: 26º 4.412 S, 28º 56.876 E) (pers comm. D. McCulloch[2] 2012/2013);
- Secretarybirds inhabit open grassland to lightly wooded savanna and are often found in agricultural areas. They are large raptors that prey on a variety of small mammals and reptiles. They are listed as Vulnerable by the IUCN (2013.1) and protected according to Schedule 2 of the Mpumalanga Nature Conservation Act (Act No. 10 of 1998). A pair of Secretarybirds was observed hunting in a grassland area adjacent to Site C (Co-ordinates: 26º 4.477 S, 28º 52.966 E); and

[2] Formerly of Wetland Consulting Services

- Notwithstanding the fact that Sacred Ibis are general common and widespread, they are listed as protected according to the NEMBA TOPS list (2013). This species favours grassland and wetland habitats and was recorded at the pans adjacent to Site C.

According to Emery, Lotter and Williamson (2002) many of Mpumalangaôs most threatened bird species are dependent on wetlands and short, dense grasslands, as well as tall grasslands in the province. These habitats that are found to a limited extend in the proposed development footprints, but occur extensively in adjacent untransformed areas. Indeed, large pockets of the Moist grass and sedge community located between Sites C and D are dominated by *Imperata cylindrica* – a grass is the favoured nesting habitat for the vulnerable African Grass Owl (*Tyto capensis*) (Pers. comm. M. Pretorius EWT). Refer to Figure 14 for map indicating potentially important grass owl habitat based on presence of large *Imperata cylindrica* stands.

An additional 15 Red Data/protected species may occur in the study area. These, along with a probability of occurrence, are listed in Table 9.

Table 9: Red Data and protected bird species potentially occurring in the study area

Scientific name	Common name	Status			Probability of occurrence
		IUCN (2013.1)	NEMBA TOPS List (2013)	Mpumalanga Protected Species (1998)	
Alcedo semitorquata	Half-collared kingfisher	Near threatened	-	Protected	Moderate
Anthropoides paradiseus	Blue crane	Vulnerable	Vulnerable	Protected	Moderate
Charadrius pallidus	Chestnut-banded plover	Near threatened	-	Protected	Moderate
Circus ranivorus	African marsh harrier	Vulnerable	-	Protected	High
Crex crex	Corn Crake	Vulnerable	-	Vulnerable	High
Eupodotis caerulescens	Blue korhaan	Near threatened	-	Protected	Moderate
Eupodotis senegalensis	White-belled korhaan	Vulnerable	-	Protected	Low
Falco biarmicus	Lanner falcon	Near threatened	-	Protected	High
Falco naumanni	Lesser Kestrel	Vulnerable	-	Protected	High
Falco peregrinus	Peregrine Falcon	Near threatened	-	Protected	Moderate
Geronticus calvus	Southern Bald Ibis	Vulnerable	Vulnerable	Protected	High
Glareola nordmanni	Black-winged Pratincole	Near threatened	-	Protected	High
Mirafra cheniana	Melodious Lark	Near threatened	-	Protected	Moderate
Phoenicopterus minor	Lesser Flamingo	Near threatened	Protected	Protected	Recorded
Phoenicopterus ruber	Greater Flamingo	Near threatened	Protected	Protected	Recorded
Sagittarius serpentarius	Secretarybird	Vulnerable	-	Protected	Recorded

Scientific name	Common name	Status			Probability of occurrence
		IUCN (2013.1)	NEMBA TOPS List (2013)	Mpumalanga Protected Species (1998)	
Threskiornis aethiopicus	Sacred Ibis	-	Protected	-	Recorded
Tyto capensis	African Grass Owl	Vulnerable	-	Protected	High

4.4.3 Herpetofauna

Amphibians recorded in the study area are the Common Platanna (*Xenopus laevis*), Common River Frog (*Afrana angolensis*), Striped Stream Frog (*Strongylopus fasciatus*) and Red Toad (*Schismaderma carens*). These are all common species with widespread distributions.

In terms of reptiles, only the Variable Skink (*Mabuya varia*) was observed in the study area, yet 12 additional species of herpetofauna, as listed in Table 10, have previously been recorded (refer to Golder 2007 Report no. 10613-5792-1 & Du Preez 2006). These include eight reptile and four amphibian species. All recorded species are common and not restricted in terms range or habitat. Refer to APPENDIX E for a list of all herpetofauna potentially occurring in the study area.

Table 10: Herpetofauna previously recorded in and adjacent to the study area

Biological Name	Common Name
Reptiles	
Bitis arietans	Puff Adder
Dasypeltis scabra	Rhombic Egg Eater
Hemachatus heamachatus	Rinkhals
Lamprophis fuliginosus	Brown House Snake
Pelomedusa subrufa	Marsh Terrapin
Philothamnus hoplogaster	Green Water Snake
Psammophylax tritaenlatus	Striped Skaapsteker
Varanus niloticus	Water Monitor
Amphibians	
Afrana fuscigula	Cape River Frog
Bufo gutturalis	Guttural Toad
Kassina senegalensis	Bubbling Kassina
Tomopterna cryptotis	Tremolo Sand Frog
Source: Golder (2007)	

Red Data and protected herpetofauna

According to Schedule 2 of the Mpumalanga Nature Conservation Act (Act No. 10 of 1998), all species of reptile excluding both Monitor species (*Varanus exanthematicus* and *Varanus niloticus*) and all snakes, are listed as Protected. This notwithstanding, the Spotted Harlequin Snake (*Homoroselaps lacteus*) which may potentially occur in the study area, has been categorized by the MPTA as Near-threatened, while two other species that may also be present, the Breyerôs Long-tailed Seps (*Tetradactylus breyeri*) and the Striped Harlequin Snake *(Homoroselaps dorsalis*), are listed as Vulnerable and Near Threatened, respectively (IUCN 2013.1). The probability that these species occur in the study area is considered moderate.

The Giant Bullfrog (*Pyxicephalus adspersus*) is the only listed amphibian potentially occurring in the study area. This species is listed as Near Threated (IUCN- regional status) nationally and protected at a provincial

level (Mpumalanga Nature Conservation Act (1998). The probability that Giant Bullfrogs occur in the wetlands and pans surrounding the proposed ADF footprints is considered high.

4.4.4 Arthropoda

Ninety five arthropod taxa have been recorded in, and/or adjacent to the study area. These are mostly common and widespread species. Refer to APPENDIX F for a list of recorded arthopods.

Red Data and protected arthropods

The Marsh Sylph (*Metisella meninx*) butterfly was recorded at several wetland locations in the study area during the wet season survey.

This species was listed as Vulnerable (*sensu* Henning *et al.* 2009), but has subsequently been down-rated. Despite this, considering its preference for wetland and marsh habitats on the Highveld, Marsh Sylphs are still considered sensitive species.

Other arthropods of conservation importance that potentially occur in the study area include members of the *CTENIZIDAE* (trapdoor spiders) and *THERAPHOSIDAE* families (Baboon spiders). These spiders usually live in burrows or silk-lined retreats, none of which were observed in the study area. Be that as it may, the on-site habitat is suitable and the probability that they are present is considered moderate.

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

5.0 FINDINGS AND RECOMMENDATIONS

General ecological context

The majority of each of the proposed ADF sites have been transformed or highly degraded by mining and agricultural activities. Moreover, dense and often monospecific stands of exotic invasive woody species, such as *Acacia mearnsii* and *Populus x canescens,* occur on each site alternative.

Areas of natural and semi-natural habitat typically occur as small, isolated patches in amongst agricultural fields, or along stream channels and rocky hillsides. In these areas, rocky or moist soils have precluded or hampered cultivation. Untransformed areas have been categorised as either Dry mixed grassland or the moist sedge and grass community. Current levels of anthropogenic disturbances in both vegetation communities range considerably and are typically caused by encroaching mining and agricultural activities. Despite this, large connected areas of Dry mixed grassland and the Moist sedge and grass community, such as those along the Leeufontein stream between Sites B and C, are present and provide important natural habitat, supporting fauna populations typical of the Mpumalanga Highveld grasslands.

Several fauna species of conservation importance were recorded in the study area and a number of additional such species have a high probability of occurrence. Recorded Red Data and protected fauna species include Secretarybird (*Sagittarius serpentarius*), Serval (*Leptailurus serval*) Cape Clawless Otter (*Aonyx capensis*) and Marsh Sylph (*Metisella meninx*). Red Data and protected plants include *Boophane disticha, Callilepis leptophylla, Crinum bulbispermum, Disa woodii, Eucomis autumnalis, Gladiolus* spp. and *Kniphofia* sp.

It is important that as far as possible the integrity of natural habitat within the study area is maintained. This can be achieved by: 1) minimising the loss and degradation of naturally-vegetated areas; and by 2) maintaining the connectivity of habitat patches, particularly those along stream channels.

This rationale guided the selection of a preferred ADF site from a terrestrial ecosystems perspective.

Comparative site evaluation

Of the four site alternatives, Site F is the most transformed and degraded. Coal mining has caused irreparable modification of much of the site, and even areas not directly mined or impacted by mining

activities are significantly degraded. Site F is also largely isolated from adjacent natural areas as it is surrounded by other mining operations, agricultural fields, roads, railway tracks and residential areas.

The proposed conveyor corridor between Kendal Power Station and Site F is comparatively short (approx. 3 km) and traverses across mostly degraded or transformed land. Overall, Site F is thus almost ecologically sterile and accordingly, is regarded as the preferred site alternative.

Sites B and C have similar ecological characteristics. Both are dominated by cultivated land and mining. Within its footprint, Site B does contain more natural/semi-natural habitat. A small patch of Dry mixed grassland located in the south-west corner of Site B is designated as CBA ï Optimal by the Mpumalanga Biodiversity Sector Plan (MBSP) (2013). This small site warrants protection and it is recommended that all future planning exclude it.

The habitat corridor along the Leeufontein between Site B and C is ecologically important. The intrusion of both proposed ADF footprints into the corridor is minimal. However, the proposed conveyor route to Site C will cross the corridor at two points (Leeufontein and a small tributary). This will cause additional habitat fragmentation, which may disrupt fauna movement and dispersal. The conveyor corridor to Site C is also the longest (approx. 5.3 km) and traverses across land designated by the MBSP as CBA ï Optimal. For these reasons, Site C is not considered a preferred option.

The central and northern portion of Site H consists of cultivated land, and isolated patches of the moist grass and sedge vegetation community. The south-eastern portion of the site is characterised by disturbed and undisturbed Dry mixed grassland and moist grass and sedge vegetation community. Sections are designated CBA ï Optimal by the MBSP. Greater Flamingo have previously been recorded at a pan located at the centre of Site H (pers comm. D. McCulloch[3] 2012/2013). Site H thus contains an ecological feature of conservation importance and is also not considered a preferred option.

The site ranking from a terrestrial ecology perspective is summarised in Table 11.

Table 11: Site alternatives ranking

Rank	Site alternative
1 ï Preferred option	Site F
2	Site B
3 ï Least preferred options	Site C & H

PART B: PREFERRED SITE (SITE H) IMPACT ASSESSMENT

6.0 PART B OBJECTIVES

- Conduct an impact assessment for the preferred site alternative; and
- Recommend appropriate mitigation measures.

7.0 IMPACT ASSESSMENT

Severe contraints on Sites B, C and F mainly relating to current and future mining activities have rendered these sites unfeasible. Site H is the only feasible site alternative and has been taken forward into the impact assessment phase.

Section 7.2 provides a focussed assessment of the potential impacts on terrestrial ecology that may result from the proposed development of the ADF at **Site H**.

[3] Formerly of Wetland Consulting Services

7.1 Impact Assessment Methodology

The impacts have been ranked according to the methodology described below. Where possible, mitigation measures are recommended to manage impacts. The impact assessment methodology makes provision for the assessment of impacts against the following criteria:

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

A combined quantitative and qualitative methodology was used to describe impacts for each of the aforementioned assessment criteria. A summary of each of the qualitative descriptors along with the equivalent quantitative rating scale for each of the aforementioned criteria is given in Table 12.

Table 12: Quantitative rating and equivalent descriptors for the impact assessment criteria

Rating	Significance	Extent Scale	Temporal Scale
1	VERY LOW	*Proposed site*	Incidental
2	LOW	*Study area*	Short-term
3	MODERATE	*Local*	Medium-term
4	HIGH	*Regional/Provincial*	Long-term
5	VERY HIGH	*Global/National*	Permanent

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

7.1.1 Significance Assessment

Significance rating (importance) of the associated impacts involves extent and magnitude, but does not always clearly define these, since their importance in the rating scale is very relative. For example, the magnitude (i.e. the size) of area affected by atmospheric pollution may be extremely large (1 000 km^2) but the significance of this effect is dependent on the concentration or level of pollution. If the concentration is great, the significance of the impact would be HIGH or VERY HIGH, but if it is diluted it would be VERY LOW or LOW. Similarly, if 60 ha of a grassland type are destroyed the impact would be VERY HIGH if only 100 ha of that grassland type were known. The impact would be VERY LOW if the grassland type was common. A more detailed description of the impact significance rating cale is given in Table 13.

Table 13: Description of the significance rating scale

Rating		Description
5	Very high	Of the highest order possible within the bounds of impacts which could occur. In the case of adverse impacts, there is no possible mitigation or remedial action that could offset the impact. In the case of beneficial impacts, there is no real alternative to achieving this benefit.
4	High	Impact is of substantial order within the bounds of impacts that could occur. In the case of adverse impacts, mitigation and/or remedial action is feasible but difficult, expensive and time-consuming, or some combination of these. In the case of beneficial impacts, other means of achieving this benefit are feasible but they are more difficult, expensive and time-consuming, or some combination of these.

Rating		Description
3	Moderate	Impact is real but not substantial in relation to other impacts, which might take effect within the bounds of those that could occur. In the case of adverse impacts, mitigation and/or remedial action are both feasible and fairly easy to implement. In the case of beneficial impacts, other means of achieving this benefit are about equal in time, cost, effort, etc.
2	Low	Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts, mitigation and/or remedial action is either easily achieved or little will be required, or both. In the case of beneficial impacts, alternative means of achieving this benefit are likely to be easier, cheaper, more effective and less time consuming, or some combination of these.
1	Very low	Impact is negligible within the bounds of impacts that could occur. In the case of adverse impacts, almost no mitigation and/or remedial actions are needed, and any minor steps which might be needed are easy, cheap, and simple. In the case of beneficial impacts, alternative means are almost all likely to be better, in one or a number of ways, than this means of achieving the benefit. Three additional categories must also be used where relevant. They are in addition to the category represented on the scale, and if used, will replace the scale.
0	No impact	There is no impact at all - not even a very low impact on a party or system.

7.1.2 Spatial Scale

The spatial scale refers to the extent of the impact i.e. will the impact be felt at the local, regional, or national/global scale. The spatial assessment scale is described in more detail in Table 14**.**

Table 14: Description of the significance rating scale

Rating		Description
5	Global/National	The maximum extent of any impact.
4	Regional/Provincial	The spatial scale is moderate within the bounds of possible impacts, and will be felt at a regional scale (District Municipality to Provincial Level).
3	Local	The impact will affect an area up to 10 km from the proposed site.
2	Study Site	The impact will affect an area not exceeding the Eskom property.
1	Proposed site	The impact will affect an area no bigger than the ADF site.

7.1.3 Duration Scale

In order to describe the impact accurately, it is necessary to understand the duration and persistence of an impact in the environment. The temporal scale is rated according to criteria set out in Table 15.

Table 15: Description of the temporal rating scale

Rating		Description
1	Incidental	The impact will be limited to isolated incidences that are expected to occur very sporadically.

Rating		Description
2	Short-term	The environmental impact identified will persist for the duration of the construction phase or a period of less than 5 years, whichever is the greater.
3	Medium term	The environmental impact identified will persist for the duration of the life of the facility.
4	Long term	The environmental impact identified will persist beyond the life of operation.
5	Permanent	The environmental impact will be permanent.

7.1.4 Degree of Probability

Probability or likelihood of an impact occurring will be described as shown in Table 16.

Table 16: Description of the degree of probability of an impact occurring

Rating	Description
1	Practically impossible.
2	Unlikely.
3	Could happen.
4	Very likely.
5	It's going to happen/has occurred.

7.1.5 Degree of Certainty

As with all studies it is not possible to be 100% certain of all facts, and for this reason a standard "degree of certainty" scale is used as discussed in Table 17. The level of detail for specialist studies is determined according to the degree of certainty required for decision-making. The impacts are discussed in terms of affected parties or environmental components.

Table 17: Description of the degree of certainty rating scale

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

7.1.6 Quantitative Description of Impacts

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

- ***Impact Risk*** = (SIGNIFICANCE **+** *Spatial* **+** Temporal) X Probability

3 **5**

The impact risk is classified according to five classes as described in the Table 18.

Table 18: Impact Risk Classes

Rating	Impact Class	Description
0.1 ï 1.0	1	Very low.
1.1 ï 2.0	2	Low.
2.1 ï 3.0	3	Moderate.
3.1 ï 4.0	4	High.
4.1 ï 5.0	5	Very high.

7.1.7 Cumulative Impacts

It is a requirement that the impact assessments take cognisance of cumulative impacts. In fulfilment of this requirement, the impact assessment will take cognisance of any existing impact caused by the operations, any mitigation measures already in place, any additional impact on the environment through continued and proposed future activities, and the residual impact after mitigation measures.

It is important to note that cumulative impacts at the national or provincial level will not be considered in this assessment, as the total quantification of external companies on resources is not possible at the project level due to a lack of information and research documenting the effects of existing activities. Such cumulative impacts that may occur across industry boundaries can also only be effectively addressed at Provincial and National Government levels.

7.1.8 Development of Mitigation Measures

A common approach to developing mitigation measures for critical impacts is to specify a range of targets with a predetermined acceptable range and an associated monitoring and evaluation plan. To ensure successful implementation, mitigation measures should be unambiguous statements of actions and requirements that are practical to execute. The following summarises the different approaches that may be used in prescribing and designing mitigation measures:

- Avoidance: Mitigation by not carrying out the proposed action on the specific site, but rather on a more suitable site;
- Minimization: Mitigation by scaling down the magnitude of a development, reorienting the layout of the project or employing technology to limit the undesirable environmental impact;
- Rectification: Mitigation through the restoration of environments affected by the action;
- Reduction: Mitigation by taking maintenance steps during the course of the action; and
- Compensation: Mitigation through the creation, enhancement or acquisition of similar environments to those affected by the action.

7.2 Identification and Characterisation of Impacts

Several potential negative impacts on the ecology have been identified for the proposed project. It must be appreciated that there is interplay between impacts:

- Habitat loss and degradation;
- Establishment and spread of alien invasive species;
- Mortality and disturbance of general fauna;
- Loss and disturbance of fauna of conservation importance; and
- Loss and disturbance of flora of conservation importance.

7.2.1 Habitat Loss and Degradation

Habitat loss refers to the removal of natural habitat. In terrestrial ecosystems this occurs primarily through the clearing of indigenous vegetation and earthworks. The immediate result is the destruction of individual plants and some fauna species within the development footprint and the fragmentation of remaining habitat patches. This can also lead to a contingent breakdown or impairment of ecosystem integrity and functioning at broader ecological scales, if remaining habitat is insufficient in size and heterogeneity to sustain ecological processes.

Habitat loss can also refer to habitat degradation. In this instance, although habitat is present, it has been disturbed to the extent that compositionally and structurally it is markedly dissimilar to reference habitat conditions. In extreme cases of habitat disturbance, the mix of functional species-types is altered and ecosystem functioning is impaired as a result (*sensu* Scholes, 2009).

Impact in relation to proposed project

Most of the proposed development footprint comprises cultivated fields. Small areas of natural habitat are present within the footprint and these will be completely cleared of vegetation during the construction phase. The proposed conveyor traverses across areas of Dry mixed grassland vegetation, while the ADF covers small pockets of the Moist grass and sedge community that are associated with pans and wetlands ï a portion of this habitat in the north-east corner of the proposed ADF footprint is classified as CBA ï Optimal by the MBSP (2013).

Of particular concern is the large pan located in the south-eastern corner of the proposed ADF footprint. At the time of the field vists this pan was frequented by waterfowl such as Red-knobbed Coot (*Fulica cristata*) and anecdotal evidence suggests that Greater flamingo (*Phoenicopterus ruber*) have been recorded there ï see impact discussed in section 7.2.4: Disturbance of fauna of conservation importance for more information.

7.2.2 Establishment and spread of alien invasive species

Disturbances caused by vegetation clearing and earthworks can create conditions conducive to the establishment and rapid colonisation of alien invasive vegetation. If left uncontrolled, infestations of alien species can spread exponentially, suppressing or replacing indigenous vegetation. This may lead to a breakdown in ecosystem functioning and a loss of biodiversity.

Impact in relation to proposed project

Several listed alien invasive plant species were recorded in the study area during the field programme (site visits). Construction related activities will disturb natural vegetation, which will facilitate the further establishment and spread of alien invasive plants. This potential impact will be present throughout the life of the project and will be of concern if not managed appropriately.

7.2.3 Mortality and disturbance of general fauna

The study area has a notable fauna community. Apart from the large impacts associated with habitat loss, fauna may also be directly harmed or disturbed during all project phases:

- Small and less mobile species may be trapped, injured and killed during vegetation clearing and earthworks. These may include fossorial[4] mammals (e.g. moles, rodents), nesting birds, reptiles and amphibians.

Other common causes of fauna injury, death or disturbance during the operational phase include:

- Vehicle-wildlife collisions along haul and access roads;
- Fauna becoming trapped/caught in infrastructure (e.g. fences and excavations); and

[4] Organism adapted to digging and life underground.

- Lights can disrupt nocturnal species, such as bats, which can cause changes in community characteristics.

7.2.4 Disturbance of fauna of conservation importance

During all phases of the proposed project, but particularly during the construction phase, fauna of conservation importance may be disturbed, either through the loss of viable habitat or through direct impacts as discussed in section 7.2.3. This impact is of particular concern *viz* Greater Flamingo that have been recorded at the pan in the south-eastern corner of the proposed ADF footprint (pers comm. D. McCulloch[5] 2012/2013). (2012/2013) (Co-ordinates: 26º 4.412 S, 28º 56.876 E). Both Flamingo species are listed as Near Threatened (IUCN regional status - 2013.1) and protected (NEMBA TOPS list 2013).

7.2.5 Loss and disturbance of flora of conservation importance

During vegetation clearing and earthworks, flora species of conservation importance may be destroyed or damaged. Several species of conservation importance have been recorded in the study area, with a number favouring moist habitats (e.g. *Crinum bulbispermum, Gladiolus* spp*., Eucomis autumnalis and Kniphofia* sp.). These may be destroyed or damaged during the clearing of vegetation around the pans and wetlands in the ADF footprint.

7.3 Impact Rating

Based on the ecological characteristics of Site H and the surrounding landscape, the significance of each identified negative ecological impact was assessed for the pre-construction and construction phases (Table 19), operational phase (Table 20) and pre-closure and closure phases (Table 21).

These tables also include recommended mitigation measures for inclusion into the proposed projects environmental management programme.

[5] Formerly of Wetland Consulting Services

Table 19: Pre-Construction and Construction Phase Impact Rating

Activity	Description of Impact	Impact type	Spatial Scale	Duration	Significance	Probability	Rating	Mitigation Measures	Intepretation
Clearing of vegetation and earth works	Habitat loss and degradation	Existing	3	4	3	5	3.3 - HIGH	■ Vegetation clearing should be restricted to the proposed development footprint only, with no clearing permitted outside of these areas; ■ Areas to be cleared should be clearly demarcated to prevent unnecessary clearing outside of these sites; ■ Removed topsoil should be stockpiled and used to rehabilitate disturbed areas; and ■ A suitable rehabilitation programme should be developed and implemented in all disturbed areas not under infrastructure. The programme should include active revegetation using locally indigenous flora species.	Most of the proposed development footprint comprises cultivated fields. Small areas of natural habitat are present and these will be completely cleared of vegetation during the construction phase. The proposed conveyor traverses across areas of Dry mixed grassland vegetation, while the ADF covers small pockets of the Moist grass and sedge community that are associated with pans and wetlands ï a portion of this habitat in the north-east corner of the proposed ADF footprint is classified as CBA ï Optimal by the MBSP (2013). Habitat loss is difficult to prevent due to the scope of the proposed project. However measures such as limiting unnecessary vegetation clearing and implementing appropriate rehabilitation can lead to some mitigatation.
		Cumulative	3	5	4	5	4 - HIGH		
		Residual	3	5	4	5	4 - HIGH		

Activity	Description of Impact	Impact type	Spatial Scale	Duration	Significance	Probability	Rating	Mitigation Measures	Intepretation
Clearing of vegetation and earth works	Establishment and spread of alien invasive species	Existing	2	4	4	5	3.3 - HIGH	An alien invasive species control programme must be developed and implemented. It is recommended that the programme include: ■ A combined approach using both chemical and mechanical control methods; ■ Periodic follow-up treatments informed by regular monitoring; and ■ Monitoring in disturbed areas, as well as adjacent undisturbed areas.	Several listed alien invasive plant species were recorded in the study area during the field programme. Construction related activities will disturb natural vegetation, which will facilitate the further establishment and spread of alien invasive plants. This potential impact will be present throughout the life of the project and will be of concern if not managed appropriately. This impact can be successfuly mitigated through the implementation of an alien invasive species control programme. The programme needs to run for the life of the project to be effective.
		Cumulative	2	4	4	5	3.3 - HIGH		
		Residual	1	3	3	5	2.3 - MOD		
Clearing of vegetation and earth works & increased vehicle and machinary activity on-site	Mortality and disturbance of general fauna	Existing	-	-	-	-	-	■ An ECO should be on-site during vegetation clearing to monitor for and manage any wildlife-human interactions; ■ Construction sites should be fenced off to prevent fauna gaining access to construction and operational areas;	The study area has a notable fauna community. Apart from the large impacts associated with habitat loss, fauna may also be directly harmed or disturbed during all project phases: ■ Injured or killed by heavy machinery during vegetation clearing and earthworks;
		Cumulative	2	3	3	4	2.1 - MOD		

Activity	Description of Impact	Impact type	Spatial Scale	Duration	Significance	Probability	Rating	Mitigation Measures	Intepretation
		Residual	2	3	3	3	1.6 - LOW	■ A low speed limit should be enforced on site to reduce wildlife collisions; ■ The destruction, harvesting, handling, poisoning and killing of on-site fauna and flora must be strictly prohibited; ■ Employees and contractors should be made aware of the presence of, and rules regarding fauna through suitable induction training and on-site signage; ■ General noise abatement equipment should be fitted to machinery and vehicles; ■ Noisy activities should be limited/restricted during the summer months, as this is when most birds are breeding; and ■ Noise shields, including earth berms, should be erected around sites of noise origin.	■ Vehicle-wildlife collisions along haul and access roads; and ■ Fauna becoming trapped/caught in infrastructure (e.g. fences and excavations). Careful and sensitive on-site management coupled with awareness amongst contractors and employees can reduce the likelihood of fauna being negatively impacted during construction.

Activity	Description of Impact	Impact type	Spatial Scale	Duration	Significance	Probability	Rating	Mitigation Measures	Intepretation
Clearing of vegetation and earth works	Loss and disturbance of habitat for fauna of conservation importance (e.g. Greater Flamingo)	Existing	-	-	-	-	-	■ *No management measures will mitigate the loss of the pan.*	During all phases of the proposed project, but particularly during the construction phase, fauna of conservation importance may be disturbed, either through the loss of viable habitat or through direct impacts This impact is of particular concern *viz* the Flamingo recorded at the pan in the south-eastern corner of the proposed ADF. The pan will be lost during construction and will therefore not provide foraging habitat for Greater Flamingo.
		Cumulative	4	5	4	5	4.3 - VERY HIGH		
		Residual	4	5	4	5	4.3 - VERY HIGH		
Clearing of vegetation and earth works	Loss and disturbance of flora of conservation importance	Existing	-	-	-	-	-	■ Prior to construction, all areas designated for vegetation clearing should be clearly marked and surveyed by a trained botanist for flora species of conservation importance; ■ Rescue/destruction permits must be obtained from the provincial or relevant authority before vegetation clearing commences; and	During vegetation clearing and earthworks, flora species of conservation importance may be destroyed or damaged. This impact can be mitigated through the implementation of an effective flora species of conservation importance search and rescue programme.
		Cumulative	1	1	4	3	1.2 - LOW		
		Residual	1	1	1	2	0.4 - VERY LOW		

Activity	Description of Impact	Impact type	Spatial Scale	Duration	Significance	Probability	Rating	Mitigation Measures	Intepretation
								■ Under the correct permit, herbaceous plants of conservation concern should be rescued and relocated to adjacent undisturbed areas. The ECO or suitable ecologist must oversee the rescue and relocation operation.	

Table 20: Operational Phase Impact Rating

Activity	Description of Impact	Impact type	Spatial Scale	Duration	Significance	Probability	Rating	Mitigation Measures	Intepretation
Clearing of vegetation and earth works	Establishment and spread of alien invasive species	Existing	-	-	-	-	-	■ Continue to implement alien invasive species control, including regular follow-up and monitoring across the entire project site.	Vegetation disturbances caused during the construction phase will facilitate the spread of listed alien invasive plant species, of which several were recorded in the study area. Alien species will continue to colonise disturbed and adjacent areas during the operational phase.
		Cumulative	2	4	4	5	3.3 - HIGH		
		Residual	1	3	3	5	2.3 - MOD		

Activity	Description of Impact	Impact type	Spatial Scale	Duration	Significance	Probability	Rating	Mitigation Measures	Intepretation
									This impact can be successfuly mitigated through the continued implementation of an alien invasive species control programme.
Vehicle and machinery activity on-site. Trapping of fauna in infrastructure.	Mortality and disturbance of general fauna	Existing	-	-	-	-	-	■ Operational areas should be fenced off to prevent fauna gaining access; ■ A low speed limit should be enforced on site to reduce wildlife-collisions; ■ The destruction, harvesting, handling, poisoning and killing of on-site fauna and flora must be strictly prohibited; ■ Employees and contractors should be made aware of the presence of, and rules regarding fauna through suitable induction training and on-site signage; and ■ General noise abatement equipment should be fitted to machinery and vehicles.	Vehicle and heavy machinery will continue to be used on-site during the operational phase. This, coupled with potential incidences such as fauna becoming trapped/caught in infrastructure, and being disturbed by artificial lighting and increased noise can negatively affect fauna populations. Careful and sensitive on-site management coupled with awareness amongst contractors and employees can reduce the likelihood of fauna being negatively impacted during the operational phase.
		Cumulative	2	3	3	4	2.1 - MOD		
		Residual	2	3	3	3	1.6 - LOW		

Table 21: Closure and Post-Closure Phase Impact Rating.

Activity	Description of Impact	Impact type	Spatial Scale	Duration	Significance	Probability	Rating	Mitigation Measures	Intepretation
Disturbance of vegetation	Establishment and spread of alien invasive species	Existing	-	-	-	-	-	■ Continue to implement alien invasive species control, including regular follow-up and monitoring across the entire project site for a period of 5 years following cessation of project activities.	Once established, alien invasive plant species will continue to colonise disturbed and adjacent areas during the closure phase. This impact can be successfuly mitigated through the continued implementation of an alien invasive species control programme during the closure and post closure phases.
		Cumulative	2	4	4	5	3.3 - HIGH		
		Residual	1	3	3	5	2.3 - MOD		

8.0 CONCLUSIONS

The majority of Site H comprises cultivated land, mostly under maize production. An exotic woodlot is present in the north of Site H and various small parcels of natural/semi-natural grassland habitat, often associated with wetland areas, are also present.

A prominent pan is located close to the southern boundary of Site H. Water in the pan appears to be supplemented and used for centre-pivot irrigation, and it is expected that the hydroperiod and water quality of the pan is altered as a result (see Wetland Consulting Services 2011). Both the Present Ecological State (PES) and Ecological Importance and Sensetivity (EIS) of the pan are rated as category D[6][7] (Wetland Consulting Services 2011). This notwithstanding, the pan is used by waterfowl, and Greater Flamingo have previously been recorded at the pan (pers comm. D. McCulloch[8] 2012/2013).

The proposed development of the ADF at Site H will result in the complete loss of remaining patches of untransformed habitat in the proposed footprint, including the pan. Apart from restricting vegetation clearing outside of the immediate ADF footprint and implementing rehabilitaion, habitat loss is inevitable. A number of other impacts have also been identified. These can however be mitigated, provided careful management is implemented throughout all stages of the proposed project. It is thus recommended that all the mitigation measures outlined in this report are included in the environmental management programme for the proposed ADF facility at Site H.

9.0 REFERENCES

Please note reference books, field guides and guidelines not necessarily referenced in the text but used in the field work and in the compilation of this report have also been included in the reference list.

1) Alexander, G. & Marais, J., 2010. A guide to the reptiles of Southern Africa. Cape Town: Struik Nature.

2) BirdLife South Africa, Important Bird Areas. [Online] Available at: www.birdlife.org.za/conservation/iba/ibamap [Accessed July 2013].

3) Branch, B., 1998. Field guide to snakes and other reptiles of Southern Africa. Cape Town: Struik Publishers.

4) Bromilow, C., 2010. Problem Plants and Alien Weeds of South Africa. Pretoria: Briza Publishers.

5) Carruthers, V., 2001. Frogs and Frogging in South Africa. Cape Town: Struik Publishers.

6) Du Preez, L. & Carruthers, V., 2009. A complete guide to the frogs of Southern Africa. Cape Town: Struik Publishers.

7) Eekhout, X., 2010. Chapter 20: Sampling amphibians and reptiles. In: J. Eymann, *et al*. eds. Manual on field recording techniques and protocols for All Taxa Biodiversity Inventories and Monitoring. pp. 530 - 557.

8) Emery, A. J., Lotter, M. & Williamson, S. D., 2002. Determining the conservation value of land in Mpumalanga. Pretoria: Department of Water Affairs and Forestry.

9) Estes, R., 1991. The Behaviour guide to African mammals. Halfway House: Russel Friedman Books.

10) Fahrig, L., 2003. Effects of habitat fragmentation on biodiversity. Annual Review of Ecological Evolutionary Systems, pp. 487-515.

[6] PES Category D: Largely modified. A large loss of natural habitats and basic ecosystem functions has occurred.

[7] EIS Category D: Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of major rivers.

[8] Formerly of Wetland Consulting Services

11) Ferrrar, A. & Lötter, M. C., 2007. Mpumalanga Biodiversity Conservation Plan Handbook. Nelspruit: Mpumalanga Tourism and Parks Agency.

12) Filmer, M. R., 1995. Southern African Spiders. Cape Town: Struik Publishers.

13) Golder Associates Africa, 2013. Terrestrial ecosystems assessment of proposed ash dump sites at Kusile Power Station, Report No. 13614949-11847-1.

14) Golder Associates Africa, 2013. Terrestrial ecosystems assessment of the proposed Continuous and Emergency ash dumps at Kendal Power station, s.l.: Report No. 13614982-11971-1.

15) Golder Associates, 2007. Terrestrial and wetland assessment of the corridors associated with Eskom Bravo Power Station near, Kendal, Mpumalanga, s.l.: Report No. 10613-5792-1.

16) Grootaert, P., Pollet, M., Dekoninck, W. & Van Achterberg, C., 2010. Chapter 15: Sampling insects: general techniques, strategies and remarks. In: A. Hoffmann, *et al*. eds. Manual of field recording techniques and protocols for All taxa Biodiversity Inventories and Monitoring. pp. 337-399.

17) Henning, G. A., Terblanche, R. F. & Ball, J. B., 2009. South African Red Data book: Butterflies.SANBI Biodiversity Series 13. Pretoria: South African National Biodiversity Institute.

18) Hoffmann, A. *et al*., 2010. Chapter 19 - Field methods and techniques for monitoring mammals. In: J. Eymann, *et al*. eds. Manual on field recording techniques and protocols for All Taxa Biodiversity Inventories and Monitoring, pp. 482-529.

19) International Union for the Conservation of Nature (IUCN), 2011. IUCN Otter Specialist Group. [Online] Available at: http://www.otterspecialistgroup.org/Species/Aonyx_capensis.html [Accessed April 2012].

20) Lemming, J., 2003. Scorpions of Southern Africa. Cape Town: Struik Publishers.

21) Leroy, A. & Leroy, J., 2003. Spiders of Souther Africa. Cape Town: Struik Publishers.

22) Manning, J., 2009. Field guide to wild flowers of South Africa. Cape Town: Struik Nature.

23) Migdoll, I., 1994. Field guide to butterflies of Southern Africa. Cape Town: Struik Publishers.

24) Mucina, L. & Rutherford, M. C., 2006. Vegetation map of South Africa, Lesotho and Swazliland. Pretoria: South African National Biodiversity Institute.

25) Picker, M., Griffiths, C. & Weaving, A., 2002. Filed guide to insects of South Africa. Cape Town: Struik Publishers.

26) Pooley, E., 2005. A field guide to wild flowers of KwaZulu-Natal and the Eastern Region. Durban: Natal Flora Publications Trust.

27) Schmidt, E., Lotter, M. & McCleland, W., 2002. Trees and shrubs of Mpumalanga and Kruger National Park. Johannesburg: Jacana media.

28) Sinclair, I., Hockey, P. & Tarboton, W., 1997. Birds of Southern Africa. Cape Town: Struik Publishers.

29) South African Biodiversity Institute (SANBI), 2009. Plants of Southern Africa. [Online] Available at: http://posa.sanbi.org/searchspp.php [Accessed September 2013].

30) South African Biodiversity Institute (SANBI), V2. SIBIS South African Biodiversity Information Facility. [Online] Available at: http://sibis.sanbi.org/ [Accessed September 2013].

31) Stuart, C. & Stuart, T., 2000. A field guide to the tracks and signs of Southern and East African wildlife. Cape Town: Struik Publishers.

32) Stuart, C. & Stuart, T., 2007. Field Guide to Mammals of Southern Africa. Cape Town: Struik Publishers.

33) Tainton, N., 1999. Veld Management in South Africa. Pietermaritzburg: University of Natal.

34) Van Oudtshoorn, F., 1999. Guide to grasses of Southern Africa. Pretoria: Briza Publishers.

35) Van Wyk, B. & Malan, S., 1998. Field guide to the wild flowers of the Highveld. Cape Town: Struik Publishers.

36) Wetland Consulting Services. 2013. Baseline Wetland Delineation and Assessment for the Kendal 30-year Ash Dam Project. Reference 1032-2013.

GOLDER ASSOCIATES AFRICA (PTY) LTD

Andrew Zinn
Terrestrial Ecologist (Pr. Sci.Nat)

Warren Aken
Aquatic Biologist

AZ/WA/jep

Reg. No. 2002/007104/07
Directors: RGM Heath, MQ Mokulubete, SC Naidoo, GYW Ngoma

g:\projects\13615277 - kendal ecological services\6.1 deliverables\13615277-12416-2_rep_terrestrial_rev1_30jun16jep.docx

APPENDIX A

Detailed Methodology

June 2016
Report No. 13615277-12416-2 **(Rev1)**

Literature Review Component

To establish a baseline ecological characterisation of the study area and its environs, the following tasks were undertaken at a desktop level prior to the field visit:

Vegetation

Flora species lists for the 2628BB grid squares were obtained from the PRECIS (National Herbarium Pretoria Computer Information System) database using the SANBI SIBIS website (SIBIS: South African Biodiversity Information Facility, 2009, internet) and the Plants of South Africa database (Plants of Southern Africa, 2009, internet).

In addition, Mucina & Rutherford (2006) was consulted, as were the flora species lists detailed in previous reports relevant to the region in which the study area is located. These include Golder (2007) Report no. 10613-5792-1, Golder (2013) Report no. 13614949-11847-1, Golder (2013) Report no. 13614982-11971-1 & Du Preez (2006). Information relating to specific areas and species of concern for the study area and the surrounding landscape was obtained from the Mpumalanga Biodiversity Sector Plan (MBSP) (2013) online resource.

Mammals

A list of expected mammal species was compiled by consultation of a number of literature sources including Skinner & Smithers (1990), Du Preez (2006), Stuart & Stuart (2007), Golder (2007) Report no. 10613-5792-1, Golder (2013) Report no. 13614949-11847-1 and Golder (2013) Report no. 13614982-11971-1.

Birds

A list of expected bird species was compiled by consultation of a number of literature sources relevant to the study area, including the SANBIôs SIBIS database (SIBIS: SABIF, 2009, internet), Sinclair *et al.* (2002), Du Preez (2006), Golder (2007) Report no. 10613-5792-1, Golder (2013) Report no. 13614949-11847-1 and Golder (2013) Report no. 13614982-11971-1.

Herpetofauna (reptiles and amphibians)

Expected reptile and amphibian species lists were compiled by consultation of various field guides and previous reports, including Branch (1994), Carruthers (2001), Golder (2007) Report no. 10613-5792-1, Alexander & Marais (2010), Golder (2013) Report no. 13614949-11847-1 and Golder (2013) Report no. 13614982-11971-1.

Red Data and protected flora and fauna

In order to assess the Red Data and/or protected status of species in the study area, the following sources were consulted:

- National Environmental Management: Biodiversity Act (Act No. 10 of 2004) ï Lists of critically endangered, endangered, vulnerable and protected species (NEMBA TOPS List 2013);
- International Union for the Conservation of Nature (IUCN) Red List of Threatened Species (2013.1);
- National Forests Act (Act No. 84 of 1998) ï List of Protected Tree Species;
- Mpumalanga Nature Conservation Act (Act No. 10 of 1998):
  - Schedule 2: Protected Game;
  - Schedule 4: Protected Wild Animals;
  - Schedule 7: Protected Invertebrates;
  - Schedule 11: Protected Plants; and
  - Schedule 12: Specially Protected Plants.

Field Sampling Methodology

To account for seasonal variations, two field sampling surveys were conducted; one in the dry/dormant season (9th - 13th of September 2013) and one in the wet/growing season (4th - 7th of February 2014). Field sampling comprised both vegetation and fauna surveys, as detailed below:

Vegetation sampling

Vegetation surveys comprised standard belt transects and line/point sampling to determine the composition and relative abundances of woody and herbaceous species respectively.

Line/point sampling was adapted from Tainton (1999) and involved recording the closest herbaceous species at one metre intervals along a 50 m transect line. Transects were located in representative vegetation communities as identified and delineated at a desktop level. Vegetation communities were also traversed on foot and any unusual or hitherto unrecorded plant species were documented. Due to the absence of a substantial woody component no belt transects were undertaken. Woody species were however recorded as they were encountered in the field.

Flora species that were not identified in the field were photographed for later identification. Identification was undertaken using Van Wyk & Malan (1998), Gerber *et al.* (2004), Pooley (2005), Bromilow (2010), Schmidt *et al.* 2002 and Van Oudtshoorn (1999), where applicable.

Fauna surveys

Mammals

Mammal surveys included both active and passive sampling, and followed the protocols elucidated by Hoffmann, *et al*., (2010).

Active sampling was conducted at 10 sampling sites located in the study area. These sites were selected in representative habitats and in areas where the probability of trap tampering/stealing was considered low. Sampling included the use of Sherman traps to sample for small mammals (<500 g) and Cage/Tomahawk traps to sample for medium-sized (<5 kg) mammals. At each of the fauna sampling sites, 10 Sherman traps were placed at regular intervals along a transect line, and 1 Cage/Tomahawk trap was placed adjacent to a habitat feature (tree, rocks, bush cluster). Sherman traps were bated with a pre-prepared ócakeô of oats, peanuts, peanut butter, syrup and garlic polony. The Cage/Tomahawk traps were bated with fresh chicken pieces or other fresh meat. Traps were inspected each morning of the field survey and all captured individuals were documented and released.

Passive or observational sampling was used to recorded small to large-sized mammals, and included:

- Direct observations ï These are based on opportunistic observations on mammals in the study area;
- Indirect observation ï This involved traversing the study area on foot and identifying and recording mammal tracks, faeces, burrows, feedings signs and other physical evidence. Anecdotal evidence from local residents and land users was also documented; and
- Camera trapping ï This involves the placement of motion-sensor camera traps, bated with fresh chicken pieces at the fauna sampling sites.

As required, Stuart & Stuart (2007) and Stuart & Stuart (2013) was used to identify mammals or evidence of their presence.

Birds

Passive techniques were used to sample bird diversity in the study area. Methods included:

- Point counts of 15 min each, as per Bibby *et al*. (1998), were conducted at the fauna survey sites and at locations of high bird activity, such as at pans and dams, in the study area and adjacent natural areas;
- Opportunistic observations of birds made while driving and walking through the study area were also recorded; and

- Acoustic identification ï This passive sampling technique is based on identifying bird calls.

Bird species were identified using Sinclair *et al*. (2002).

Herpetofauna (Reptiles and Amphibians)

Sampling for reptiles and amphibians included both active and passive sampling, and followed the protocols outlined by Eekhout (2010). Methods involved included:

- Visual encounter surveys ï This method involves walking transects in representative habitats and conducting active searches of suitable herpetofauna refuges in the study area. Refuges may include aquatic features, rocks, logs, artificial cover, leaf litter, bark, leaf axils, and basking sites;
- Pitfall traps with drift fences- This technique involves using 5 ă- 10 ăbuckets with accompanying plastic drift fences. The buckets are dug into the ground and regular intervals and linked with plastic drift fences, creating a trapping array. Trapping arrays are located at the fauna sampling sites; and
- Acoustic identification ï Acoustic identification is used to survey for amphibians and is based on the identification of amphibian calls.

	Ecological Integrity	**Conservation Importance**
HIGH	Habitats of high ecological integrity have compositional, structural and functional characteristics that are close to the natural/sustainable state (i.e. reference conditions). As such, they have a combination of the following attributes: ■ Key flora and faunal indictors are present or highly likely to be present; ■ Large habitat patch that is mostly unfragmented and has a high level of connectivity to adjacent natural habitat patches; ■ Has little to no evidence of anthropogenic disturbances (pollution, earthworks, etc.); and ■ Little or no alien invasive species establishment.	Habitats of high conservation importance have one or a combination of the following attributes: ■ Pristine or relatively undisturbed habitat displaying high species richness; ■ Areas playing an important functional role in ecological processes at a landscape scale (e.g. high levels of connectivity, source patches, water attenuation, etc.); ■ Niche or relatively rare/unique habitat within the landscape which contributes to overall habitat heterogeneity; ■ Areas designated by provincial or national authorities as of high conservation importance, sensitivity or irreplaceability; and ■ Areas with confirmed presence or high probability of occurrence of Red Data and/or protected species (See Red Data species assessment below).
MODERATE	Habitats of moderate ecological integrity have a combination of the following attributes: ■ Moderate levels of anthropogenic disturbance; and ■ Despite disturbances, habitat maintains much of the same functional attributes as areas in a natural/sustainable state.	Habitats of moderate conservation importance have a combination of the following attributes: ■ Intermediate levels of species richness; ■ No or low probability of Red Data and/or protected species (See Red Data species assessment below); and ■ Disturbed areas that are situated adjacent to habitat of high ecological integrity and/or conservation importance and therefore may play a role as an ecological support area.

	Ecological Integrity	**Conservation Importance**
LOW	Habitats of low ecological integrity have a combination of the following attributes: ■ Severely modified from natural state as a consequence of anthropogenic activities, with poor species richness and all or most key flora and fauna indicators absent; ■ Highly fragmented areas, with little or no connectivity to adjacent natural habitat; ■ High incidence of alien species establishment; and ■ Successful rehabilitation may restore some degree of habitat integrity.	Habitats of low conservation importance are typically transformed or highly disturbed, with little or no ecological integrity. These areas are species poor and in their current form play little role in ecological processes and thus cannot contribute toward biodiversity conservation.
Negligible	Completely transformed or developed areas with no natural habitat remaining and no scope for rehabilitation.	Completely transformed or developed areas with no natural habitat remaining and no scope for rehabilitation.

Reptiles encountered were identified using Branch (1994) and Alexander & Marais (2010), while Carruthers (2001) and Du Preez & Carruthers (2009) were used to identify amphibians found in the study area.

Anthropoda

Arthropod surveys followed the methods described by Grootaert, *et al*., (2010) and included:

- Sweep netting - This is a random sampling technique whereby a finely-meshed insect net is swept through/over vegetation, capturing insects as they fly up. Flying insects, such as butterflies, were also caught directly using an insect net. Sweep netting was undertaken in representative habitats;
- Pitfall traps with drift fences - *see technique description for herpetofauna*; and
- Active searching - This involves traversing the study area on foot and searching suitable habitats (rocks, logs, artificial cover, leaf litter, bark, leaf axils, etc.) and scanning sites for arthropod specimens.

Arthropods encountered in the field were documented and where applicable Migdoll (1994), Filmer (1995), Leeming (2003), Leroy & Leroy (2003) and Picker *et al.* (2004) were used to identify species to the lowest possible taxonomic level.

Floristic Sensitivities Analysis

Habitat sensitivity was determined by subjectively analysing the ecological integrity and conservation importance of identified vegetation communities and land units in the study area. The indices and attributes described in the table below were used to direct the analysis:

Rating of ecological integrity and conservation importance

Red Data Assessment

Based on the potential Red Data species lists compiled during the literature review and on the findings of the field survey, the probability of occurrence of Red Data species in the study area were determined for each relevant taxon. The following parameters were used in the assessment:

- Habitat requirements (HR): Most Red Data species have very specific habitat requirements and the presence of these habitat characteristics in the study area was evaluated;

- Habitat status (HS): The status or ecological condition of available habitat in the area was assessed. Often a high level of habitat degradation prevalent in a specific habitat will negate the potential presence of Red Data species (this is especially evident in wetland habitats); and
- Habitat linkage (HL): Movement between areas for breeding and feeding forms an essential part of the existence of many species. Connectivity of the study area to surrounding habitat and the adequacy of these linkages are evaluated for the ecological functioning of Red Data species within the study area.

Probability of occurrence is presented in four categories, namely:

- Low;
- Moderate;
- High; and
- Recorded.

APPENDIX B

Flora species recorded in study area during the field programme and in the QDS 2628BB, as per online databases

Family	Species name
ACANTHACEAE	*Crabbea angustifolia*
AMARYLLIDACEAE	*Boophone disticha*
AMARYLLIDACEAE	*Crinum graminicola*
AMARYLLIDACEAE	*Crinum* sp.
AMARYLLIDACEAE	*Nerine gracilis*
ANACARDIACEAE	*Rhus discolor*
ANACARDIACEAE	*Rhus pyroides*
APIACEAE	*Alepidea peduncularis*
APIACEAE	*Ammi majus var. glaucifolium*
APOCYNACEAE	*Asclepias adscendens*
APOCYNACEAE	*Aspidoglossum interruptum*
ASCLEPIADACEAE	*Gomphocarpus fruticosa*
ASCLEPIADACEAE	*Xysmalobium undulatum*
ASPHODELACEAE	*Aloe ecklonis*
ASPHODELACEAE	*Trachyandra saltii var. saltii*
ASTERACEAE	*Schkuhria pinnata*
ASTERACEAE	*Berkheya radula*
ASTERACEAE	*Berkheya setifera*
ASTERACEAE	*Bidens pilosa*
ASTERACEAE	*Callilepis leptophylla*
ASTERACEAE	*Campuloclinium macrocephalum*
ASTERACEAE	*Cirsium vulgaris*
ASTERACEAE	*Conyza alba*
ASTERACEAE	*Conyza bonariensis*
ASTERACEAE	*Conyza podocephalum*
ASTERACEAE	*Cosmos bipinnatus*
ASTERACEAE	*Dicoma zeyheri*
ASTERACEAE	*Gerbera ambigua*
ASTERACEAE	*Haplocarpha lyrata*
ASTERACEAE	*Haplocarpha scaposa*
ASTERACEAE	*Helichrysum acutatum*
ASTERACEAE	*Helichrysum aureonitens*
ASTERACEAE	*Helichrysum caespititium*
ASTERACEAE	*Helichrysum dasymallum*
ASTERACEAE	*Helichrysum nudifolium*
ASTERACEAE	*Helichrysum oreophilum*
ASTERACEAE	*Helichrysum rugulosum*
ASTERACEAE	*Hypochaeris radicata*
ASTERACEAE	*Senecio coronatus*
ASTERACEAE	*Senecio inornatus*
ASTERACEAE	*Seriphium plumosa*

Family	Species name
ASTERACEAE	*Tagetes minuta*
ASTERACEAE	*Vernonia natalensis*
ASTERACEAE	*Xanthium strumarium*
BORAGINACEAE	*Trichodesma physaloides*
CAESALPINIACEAE	*Chamaecrista comosa*
CAMPANULACEAE	*Wahlenbergia caledonica*
CHENOPODIUM	*Chenopodium album*
CHRYSOBALANACEAE	*Parinari capensis subsp. capensis*
CONVOLVULACEAE	*Ipomoea ficifolia*
CONVOLVULACEAE	*Ipomoea oblongata*
CRASSULACEAE	*Crassula capitella*
CRASSULACEAE	*Crassula natans var. natans*
CUCURBITACEAE	*Cucumis hirsutus*
CUCURBITACEAE	*Cucumis zeyheri*
CYPERACEAE	*Cyperus marginatus*
CYPERACEAE	*Cyperus* sp.
CYPERACEAE	*Cyperus usitatus*
CYPERACEAE	*Eleocharis acutangula*
CYPERACEAE	*Eleocharis limosa*
CYPERACEAE	*Kyllinga erecta*
CYPERACEAE	*Mariscus congestus*
CYPERACEAE	*Schoenoplectus brachyceras*
CYPERACEAE	*Schoenoplectus corymbosus*
CYPERACEAE	*Schoenoplectus muriculatus*
CYPERACEAE	*Schoenoplectus pulchellus*
EBENACEAE	*Diospyros austro-africana*
EUPHORBIACEAE	*Acalypha villicaulus*
EUPHORBIACEAE	*Euphorbia sp.*
EXORMOTHECACEAE	*Exormotheca holstii*
FABACEAE	*Indigastrum burkeanum*
FABACEAE	*Indigofera oxytropis*
FABACEAE	*Indigofera setiflora*
FABACEAE	*Lotononis arida*
FABACEAE	*Melolobium wilmsii*
FABACEAE	*Pearsonia cajanifolia subsp. cajanifolia*
FABACEAE	*Sphenostylis angustifolia*
FABACEAE	*Tephrosia capensis*
FABACEAE	*Trifolium africanum var. africanum*
FABACEAE	*Zornia* sp.
GENTIANACEAE	*Sebaea grandis*
GERANIACEAE	*Pelargonium dolomiticum*

Family	Species name
HIPPOCRATEACEAE	*Eucomus autumnalis*
HYACINTHACEAE	*Drimia intricata*
HYDROCHARITACEAE	*Lagarosiphon major*
HYPOXIDACEAE	*Hypoxis argentea*
HYPOXIDACEAE	*Hypoxis multiceps*
ILLECEBRACEAE	*Pollichia campestris*
IRIDACEAE	*Gladiolus crassifolius*
IRIDACEAE	*Gladiolus papilio*
IRIDACEAE	*Gladiolus permeabilis subsp. edulis*
IRIDACEAE	*Gladiolus vinosomaculatus*
JUNCACEAE	*Juncus lomatophyllus*
JUNCACEAE	*Juncus oxycarpus*
LAMIACEAE	*Becium angustifolium*
LILIACEAE	*Ledebouria ovatifolia*
LILIACEAE	*Ledebouria revoluta*
LILIACEAE	*Monopsis decipiens*
MALVACEAE	*Nesaea sagittifolia*
MESEMBRYANTHEMACEAE	*Mossia intervallaris*
OCHNACEAE	*Epilobium hirsutum*
ORCHIDACEAE	*Satyrium hallackii*
POACEAE	*Agrostis lachnantha*
POACEAE	*Andropogon schirensis*
POACEAE	*Aristida aequiglumis*
POACEAE	*Aristida congesta subsp. barbicollis*
POACEAE	*Aristida congesta* var. *congesta*
POACEAE	*Aristida diffusa*
POACEAE	*Aristida junciformis*
POACEAE	*Aristida* sp.
POACEAE	*Arundinella nepalensis*
POACEAE	*Bewsia biflora*
POACEAE	*Brachiaria serrata*
POACEAE	*Brachiaria* sp.
POACEAE	*Calamagrostis epigejos* var. *capensis*
POACEAE	*Cymbopogon excavatus*
POACEAE	*Cymbopogon plurinodis*
POACEAE	*Cynodon dactylon*
POACEAE	*Digitaria argyrograpta*
POACEAE	*Digitaria monodactyla*
POACEAE	*Digitaria tricholaenoides*
POACEAE	*Diheteropogon amplectens*
POACEAE	*Elionurus muticus*

Family	Species name
POACEAE	*Eragrostis capensis*
POACEAE	*Eragrostis chloromelas*
POACEAE	*Eragrostis curvula*
POACEAE	*Eragrostis plana*
POACEAE	*Eragrostis racemosa*
POACEAE	*Harpochloa falx*
POACEAE	*Hemarthria altissima*
POACEAE	*Heteropogon contortus*
POACEAE	*Hyparrhenia hirta*
POACEAE	*Imperata cylindrica*
POACEAE	*Leersia hexandra*
POACEAE	*Melinis nerviglumis*
POACEAE	*Microchloa caffra*
POACEAE	*Monocymbium ceresiiforme*
POACEAE	*Oropetium capense*
POACEAE	*Panicum natalense*
POACEAE	*Panicum natalense*
POACEAE	*Paspalum dilatatum*
POACEAE	*Paspalum urvillei*
POACEAE	*Phragmites australis*
POACEAE	*Pogonarthria squarrosa*
POACEAE	*Schizachyrium sanguineum*
POACEAE	*Setaria pallid-fusca*
POACEAE	*Setaria sphacelata*
POACEAE	*Sporobolus africana*
POACEAE	*Sporobolus pectinatus*
POACEAE	*Themeda triandra*
POACEAE	*Tricholaena monachne*
POACEAE	*Trichoneura grandiglumis*
POACEAE	*Tristachya leucothrix*
POACEAE	*Typha capensis*
POACEAE	*Urelytrum agropyroides*
POLYGALACEAE	*Polygala hottentotta*
POLYGONACEAE	*Persicaria decipiens*
POLYGONACEAE	*Persicaria limbata*
POLYGONACEAE	*Rumex sp.*
PORTULACACEAE	*Portulaca* sp.
POTAMOGETONACEAE	*Potamogeton pectinatus*
POTTIACEAE	*Trichostomum brachydontium*
RANUNCULACEAE	*Ranunculus meyeri*
RHAMNACEAE	*Ziziphus zeyheriana*

Family	Species name
RICCIACEAE	*Riccia atropurpurea*
RICCIACEAE	*Riccia cupulifera*
RICCIACEAE	*Riccia nigrella*
RICCIACEAE	*Riccia okahandjana*
RICCIACEAE	*Riccia rosea*
RICCIACEAE	*Riccia volkii*
RUBIACEAE	*Oldenlandia herbacea var. herbacea*
RUBIACEAE	*Pentanisia angustifolia*
RUBIACEAE	*Richardia brasiliensis*
SALICACEAE	*Salix babylonica*
SCROPHULARIACEAE	*Alectra sessiliflora*
SCROPHULARIACEAE	*Mimulus gracilis*
SCROPHULARIACEAE	*Selago densiflora*
SCROPHULARIACEAE	*Striga bilabiata*
SCROPHULARIACEAE	*Striga elegans*
SELAGINACEAE	*Walafrida densiflora*
SELAGINELLACEAE	*Selaginella dregei*
SOLANACEAE	*Solanum panduriforme*
VERBENACEAE	*Verbena bonariensis*
VERBENACEAE	*Verbena officinalis*
XYRIDACEAE	*Xyris capensis*

Sources: Field programe, Plants of Southern Africa (POSA) (Internet, Accessed: January 2013) and SIBIS South African Biodiversity Facility (Internet, *Accessed: January 2013*)

APPENDIX C

Mammals potentially occurring in the study area

Scientific name	Common name
Aethomys ineptus	Tete veld rat
Amblysomus robustus	Robust golden mole
Amblysomus septentrionalis	Highveld golden mole
Antidorcas marsupialis	Springbok
Aonyx capensis	Cape clawless otter
Atelerix frontalis	South African hedgehog
Atilax paludinosus	Water mongoose
Canis adustus	Side-striped jackal
Canis mesomelas	Black-backed jackal
Caracal caracal	Caracal
Chrysospalax villosus	Rough-haired golden mole
Crocidura cyanea	Reddish-grey musk shrew
Crocidura flavescens	Greater musk shrew
Crocidura mariquensis	Swamp musk shrew
Crocidura silacea	Lesser grey-brown musk shrew
Cryptomys hottentotus	Common molerat
Cynictis penicillata	Yellow mongoose
Damaliscus pygargus phillipsi	Blesbok
Dasymys incomtus	Water rat
Dendromus mesomelas	Brantôs climbing mouse
Elephantulus myurus	Rock elephant-shrew
Felis nigripes	Black-footed cat
Felis sylvestris	African wild cat
Galerella sanguinea	Slender mongoose
Genetta tigrina	Large-spotted genet
Georychus capensis	Cape molerat
Huaena burnea	Brown hyaena
Hystrix africaeaustralis	Porcupine
Ichneumia albicauda	White-tailed mongoose
Ictonyx striatus	Striped polecat
Leptailurus serval	Serval
Lepus capensis	Cape hare
Lepus saxatilis	Scrub hare
Lutra maculicollis	Spotted-necked otter
Mastomys coucha	Multimammate mouse
Mellivora capensis	Honey badger
Micaelamys namaquensis	Namaqua rock mouse
Miniopterus natalensis	Natal long-fingered bat
Mus minutoides	Pygmy mouse
Myosorex cafer	Dark-footed forest shrew
Myosorex varius	Forest shrew
Neoromicia capensis	Cape serotine bat

Scientific name	Common name
Orycteropus afer	Aardvark
Otomys angoniensis	Angoni vlei rat
Otomys irroratus	Vlei rat
Ourebia ourebi	Oribi
Pelea capreolus	Grey rhebok
Poecilogale albinucha	African striped weasel
Potamochoerus procus	Bush pig
Procavia capensis	Rock hyrax
Proteles cristatus	Aardwolf
Raphicerus campestris	Steenbok
Redunca fulvorufula	Mountain reedbuck
Rhabdomys pumilio	Striped mouse
Rhinolophus clivosus	Geoffroy's horseshoe bat
Steatomys pratensis	Fat mouse
Suncus varilla	Lesser dwarf shrew
Suricata suricatta	Suricate
Sylvicapra grimmia	Common duiker
Tadarida aegyptiaca	Egyptian free-tailed bat
Tatera brantsii	Highveld gerbil
Thryonomys swinderianus	Greater cane rat
Vulpes chama	Cape fox
Source: Stuart & Stuart (1997)	

APPENDIX D

Birds potentially occurring in the study area

Scientific name	Common name
Acridotheres tristis	Indian myna
Acrocephalus baeticatus	African marsh wabler
Acrocephalus gracilirostris	Cape reed warbler
Acrocephalus schoenobaenus	European sedge wabler
Actitis hypoleucos	Common sandpiper
Alopochen aegyptiaca	Egyptian goose
Amadina erythrocephala	Redheaded finch
Amandava subflava	Orange breasted waxbill
Amaurornis flavirostris	Black crake
Anas erythrorhyncha	Red-billed teal
Anas hottentota	Hottentot teal
Anas smithii	Cape shoveller
Anas sparsa	African black duck
Anas undulata	Yellow-billed duck
Anhinga rufa	Darter
Anomalospiza imberbis	Cuckoofinch
Anthropoides paradiseus	Blue crane
Anthus cinnamomeus	Grassveld pipit
Anthus leucophrys	Plain backed pipit
Anthus similis	Long billed pipit
Apus affinis	Little swift
Apus caffer	White rumped swift
Ardea cinerea	Grey heron
Ardea goliath	Goliath heron
Ardea melanocephala	Blackheaded heron
Ardea purpurea	Purple heron
Ardeola ralloides	Squacco heron
Asio capensis	Marsh owl
Bostrychia hagedash	Hadeda ibis
Bradypterus baboecala	African sedge warbler
Bubo africanus	Spotted eagle owl
Bubulcus ibis	Cattle egret
Burhinus capensis	Spotted thick-knee
Buteo rufofuscus	Jackal Buzzard
Buteo vulpinus	Steppe buzzard
Calandrella cinerea	Red capped lark
Calendulauda sabota	Sabota lark
Calidris ferruginea	Curlew sandpiper

Scientific name	Common name
Calidris minuta	Little stint
Centropus burchelli	Burchell's coucal
Ceryle rudis	Pied kingfisher
Chalcomitra amethystina	Black sunbird
Charadrius hiaticula	Ringed lapwing
Charadrius pecuarius	Kittlitz's lapwing
Charadrius tricollaris	Three-banded lapwing
Chersomanes albofasciata	Spike heeled lark
Chlidonias hybrida	Whiskered tern
Chlidonias leucopterus	White winged tern
Chrysococcyx caprius	Diederik's cuckoo
Ciconia abdimii	Adbims' stork
Ciconia ciconia	White stork
Circus ranivorus	African marsh harrier
Cisticola aridulus	Desert cisticola
Cisticola ayresii	Ayre's cisticola
Cisticola fulvicapilla	Neddicky
Cisticola juncidis	Fantailed cisticola
Cisticola textrix	Cloud cisticola
Cisticola tinniens	Levaillant's cisticola
Colius striatus	Speckled mousebird
Columba guinea	Rock pigeon
Columba livia	Feral pigeon
Corvus albus	Pied crow
Corvus capensis	Black crow
Cossypha caffra	Cape robin
Coturnix coturnix	Common quail
Creatophora cinerea	Wattled starling
Crithagra atrogularis	Black-throated canary
Crithagra gularis	African cuckoo
Crithagra mozambicus	Yellow-fronted canary
Cuculus solitarius	Red-chested cuckoo
Cypsiurus parvus	Palm swift
Delichon urbicum	House martin
Dendrocygna bicolor	Fulvous duck
Dendrocygna viduata	White-faced duck
Dicrurus adsimilis	Fork tailed drongo
Egretta alba	Great white egret

Scientific name	Common name
Egretta ardesiaca	Black egret
Egretta garzetta	Little egret
Egretta intermedia	Yellowbilled egret
Elanus caeruleus	Blackshouldered kite
Emberiza tahapisi	Rock bunting
Eremopterix leucotis	Chestnut-backed sparrow-lark
Estrilda astrild	Common waxbill
Euplectes afer	Golden bishop
Euplectes albonotatus	White winged widow
Euplectes ardens	Red-collared widow
Euplectes axillaris	Red-shouldered widow
Euplectes capensis	Yellow-rumped widow
Euplectes orix	Red bishop
Euplectes progne	Longtailed widow
Eupodotis afra	Southern black korhaan
Eupodotis caerulescens	Blue korhaan
Eupodotis senegalensis	White-bellied korhaan
Falco amurensis	Eastern red-footed kestrel
Falco naumanni	Lesser kestrel
Falco rupicolis	Rock kestrel
Falco rupicoloides	Greater kestrel
Fulica cristata	Red-knobbed coot
Gallinago nigripennis	Ethiopian snipe
Gallinula chloropus	Common moorhen
Haliaetus vocifer	African fish eagle
Himantopus himantopus	Black winged stilt
Hirundo albigularis	White throated swallow
Hirundo cucullata	Greater striped swallow
Hirundo fuligula	Rock Martin
Hirundo rustica	Eurasian Swallow
Hirundo semirufa	Red-breasted Swallow
Hirundo spilodera	South African Cliff Swallow
Hirundo spilodera	South African cliff swallow
Lamprotornis nitens	Glossy Starling
Lanius collaris	Fiscal shrike
Lanius collurio	Red-backed shrike
Larus cirrocephalus	Greyheaded gull
Lybius torquatus	Black collared barbet

Scientific name	Common name
Macronyx capensis	Orange throated longclaw
Megaceryle maximus	Giant kingfisher
Mirafra africana	Rufousnaped lark
Mirafra apiata	Cape clapper lark
Motacilla capensis	Cape wagtail
Muscicapa striata	Spotted flycatcher
Mycteria ibis	Yellow billed stork
Myrmecocichla formicivora	Ant-eating chat
Netta erythrophthalma	Southern pochard
Numida meleagris	Helmeted guineafowl
Nycticorax nycticorax	Black-crowned night heron
Oena capensis	Namaqua dove
Oenanthe monticola	Mountain chat
Oenanthe pileata	Capped wheatear
Onychognathus morio	Red-winged starling
Oriolus larvatus	Blackheaded oriole
Ortygospiza atricollis	Quail finch
Oxyura maccoa	Maccoa duck
Passer diffusus	Southern greyheaded sparrow
Passer domesticus	House sparrow
Passer melanurus	Cape sparrow
Peliperdix coqui	Coqui francolin
Petronia superciliaris	Yellow-throated sparrow
Phalacrocorax africanus	Reed cormorant
Phalacrocorax lucidus	White-breasted cormorant
Phoenicopterus minor	Lesser flamingo
Phoenicopterus ruber	Greater flamingo
Phoeniculus purpureus	Red-billed woodhoopoe
Phylloscopus trochilus	Willow warbler
Platalea alba	African spoonbill
Plectropterus gambensis	Spurwinged goose
Plegadis falcinellus	Glossy ibis
Plocepasser mahali	White-browed sparrowweaver
Ploceus capensis	Cape weaver
Ploceus velatus	Masked weaver
Ploceus xanthops	Golden weaver
Podica senegalensis	African finfoot
Podiceps cristatus	Great crested grebe

Scientific name	Common name
Porphyrio madagascariensis	Purple gallinule
Prinia flavicans	Black-chested prinia
Prinia subflava	Tawny-flanked prinia
Pternistis swainsonii	Swainson's francolin
Pycnonotus tricolor	Blackeyed bulbul
Quelea quelea	Redbilled quelea
Rallus caerulescens	African rail
Recurvirostra avosetta	Pied avocet
Rhinopomastus cyanomelas	Greater scimitarbill
Riparia cincta	Banded martin
Riparia paludicola	Brown-throated martin
Riparia riparia	Sand martin
Sagittarius serpentarius	Secretarybird
Sarkidiornis melanotos	Knobbilled duck
Sarothrura rufa	Red chested flufftail
Saxicola torquatus	Stonechat
Scopus umbretta	Hamerkop
Serinus canicollis	Cape canary
Sigelus silens	Fiscal flycatcher
Sphenoeacus afer	Grassbird
Spizocorys conirostris	Pink-billed lark
Spreo bicolor	Pied starling
Streptopelia capicola	Cape turtle dove
Streptopelia semitorquata	Red-eyed dove
Streptopelia senegalensis	Laughing dove
Struthio camelus	Ostrich
Sylvia borin	Garden warbler
Sylvietta rufescens	Long-billed crombec
Tachybaptus ruficollis	Dabchick
Tadorna cana	South African shelduck
Telophorus zeylonus	Bokmakierie
Terpsiphone viridis	Paradise flycatcher
Thalassornis leuconotus	White-backed duck
Threskiornis aethiopicus	Sacred ibis
Trachyphonus vaillantii	Crested barbet
Tricholaema leucomelas	Pied barbet
Tringa glareola	Woods
Tringa nebularia	Greenshank

Scientific name	Common name
Tringa stagnatilis	Marsh sandpiper
Turdoides jardineii	Arrow-marked babbler
Turdus libonyanus	Kurrichane thrush
Turdus olivaceus	Olive thrush
Turnix sylvaticus	Kurrichane buttonquail
Turtur chalcospilos	Green-spotted wood dove
Tyto alba	Barn owl
Upupa africana	African hoopoe
Urocolius indicus	Red-faced mousebird
Vanellus armatus	Blacksmith lapwing
Vanellus coronatus	Crowned lapwing
Vanellus senegallus	Wattled lapwing
Vidua macroura	Pintailed whydah
Zosterops pallidus	Cape white-eye

Source: PRECIS Database - SIBIS South African Biodiversity Facility (Internet, Accessed: January 2013)

APPENDIX E

Herpetofauna potentially occurring in the study area

June 2016
Report No. 13615277-12416-2 **(Rev1)**

Scientific name	Common name
Reptiles	
Agama aculeata	Ground agama
Aparallactus capensis	Cape centipede eater
Bitis arietans	Puff adder
Causus rhombeatus	Rhombic night adder
Chammaesaura aenea	Transvaal grass lizard
Ichnotropis squamulosa	Common rough-scaled Lizard
Nucras taeniolata	Ornate sandveld Lizard
Cordylus vittifer	Transvaal girdled Lizard
Crotaphopeltis hotamboeia	Red-lipped snake
Dasypeltis scabra	Rhombic egg eater
Duberria lutrix	Common slug eater
Elapsoidea sundevallii	Sundevall's garter snake
Gerrhosaurus flavigularis	Yellow-throated plated lizard
Hemachatus heamachatus	Rinkhals
Homoroselaps dorsalis	Striped harlequin snake
Homoroselaps lacteus	Spotted harlequin snake
Lamprophis aurora	Aurora house snake
Lamprophis fuliginosus	Brown house snake
Leptotyphlops conjunctus	Cape thread snake
Leptotyphlops distanti	Distantôs thread snake
Leptotyphlops scutifrons	Peter's thread snake
Lycodonomorphus rufulus	Common brown water snake
Lycophidion capense	Cape wolf snake
Naja haje	Egyptian cobra
Naja mossambica	Mozambique spitting cobra
Philothamnus hoplogaster	Green water snake
Philothamnus natalensis	Natal green snake
Psammophis crucifer	Montane grass snake
Psammophylax rhombeatus	Rhombic skaapsteker
Panaspis wahlbergii	Wahlbergôs snake-eyed skink
Pseudaspis cana	Mole snake
Tetradactylus breyeri	Breyerôs long-tailed Seps
Typhlops bibronii	Bibron's blind snake
Typhlops lalandei	Delalandes blind snake
Varanus exanthematicus	Rock monitor
Varanus niloticus	Water monitor
Kinixys belliana	Bellôs hinged tortoise
Typhlops schlegelii	Schlegelôs blind snake
Leptotyphlops nigricans	Black thread snake
Psammophylas tritaeniatus	Striped skaapsteker
Atractaspis bibronii	Southern burrowing asp

Scientific name	Common name
Philothamnus semivariegatus	Spotted bush snake
Pedioplanis lineoocellata	Spotted sand snake
Mabuya capensis	Cape skink
Mabuya striata	Striped skink
Mabuya varia	Variable skink
Acontias gracilicauda	Thin-tailed legless skink
Pachydactylus capensis	Cape thick-toed gecko
Pelomedusa subrufa	Marsh terrapin
Chamaeleo dilepis	Flap-neck chameleon
Amphibians	
Bufo gutturalis	Guttural toad
Bufo garmani	Eastern olive toad
Bufo rangeri	Raucous toad
Schismaderma carens	Red toad
Kassina senegalensis	Bubbling kassina
Semnodactylus wealii	Rattling frog
Breviceps adspersus	Bushveld rain frog
Breviceps mossambicus	Mozambique rain frog
Xenopus laevis	Common platanna
Cacosternum boettgeri	Common caco
Phrynobatrachus natalensis	Snoring puddle frog
Afrana angolensis	Common river frog
Afrana fuscigula	Cape river frog
Ptychadena porosissima	Striped grass frog
Pyxicephalus adspersus	Giant bullfrog
Strongylopus fasciatus	Striped stream frog
Strongylopus grayii	Clicking stream frog
Tomopterna cryptotis	Tremelo sand frog
Tomopterna natalensis	Natal sand frog
Sources: Branch (1994) & Carruthers (2001)	

APPENDIX F

Arthropoda recorded in the study area and surrounding land

June 2016
Report No. 13615277-12416-2 **(Rev1)**

Family	Genus
Coenagrionidae	*Ceriagron glabrum*
	Pseudagrion hageni
Gomphidae	*Ictinogomphus ferox*
Aeshnidae	*Aeshna miniscula*
	Anax imperator
Libellulidae	*Nothiothemis jonesi*
	Trithemis stictica
	Trithemis annulata
	Brachythemis leucosticta
	Crocothemis sanguinolenta
Blattidae	*Deropeltis erythrocephala*
	Periplenata americana
Blatellidae	*Blatella germanica*
Blaberidae	*Derocalymma*
Pseudophyllodromiidae	*Supella dimidiata*
Termitidae	*Macrotermes natalensis*
Hymenopodidae	*Harpagomantis tricolor*
Mantidae	*Sphodromantis gastrica*
	Miomantis sp.
Empusidae	*Empusa guttula*
Libiduridae	*Euborellia annuplipes*
Anostostomatidae	*Onosandrus sp.*
Bradyporidae	*Hetrodes pupus*
Danainae	*Danaus chrysippus aegyptius*
Tettigonidae	*Phaneroptera sp.*
	Eurycorypha sp.
	Phaneroptera sp.
Gryllidae	*Gryllus bimaculatus*
	Gryllotalpidae sp.
Pamphagidae	*Hoplolopha sp.*
Pyrgomorphidae	*Zonocerus elegans*
Lentulidae	*Lentula sp.*
Acrididae	*Acrida acuminata*
	Truxaloides sp.
	Cyrtacnthacris aeruginosa
	Locustana pardalina
	Acanthacris ruficornis
	Sphigonotus scabriculus
	Rhachitopis sp.
Phasmatidae	*Palophus reyi*
Miridae	*Deraeocoris sp.*
Tingidae	*Phyllontochila walbergi*

Family	Genus
Reduviidae	*Etrichodia crux*
	Glymmatophora
	Lopodytes grassator
Plataspidae	*Solenostethium lilligerum*
Alydidae	*Mirperus faculus*
Pentatomidae	*Nezara viridula*
Scarabidae	*Gymnopleurus humanus*
	Anachalcos convexus
	Copris mesacanthus
Cerambycidae	*Prosopocera lactator*
	Macrotoma palmata
	Acanthophorus confinis
Carabidae	*Passalidius fortipes*
	Acanthoscelis ruficornis
	Anthia maxillosa
Melirydae	*Melyris sp.*
Tennebrionidae	*Psammodes striatus*
	Stenocara dentata
	Dichtha incantatoris
Meloidae	*Actenoidia curtula*
Curculionidae	*Prionorhinus canus*
	Brachycerus ornatus
Myrmeleontidae	*Centroclisi sp.*
	Cymothales sp.
	Hagenomyia tristis
Tabanidae	*Philoliche rostrata*
Culicidae	*Aedes sp.*
	Culex sp.
Bombyliidae	*Exoprosopa sp.*
Calliphoridae	*Chrysomya chloropyga*
Saturniidae	*Bunaea alcinoe*
Pieridae	*Eurema brigitta*
Nymphalidae	*Hamanumida daedalus*
	Precis hierta
	Precis oenone
	Junonia cebrene
	Junonia orithya madagascariensis
Lycaenidae	*Species 1*
	Danaus chrysippus
Vespidae	*Ropalidia sp.*
	Belonogaster dubia
Apidae	*Apis mellifera*

Family	Genus
Formicidae	*Solenopsis sp.*
	Anoplolepis custodiens
	Messor sp.
	Camponotus sp.
Buthidae	*Uroplectes olivaceus*
	Uroplectes formosus
	Parabuthus ganulatus
Arachnidae	*Species 1*
Araneidae	*Argiope australis*
	Gasteracanthus sanguinolenta
	Isoxya sp.

Source: 2013 dry- season field survey, Golder (2013) Report no. 13614949-11847-1 and Golder (2013) Report no. 13614982-11971-1

APPENDIX G

Document Limitations

DOCUMENT LIMITATIONS

This Document has been provided by Golder Associates Africa Pty Ltd (ñGolderò) subject to the following limitations:

i) This Document has been prepared for the particular purpose outlined in Golderôs proposal and no responsibility is accepted for the use of this Document, in whole or in part, in other contexts or for any other purpose.

ii) The scope and the period of Golderôs Services are as described in Golderôs proposal, and are subject to restrictions and limitations. Golder did not perform a complete assessment of all possible conditions or circumstances that may exist at the site referenced in the Document. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by Golder in regards to it.

iii) Conditions may exist which were undetectable given the limited nature of the enquiry Golder was retained to undertake with respect to the site. Variations in conditions may occur between investigatory locations, and there may be special conditions pertaining to the site which have not been revealed by the investigation and which have not therefore been taken into account in the Document. Accordingly, additional studies and actions may be required.

iv) In addition, it is recognised that the passage of time affects the information and assessment provided in this Document. Golderôs opinions are based upon information that existed at the time of the production of the Document. It is understood that the Services provided allowed Golder to form no more than an opinion of the actual conditions of the site at the time the site was visited and cannot be used to assess the effect of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.

v) Any assessments made in this Document are based on the conditions indicated from published sources and the investigation described. No warranty is included, either express or implied, that the actual conditions will conform exactly to the assessments contained in this Document.

vi) Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by Golder for incomplete or inaccurate data supplied by others.

vii) The Client acknowledges that Golder may have retained sub-consultants affiliated with Golder to provide Services for the benefit of Golder. Golder will be fully responsible to the Client for the Services and work done by all of its sub-consultants and subcontractors. The Client agrees that it will only assert claims against and seek to recover losses, damages or other liabilities from Golder and not Golderôs affiliated companies. To the maximum extent allowed by law, the Client acknowledges and agrees it will not have any legal recourse, and waives any expense, loss, claim, demand, or cause of action, against Golderôs affiliated companies, and their employees, officers and directors.

viii) This Document is provided for sole use by the Client and is confidential to it and its professional advisers. No responsibility whatsoever for the contents of this Document will be accepted to any person other than the Client. Any use which a third party makes of this Document, or any reliance on or decisions to be made based on it, is the responsibility of such third parties. Golder accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this Document.

GOLDER ASSOCIATES AFRICA (PTY) LTD

As a global, employee-owned organisation with over 50 years of experience, Golder Associates is driven by our purpose to engineer earth's development while preserving earth's integrity. We deliver solutions that help our clients achieve their sustainable development goals by providing a wide range of independent consulting, design and construction services in our specialist areas of earth, environment and energy.

For more information, visit golder.com

Africa	+ 27 11 254 4800
Asia	+ 86 21 6258 5522
Australasia	+ 61 3 8862 3500
Europe	+ 356 21 42 30 20
North America	+ 1 800 275 3281
South America	+ 56 2 2616 2000

solutions@golder.com
www.golder.com

Golder Associates Africa (Pty) Ltd.
P.O. Box 6001
Halfway House, 1685
Building 1, Maxwell Office Park
Magwa Crescent West
Waterfall City
Midrand, 1685
South Africa
T: [+27] (11) 254 4800

Golder Associates