BIODIVERSITY ASSESSMENT REPORT

KANGALA MINE

Mpumalanga

UNIVERSAL COAL SOUTH AFRICA

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Environmental Solutions Provider

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EXECUTIVE SUMMARY

The Kangala Coal Mine is a venture by Universal Coal Development 1 (Pty) Ltd which will from here on be referred to as the proposed Kangala mine. The Kangala mine incorporates prospecting rights in the Delmas District of Mpumalanga Province, South Africa. The prospecting rights consist of/ fall over the farm Wolvenfontein 244 IR, Portion 1 and R/E of Portion 2.

The coal seams in the Delmas area were historically exploited at the now defunct Largo Colliery approximately 25 km southwest of Delmas. Currently a number of Collieries are present in the Delmas area, including Exxaro's Leeuwpan Mine and Stuart Colliery, both situated within a radius of approximately 5-10 km from the proposed Kangala mine. Additionally, a number of junior coal miners, including Keaton Energy (JSE listed) and Homeland Energy (TSE listed) are actively exploring coal assets in the area.

The Greater Elof Block, including some of the Universal Coal properties, was evaluated in the 1970s and 1980s and found to contain a mineable coal resource of 1.3 billion tonnes of low strip ratio coal. The coal in general is a high ash, low moisture and low volatile bituminous coal and does not require further upgrading to be used for power generation or synthetic liquid fuel production

The aim of this survey was to undertake a basic ecological assessment of the local flora and fauna in the study areas. The objective is to establish the significance of the impacts of the construction and operation of the proposed opencast mine and associated infrastructure on the fauna and flora. Recommendations will also be made for mitigation actions that may either enhance potential benefits or minimize harmful effects. In order to meet this objective the aforementioned flora and fauna surveys were conducted.

Destruction of the natural vegetation and habitat by means of ploughed areas has taken place and approximately 20 % of the area still consists of natural grassland that has not been affected by agriculture. These natural grassland areas are restricted to the vicinity of the drainage lines, and accompanying low lying valley bottom wetlands and hill slopes.

During the wet season field survey 90 plant species were recorded as opposed to only 11 recorded during the dry season survey. The dry season is typically not ideal for a biodiversity surveys as

most vegetation is dormant and thus many animal species are not active. It must also be noted that the survey areas had been burnt prior to the dry season sampling taking place.

The recorded grass species represented pioneer, subclimax and climax species and the areas were all in different states of succession, with some areas supporting climax species like *Themeda triandra* and *Bewsia biflora* displaying more advanced stages of plant succession. The stages of succession of the various areas were dependent on the severity of disturbances such as ploughing and invasion of alien plant species, accompanied with burning. Natural areas supported grasses with average to good palatability, indicating that such areas could in future support grazing by livestock.

Furthermore, the study area also supported alien invasive plant species, such as; *Cosmos bipinnatus, Bidens pilosa, Amaranthus hybridus* and *Solanum sisymbrifolium.* An eradication and control program should be included with rehabilitation efforts to ensure that the area becomes free of these alien invasive species. The tree component will, if uncontrolled, alter the landscape and introduce bush encroachment to the grasslands. Three Red Data species (Mpumalanga Parks Board (MPB) Schedule 11 Protected) were encountered, they were *Gladiolus crassifolius*, *Gladiolus dalenii* and *Kniphofia brachystachya*.

The mammal species observed during the field work was very limited, this was expected as the animal diversity and richness is a function of the available habitat and the level of threats present. The presence of both these factors was evident as far as animal numbers where concerned. Local knowledge was sourced from the farmers, many of whom have been resident in the area for most of their lives. Upon consulting with the farmers it was found that the Serval (*Leptailurus serval)*, a Red Data Status mammal considered to be Near Threatened, has been sighted in the project area.

Many animal species that were observed in the project area are adaptable species and although they will move out of the area during mining, by increasing the natural flora diversity during rehabilitation, one will have a natural influx of animals, with smaller animals such as insects moving into the area first, followed by birds, frogs and reptiles. During the wet season survey four amphibian species were observed and no species observed during the dry season field surveys which could be attributed to timing of the survey as these species tend to hibernate during cold spells.

From the investigations performed during this assessment it was found that misuse and degradation has taken place in the study area, predominantly from agricultural activities. From a flora perspective the surrounding land use and management measures employed by land owners had a substantial impact on the species richness and abundance in the study area. From a fauna perspective very few species were encountered, with no large mammal species encountered, mostly due to increased threats, and degraded and shrinking habitat.

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1 INTRODUCTION

The National Environmental Management Biodiversity Act (NEMBA), 2004 (Act 10 of 2004), defines biodiversity as the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems as well as the ecological complexes of which they are part. This includes diversity within species, between species and of ecosystems. Living organisms, for the purpose of this report, include forms of plant life (with the focus on herbs, grasses, shrubs and trees), animal life (with the focus on mammals, birds, reptiles, amphibians) as well as associated environmental factors such as wetlands (water accumulation in streams and pans), soils (land use and land capability) and geology.

South Africa is the third most biologically diverse country in the world, after Indonesia and Brazil. The country occupies about 2% of the world's land area, but supports nearly 10% of the world's plants and 7% of the world's reptiles, birds and mammals. It also has three globally recognised biodiversity hotspots that fall within its boundaries, namely: the Cape Floristic Region, the Succulent Karroo and Maputaland-Pondoland (Driver et al, 2004).

NEMBA sets out a framework for planning the conservation and sustainable use of biological diversity within a broader framework of planning for sustainable development. Mining and its associated activities has a significant impact on the soils, land use, land capability, vegetation and animal life. The use of land for mining leads to the destruction of vegetation and therefore the loss of suitable habitat for fauna. As a result of the destruction of natural vegetation and wetlands, change in land use and the contamination of the surrounding environment, the level of biodiversity within mining areas is normally diminished. With proper planning, responsible mining with concurrent rehabilitation and through the conscious conservation and protection of resident natural species these impacts and the associated loss of biodiversity can be addressed and minimised (Driver *et al*, 2004).

Loss of biodiversity leads to ecosystem degradation and subsequent loss of important ecological services. This puts aspects of the economy and quality of life of people dependant on biodiversity at risk, and reduces socio-economic options for future generations. Biodiversity provides an important basis for economic growth and development and it is vital to keep it intact to ensure ongoing provision of ecosystem services (Driver et al, 2004). Mining is a driving force that excerts pressure on the natural habitat and biological diversity. This pressure arises from both current and past activities since there is often a time lag between human actions and environmental responses (Driver *et al*, 2004).

Mpumalanga falls within the Grassland Biome which has the highest biodiversity in South Africa after the Fynbos biome (Driver *et al*, 2004). Grasslands are dominated by a single layer of grasses and the amount of cover depends on rainfall and the degree of grazing. Trees are absent, except in a few localised habitats and geophytes are often abundant (Low & Rebelo, 1996).

Mining activities in the region have lead to habitat fragmentation (Johnson, 2001) and therefore any further loss of natural habitat is viewed as detrimental to biodiversity functioning in this particular region. The loss of biodiversity leads to ecosystem degradation and this study will try to address and identify the species that are found in the area in terms of their Red Data status and their ecological contribution (Driver et al, 2004). The greatest threat to fauna species within this area is the loss of natural habitat as a direct result of land development, agricultural or mining activities. In an area such as Mpumalanga further habitat loss is critical as bird and small mammal species are under increasing pressure from mining activities.

The objectives of the fauna and flora study, which are contained in the Terms of Reference, they were achieved by conducting a desktop study followed by wet and dry season field investigation of the wetland and surrounding grassland for both flora and fauna, delineating plant communities that are found in the area, and also identifying the rare and endangered species that occur in the wetland and grassland.

2 TERMS OF REFERENCE

Digby Wells and Associates (DWA) were commissioned by Universal Coal South Africa (Pty) Ltd (Kangala Mine) to conduct fauna and flora studies on the farm Wolvenfontein 244 IR, Portion 1and R/E of Portion 2 in order to determine the current ecological status of these farms. The studies were done in accordance to the Mpumalanga Parks Board minimum requirements. Two assessments (wet and dry season) were completed and the information and results from these studies were compiled into a comprehensive biodiversity assessment.

This specialist study serves to undertake a basic ecological assessment of the local flora and fauna communities associated with the study areas. Information generated from this survey has been used to address the impacts that the mining activities will have on this environment. The desktop and field results have been included to interpret the results.

This survey was completed in accordance with the following legislation:

- Section 21 of the Environment Conservation Act, 1989;

- Section 24 of the Constitution – Environment (Act 108 of 1996);
- Conservation of Agricultural Resources Act (CARA) no 43 of 1983;
- Section 5 of the National Environmental Management Act (Act 108 of 1998);
- National Environmental Management Biodiversity Act (NEMBA, Act 10 of 2004); and
- Mpumalanga tourism and parks agency minimum requirements (MPTP).

3 STUDY AREA

The proposed Kangala mine is located approximately 80 km east of Johannesburg in the Delmas District, Mpumalanga Province. The nearest towns are Delmas (app. 5 km), Devon (app. 60 km) and Springs (app. 30 km). Furthermore, the site is located in the quaternary catchment, B20A, which is situated within the upper reaches of the Olifants Catchment Water Management Area (WMA 4). The project area is located nearby the Exxaro coal mine Leeuwpan (which is operational), close to road and railway infrastructure and within a radius of 30-70 km from four coal-fired power stations. The study area consists of portion 1 and R/E of portion 2 of the farm Wolvenfontein 244 IR in the.

According to Acocks (1988) the area of interest falls within the Bankenveld vegetation type (Type no. 61) of the grassland biome. Three variations are recognised, namely: the Central, Eastern and Western Variations. The area of interest falls within the Eastern Variation, which has sandy plains and is wetter than the Western Variation. A more recent classification of the vegetation types of South Africa by Low and Rebelo (1996) refers to the vegetation type as the "Moist Sandy Highveld Grassland" (Type no. 38) and lists "North-eastern Sandy Highveld" (A57) and "Eastern Bankenveld" (A61c) as synonyms. According to the latest vegetation map by Mucina *et al.* (2006), this area is described as both Eastern Highveld Grassland and Eastern Temperate Freshwater Wetlands.

According to Ferrar and Lotter (2007), the Mpumalanga Province is categorised into 6 main areas of sensitivity, namely:

- Highly Significant;
- Important & Necessary;

- Irreplaceable;
- Least Concern;
- No Natural habitat Remaining; and
- Protected areas.

This study area falls within the classifications of Least Concern and No Natural Habitat Remaining (Appendix 1).

4 EXPERTISE OF THE SPECIALIST

A declaration of independence and CV's of the specialists involved is attached as Appendix 2.

5 AIMS AND OBJECTIVES

The aim of the study was to conduct baseline studies in which the current state/health of the natural environment is recorded. In order to achieve this aim, the following objectives were set:

- To determine if any fauna and flora species or assemblages will be directly impacted upon by the proposed mining activities and associated infrastructure, this includes fauna and flora communities present, the state of these communities, identification of possible red data species;
- To undertake an assessment of the impacts associated with various activities on the health of the fauna and flora species or assemblages; and
- To recommend measures that should be included in the Environmental Management Plan (EMP) to prevent as well as limit impacts to fauna and flora species or assemblages.

6 METHODOLOGY

6.1 Site Visit

The wet season survey took place on 16th to the 18th February 2009 and the dry season survey was conducted on 25th and 26th of August 2009 in order to sample the species (both fauna and flora) and that are found on this site during the two seasons.

6.2 Vegetation and Animal Survey

6.2.1 Desktop Study

A desktop study was conducted to determine which fauna and flora species could possibly occur on the site under natural conditions.

This was conducted by reviewing the available literature on the vegetation types of South Africa. The information gathered during this phase was used to identify aspects of the current natural

environment that should receive more attention. A brief description of the natural vegetation type of the area, according to the descriptions in Low & Rebelo (1996) and Acocks (1988) is given. All plants that have Red Data and Endemic status according to Hilton-Taylor (1996) were also investigated.

According to distribution maps obtained from Skinner & Chimimba (2005) and Friedman & Daly (2004) a list of mammals that could be found in this study area was created. Roberts (2003) and Barnes (2000) were used to identify bird species that may occur in and around the proposed project site as well as their Red Data status. Branch (2001), Passmore & Carruthers (1995), and Henning & Henning (1989), were all used to ascertain the distribution of reptiles and amphibians.

The invertebrate literature survey involved consulting the IUCN Red Data and CITES sites for listed animals that occur in South Africa. Unfortunately these internet sites do not always offer detailed distribution maps. Coupled with lack of information on many species (Data Deficient category), it is difficult to conclude, for certain, if these organisms occur in the particular region of South Africa relevant to this project

6.2.2 Field Survey

6.2.2.1 Vegetation

During the field survey, trees, shrubs, grasses and herbs (forbs) were recorded using the Braun-Blanquet method (Braun-Blanquet 1964). Text books and field guides such as, Pooley 1998, Sinclair *et al.* 2002 and van Oudtshoorn, 1999 were used during the field survey for identification. The sampling points (Appendix 3) were positioned such that the whole area was represented, and in cases where the area appeared homogenous, one or two representative samples were taken. This was achieved by identifying homogenous units that appeared on aerial photographs of the area. A total of 24 sample plots were distributed within the area of interest with some natural grassland vegetation, wetlands, and disturbed areas being surveyed.

The majority of the study area was mielie fields and only few samples were taken as these fields were dominated by the same species, i.e. *Zea mays*, and weeds. Most of the samples were taken in areas where there were natural grasses and trees (Figure 6-1).

Figure 6-1: Low lying natural grassland bordered by mielie fields

A comprehensive floristic and habitat survey was conducted within each of the sample plots. Taxon names were updated in accordance to the species list contained in the TURBOVEG (Hannekens, 1996b) database. The following cover-abundance scale table (Table 6-1) was therefore used:

Table 6-1. Braun-Blanquet cover-abundance scale

Symbol	**Qualitative Braun-Blanquet scale**
r	One or few individual (rare) with less than 1% of total sample plot area
+	Occasional and less than 1% of total sample plot area
1	Abundant and with very low cover or less abundant, but with higher cover, 1-

Symbol	Qualitative Braun-Blanquet scale
	5% cover of total sample plot area
2a	Covering 5-12% of the sample plot area, irrespective of the number of individuals
2b	Covering 12-25% of the sample plot area, irrespective of the number of individuals
3	>25-50% cover of the total sample plot area, irrespective of the number of individuals
4	>50-75% cover of the total sample plot area, irrespective of the number of individuals
5	>75% cover of the total sample plot area, irrespective of the number of individuals

The floristic data, which consists of 28 relevés (sample plots), was subjected to the **T**wo-**W**ay **In**dicator **S**pecies **An**alysis technique (TWINSPAN) (Hill 1976b) on two levels of division in the Juice (Tichy 2002). Results of TWINSPAN indicated a first approximation of the major units in the study area.

Due to the lack of species diversity and levels of previous disturbance, a sample plot size of 10 m x 10 m was adopted. In order to provide a clear reflection of the variation of the vegetation, sample plots were, as far as possible, equally distributed within the different stratification units, and one relevé was compiled in each plot. The exact position of each sample plot within the relevant stratification unit was chosen subjectively according to the methodology of the Zurich-Montpellier approach of phytosociology (Braun-Blanquet 1964).The Braun-Blanquette sampling method (Mueller-Dombois & Ellenberg 1974) has been successfully applied in other phytosociological studies in South African grasslands (e.g. Bredenkamp 1982, Bezeuidenhoudt & Bredenkamp 1990) and also in many other vegetation studies (Du Plessis 2001).This is a standardised method used for vegetation classification within South Africa.. A cover abundance value was estimated for each of the identified species according to the Braun-Blanquette scale.

The habitat was evaluated in terms of the topography (crest, midslope, foot slope, plain, river and plateau), aspect (north, south, east and west), slope (in degrees), altitude, soil and erosion (if present).

6.2.2.2 Mammals

The mammal survey was conducted concurrently with the vegetation survey. All mammals that were observed during the field surveys were noted. This included mammals that were seen at the sample sites and those that were observed in the general area. Signs that would indicate the presence of certain species were also looked for such as spoor and droppings. Although mammals were recorded in areas not specific to the proposed new developments, the ability of mammals to move between areas means the likelihood of these species occurring in the area of concern is high. Baited wire cages with trap doors were used for small mammal trapping. This method is species specific and only small mammals weighing less than 2kg can be captured, this method was employed during the day surveys. Information was also gathered from local farmers in the area, this was achieved by one on one consultation with several farmers.

6.2.2.3 Birds

A visit to the project site area to establish visual observations of the birds' species took place in the late afternoons on the days of the site visits. Three avifauna field guides were used for identification purposes. According to Roberts 2003, the Secretary bird (Near Threatened) occurs in grassland habitats and the African grass owl (Vulnerable) occurs in grassland with vlei areas. Both these habitats are present within the area. As these are Red Data birds, they will need to be protected and conserved should they occur on the property.

6.2.2.4 Invertebrates

Invertebrates were sampled using a sweep net of 350 mm diameter. At each sample plot 50 sweeps were conducted. Insects were collected from the net using a pooter, placed into a jar filled with 70% ethanol, and were sent to University of Johannesburg (UJ) for identification and species counts. For each sample plot the insects were identified to at least family level and where possible to genus and species level. The number of species within each family was noted as were the number of individuals of each species, and their Red Data status.

6.2.2.5 Reptiles

Any signs of reptile activity were noted, such as shed skin, spoor and droppings. Lizard and snake surveys were performed in the late morning and late afternoon, when temperatures are generally conducive to reptile activity due to thermoregulation. Snakes, if found, were not captured, but if possible, a picture will be taken, and specimens identified in the field. Lizards are captured if they cannot be identified visually in their natural habitat. Any lizard that is captured will be placed briefly in a jar. If identification cannot be completed in the field, specimens are released and subsequently identified from pictures taken while individuals are in holding containers, possibly with the help of experts. Data is recorded in a notebook along with the time, date, habitat, weather conditions and a GPS location.

6.2.2.6 Amphibians

Amphibian studies in the project area was conducted during the wet season survey only, as the increased presence of water bodies creates more favourable amphibian habitat, and coincides with their mating season which means increased activity and vocalisation. Diurnal visual and audio observations were deemed sufficient. Furthermore, during the dry season all amphibians are in hibernation.

6.2.2.7 Listed species

The IUCN Red List of Threatened Species provides taxonomic, conservation status and distribution information on plants and animals that have been globally evaluated using the IUCN Red List Categories and Criteria. This system is designed to determine the relative risk of extinction, and the main purpose of the IUCN Red List is to catalogue and highlight those plants and animals that are facing a higher risk of global extinction (i.e. those listed as Critically Endangered, Endangered and Vulnerable). The IUCN Red List also includes information on plants and animals that are categorized as Extinct or Extinct in the Wild; on taxa that cannot be evaluated because of insufficient information (i.e., are Data Deficient); and on plants and animals that are either close to meeting the threatened thresholds or that would be threatened were it not for an ongoing taxon-specific conservation programme (i.e., are Near Threatened) (Figure 6-2).

Plants and animals that have been evaluated to have a low risk of extinction are classified as Least Concern. (IUCN.org).

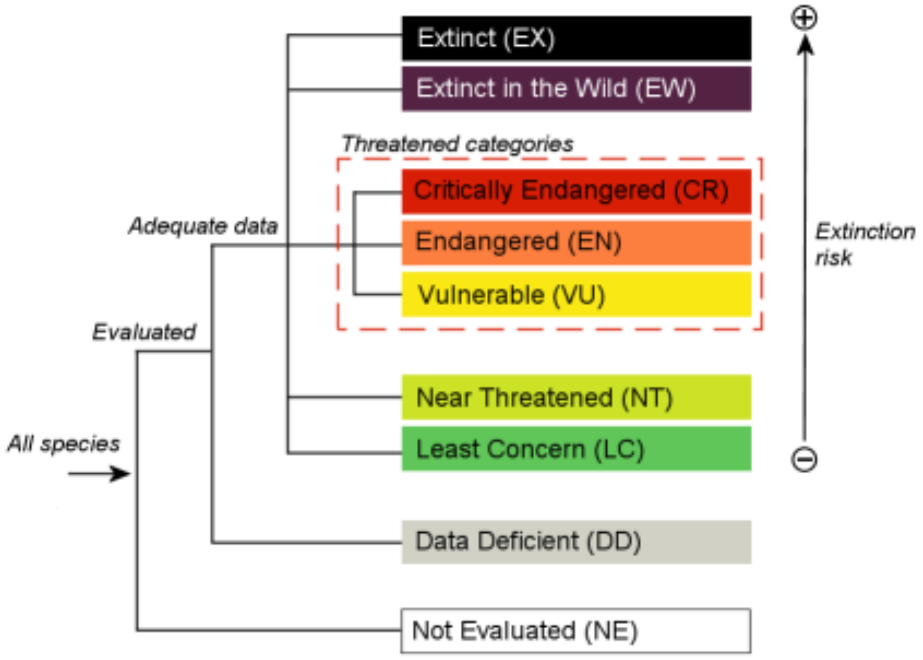

Figure 6-2: IUCN categories (IUCN.com)

7 KNOWLEDGE GAPS AND LIMITATIONS

The biggest limitation during the dry season was that a large portion of the natural habitat was destroyed by uncontrolled burning and this not only hindered the current sampling run, but also raised the question of the effect of frequency and timing of these fires on species composition and diversity.

8 RESULTS

8.1 Vegetation Survey

The results of both the wet and dry season vegetation surveys are summarised below.

8.1.1 Plant species recorded during the wet season survey

During the wet season survey, 88 plant species were recorded (Appendix 4Appendix 4). These species included two tree, nine shrub, one reed, six sedge, 33 grass and 35 herb species. From a

grass perspective twelve Decreaser grasses were observed in the area. Seven grasses are Increaser I species, with 16 climax grasses occurring in the project area, these are known to occur in underutilised veld (van Oudtshoorn, 1999). Furthermore, seven Increaser II grasses were recorded in the area, these species are abundant in over utilised veldt and therefore increase with excessive grazing. There were two Increaser III grasses species observed in the area. Five grasses recorded in the area were exotics, weed or alien invasive (Table 8-2).

The dry season survey resulted in 11 plant species being recorded (Appendix 4). This included one shrub, eight grasses and two herb species. One Decreaser grass was observed in the area. Six Increaser II grasses were recorded in the area. Increaser II grasses are abundant in overgrazed veld and include pioneer and subclimax species which will establish quickly on exposed ground (van Oudtshoorn, 1999). One of the grasses recorded in the area was exotic (*Paspalum dilatatum* or Dallis grass), (Appendix 4).

8.1.1.1 Red Data Plant Species

Three species listed as officially protected were recorded, namely *Gladiolus crassifolius, Kniphofia brachystachya* and *Gladiolus dalenii* (Table 8-1). According to Mpumalanga Nature Conservation Act, Act No. 10 (1998) Section (69) 1 (a) and (b), the species in Table 8-1 are protected from destruction or removal, without proper consent in the form of permits from the department.

Table 8-1: Red Data plant species that were recorded during both surveys.

Scientific Name	Common Name	Ecological Status	Form, Site found
Gladiolus crassifolius	Thick-leaved Gladiolus	MPB Protected	Shrub, 1
Gladiolus dalenii	Natal Lilly	MPB Protected	Shrub, 6, 19
Kniphofia brachystachya	Poker	MPB Protected	Shrub, 5, 11

8.1.1.2 Exotic and Invasive Plant Species

The Conservation of Agricultural Resources Act regards weeds as alien plants, with no known useful economic purpose that should be eradicated. Invader plants, also considered by the Act, are also of alien origin but may serve useful purposes as ornamentals, as sources of timber, or may have other benefits. These plants need to be managed and prevented from spreading.

Category 1 plants are weeds that serve no useful economic purpose and possess characteristics that are harmful to humans, animals or the environment. These plants need to be eradicated using the control methods stipulated in regulation 15.D of the Conservation of Agricultural Resources Act. Category 2 plants are plants that are useful for commercial plant production purposes but are proven plant invaders under uncontrolled conditions outside demarcated areas. Category 3 plants are mainly used for ornamental purposes in demarcated areas but are proven plant invaders under uncontrolled conditions outside demarcated areas. The planting of Category 2 and 3 plants should be confined to demarcated areas under controlled conditions of cultivation.

A total of 18 alien invasive species were observed during the wet season survey and 3 species were observed during the dry season (Table 8-2**)**. Alien invasive species tend to out compete the indigenous vegetation, this is due to the fact that they are vigorous growers that are adaptable and able to invade a wide range of ecological niches (Bromilow, 1995). They are tough, can withstand unfavourable conditions and are easily spread. This is indicative of early stages of succession and although these species are invasive their use in aid of the prevention of erosion, cannot be denied.

Table 8-2: Alien invasive and Weed species recorded

Scientific Name	Common Name	Ecological Status	Form
Amaranthus hybridus	Pigweed	Alien Invasive	Herb
Bidens pilosa	Common Black-jack	Alien Invasive	Herb
Cirsium vulgare	Scotch Thistle	Alien Invasive MPB alien cat. 1	Herb
Conyza albida	Tall fleabane	Alien Invasive	Shrub
Conyza bonariensis	Flax-leaf fleabane	Alien Invasive	Herb
Cortaderia selloana	Pampas grass	Alien Invasive MPB alien cat. 1	Grass
Cosmos bipinnatus	Cosmos	Alien Invasive	Shrub
Cyperus esculentus	Yellow Nut Sedge	Medicinal/Edible/Alien Invasive	Sedge
Eucalyptus camaldulensis	Red River Gum	Alien Invasive MPB alien cat. 2	Tree
Gomphocarpus fruticosus	Milkweed	Alien Invasive	Herb
Modiola caroliniana	-	Alien invasive	Herb
Oxalis latifolia	Pink Garden Sorrel	Alien invasive	Herb
Paspalum dilatatum	Dallis Grass	Exotic MPB alien	Grass
Paspalum urvillei	Vasey Grass	Sub climax Exotic	Grass
Persicaria lapathifolia	Spotted Knotweed	Alien Invasive	Herb
Persicaria serrulata	Knotweed/Snake Root	Alien Medicinal	Herb
Salix babylonica	Weeping Willow	Alien Invasive MPB alien	Tree
Solanum panduriforme	Yellow Bitter-apple	Medicinal Weed	Shrub
Tragus berteronianus	Carrot-seed Grass	Weed Increaser 2 - Pioneer	Grass
Typha capensis	Bulrush	Weed Alien Medicinal	Reed
Urochloa mosambicensis	Bushveld Signal Grass	Weed Increaser 2 - Pioneer to subclimax	Grass
Verbena bonariensis	Tall Verbena	Alien invasive MPB alien	Shrub

8.1.1.3 Medicinal Plant Species

Medicinal plants are important to many people and are an important part of the South African cultural heritage (Van Wyk et al, 1997). Plants have been used traditionally for centuries to cure many ailments, as well as for cultural uses such as building material and for spiritual uses such as charms.

During the wet and dry season, 15 medicinal plants were observed during field surveys. *Scabiosa columbaria* (Wild scabiosa) is used in traditional medicine to treat sterility, colic and sore eyes, and *Berkheya setifera* (Buffalo-tongue Berkheya) is traditionally used as a pot herb and in traditional medicine to treat stomach complaints (Pooley 1998).

Table 8-3: Medicinal plant species recorded.

Scientific Name	Common Name	Ecological Status	Form
Anemone caffra	Anemone	Medicinal	Herb
Aponogeton junceus	-	Medicinal	Aquatic herb
Becium obovatum	Cat's Whiskers	Medicinal	Herb
Berkheya setifera	Buffalo-tongue Berkheya	Medicinal	Herb
Berkheya speciosa	-	Medicinal	Herb
Haplocarpha scaposa	False Gerbera	Medicinal	Herb
Helichrysum aureonitens	Golden everlasting	Medicinal	Herb
Hibiscus trionum	Bladder Hibiscus	Medicinal	Herb
Hypoxis hemerocallidea	Star-flower	Medicinal	Herb
Polygala virgata	Purple broom	Medicinal	Shrub
Pycreus macranthus	-	Medicinal	Sedge
Scabiosa columbaria	Wild scabiosa	Medicinal	Herb
Senecio inornatus	-	Medicinal	Herb
Tephrosia purpurea	Silver Tephrosia	Medicinal	Herb
Solanum panduriforme	Yellow Bitter-apple	Medicinal Weed	Shrub
Cyperus esculentus	Yellow Nut Sedge	Medicinal/Edible/Alien Invasive	Sedge

8.1.1.4 Plant comunities

The plant communities described in this section occur within the boundaries of the areas of concern as a result of differentiating landscape features. These landscape features include altitude, degree of slope, rockiness, presence of moisture and soil type, and all affect the number and type of vegetation present. Vegetation assemblages can be viewed as plant species that thrive under similar habitat conditions (as described above), it therefore stands to reason that grouping

these plant assemblages contributes to the understanding of the driving forces present. Furthermore, the understanding of such driving forces aids in the formulation and implementation of habitat management plans. During field investigations one main community and two sub-communities were encountered. Listed in Appendix 5 is the species associated with the groups discussed below.

8.1.1.4.1 *Berkheya maritima - Themeda triandra* grassland

The grass layer is well developed with an average cover abundance of approximately 74%. The herb layer is fairly well developed with a cover abundance of approximately 17%. The tree and shrub layer is poorly developed with clustered individuals of *Eucalyptus camaldulensis* (sample plot 7) and no shrub layer.

The following sample plots are included within this plant community: 2, 3, 5, 7, 8, 9, 16, 17, 18, 19, 20, 21, 22, 23, and 24.

This grassland community is found in areas located on the slopes, higher than and leading to the valley bottoms. The diagnostic species are plants such as *Polygala virgata, Melinis nerviglumis, Crotalaria natalitia, Jamesbrittenia aurantiaca, Cymbopogon plurinodis, Solanum panduriforme, Anemone caffra* and *Wahlenbergia pallidiflora*. Most of the herbs found in this grassland are alien invasives.

The diagnostic grass species of this community are *Cymbopogon excavatus* and *Eragrostis racemosa* (Species Group A), and the herbs *Crotalaria natalitia* (Species Group G) and *Becium obovatum* (Species Group H).

The prominent grasses are *Chloris virgata* (Species Group F), *Melinis nerviglumis* (Species Group E), and *Cymbopogon plurinodis* (Species Group H).

The herbaceous layer is dominated by species such as *Haplocarpha scaposa* (Species Group F), *Hypoxis hemerocallidea* (Species Group C), *Amaranthus hybridus,* (Species Group H), *Helichrysum inornatum* (Species Group C). The tree layer is dominated by the alien invasive *Eucalyptus camaldulensis* (Species Group A).

8.1.1.4.1.1 Digitaria eriantha - Eustachys paspaloides sub-community

This sub-community is found in flat grasslands areas. The diagnostic species are grasses such as *Andropogon eucomus* and the reed *Phragmites australis* (Species Group E) and herbs such as *Wahlenbergia grandiflora* (Species Group A) and *Crotalaria obscura* (Species Group B).

The prominent species are the grasses, *Digitaria eriantha* and herb *Jamesbrittenia aurantiaca* (Species Group G), *Tristachya leucothrix* (Species Group B), *Geigeria burkei* (Species Group E), and *Polygala virgata* (Species Group C).

The prominent tree species are *Salix babylonica* and *Eucalyptus camaldulensis* (Species Group A)

8.1.1.4.1.1.1 *Eragrostis cilianensis - Setaria sphacelata* sub comunity

This sub community is found in moderetly disturbed areas adjacent to either a secondary road or mielie fields. This variant is characterised by Species Group H. The diagnostic species are *Scirpus ficinioides, Amaranthus hybridus* and *Setaria sphacelata.*

The prominent species in the grass layer are *Cymbopogon plurinodis, Solanum panduriforme* and *Haplocarpha scaposa.*

8.1.1.4.1.1.1.1 Cenchrus ciliaris- Persicaria serrulata community

This variant is characterised by Species Group N. The diagnostic species are *Anthephora pubescens,* and *Bothriochloa radicans.*

The dominant species are the grasses *Cynodon dactylon* (Species Group O), *Berkheya speciosa, Cymbopogon validus* (Species Group I) and *Eragrostis curvula* (Species Group J), *Senecio inornatus* (Species Group Q). The herbaceous layer is dominated by species such as *Cosmos bipinnatus* (Species Group Q), *Cirsium vulgare,* (Species Group P), and *Persicaria lapathifolia* (Species Group M).

8.1.1.4.1.2 Oxalis latifolia - Conyza albida Sub comunity

This sub community is also found in highly disturbed grasslands and is represented by Species Group K and L. The diagnpostic species are *Andropogon appendiculatus, Helichrysum cephaloideum,* and *Kniphofia brachystachya*

8.1.1.5 Descriprion of dry season plant communities

Dry season plant communities were not delineated due to the absence of suitable data sets, primarily due to unmanaged burning taking place in the area.

8.2 Animal Survey

8.2.1 Mammals

8.2.1.1 Mammals observed and recorded in the area

Actual sightings, spoor, calls, dung and nesting sites were used to establish the presence of animals on the proposed project site. The evidence of dung and spoor suggests that animals were present in the area although very few were recorded during the surveys. Traps were placed close to fresh burrows in an attempt to identify smaller mammals in the area. Table 8-4 lists all mammals observed during wet and dry season surveys, by both DWA specialists and resident farmers. During the course of personal consultation with landowners, Mr Chris Rossouw Senior indicated that Serval (*Leptailurus serval*) is present in the area, as he has observed one.

Table 8-4:.Mammals known to occur on the Kangala Mine site

Genus	Species	English name	Status	Observation Method	Sample plot observed
Sylvicapra	*grimmia*	Common duiker*	Least concern	Visual	2, 23
Cynictis	*penicillata*	Yellow mongoose*	Least concern	Visual	25, 8
Pedetes	*capensis*	Springhare*	Least concern	Visual	15, 23
Canis	*mesomelas*	Black-backed Jackal#	Least concern	-	-
Hystrix	*africeaustralis*	Porcupine# *	Least concern	Visual	11
Leptailurus	*serval*	Serval#	Near Threatened	-	-
Raphicerus	*campestris*	Steenbok#	Least concern	-	-

Note: **(**#) denotes observed by farmers in the area

(*) denotes observed by DWA specialists

The Serval (*Leptailurus serval)* is a Red Data Status mammal considered to be Near Threatened. The preferred habitat of the Serval is dense vegetation, particularly reeds, grass and thickets bordering streams and rivers. They are rarely found far from water. Their diet consists of guinea fowl and other game birds, rodents, hares and even fish and small reptiles. Vlei Rats are a favourite food source and these are found in grasslands and wetland areas such as marshes and

swamps. The decline of grasslands and wetlands over time has been detrimental to the survival of the species and management is needed to conserve non-fragmented prime habitat.

Apart from the threat that human beings and mining activities will place on the Serval population, the reduction in suitable habitat is of concern. Should their suitable habitat and food source be removed, these animals will move away from the site in search of safety, shelter and food. The wetland areas are of particular importance as a source of food and for shelter. If these habitats are destroyed during the proposed mining operation the availability of other suitable wetlands in the surrounding areas needs to be investigated to be sure that successful relocation is appropriate. In order for these animals to return to the area once mining is complete and rehabilitation has taken place it is imperative that these areas are rehabilitated to a state equally good, if not better, than prior to mining. For these apex predators to return to the area the food chain on which they rely must first be restored

Represented in Table 8-5 are the mammal species of special concern, this species list is included as it contains mammal species that have been observed during Nkangala State of the Environment report studies (SoER) in the area of interest and therefore they have a high probability of occurring in areas where favourable habitat exists (CSIR, 2006).

Table 8-5: Red data mammal species that could possibly occur in the area

Genus	Species	English name	Status
Ourebia	*ourebi*	Oribi	Endangered
Damaliscus	*lunatus lunatus*	Tsessebe	Endangered
Hyaena	*brunnea*	Brown Hyaena	Near Threatened
Mellivora	*capensis*	Honey Badger	Near Threatened
Poecilogale	*albinucha*	African Weasel	Data deficient
Lutra	*maculicollis*	Spotted-necked Otter	Near Threatened
Rhynchogale	*melleri*	Meller's Mongoose	Data deficient
Miniopterus	*schreibersii*	Schreiber's Long-fingered Bat	Near Threatened
Myotis	*tricolor*	Temminck's Hairy Bat	Near Threatened
Myotis	*welwitschii*	Welwitsch's Hairy Bat	Near Threatened
Rhinolophus	*clivosus*	Geoffroy's Horseshoe Bat	Near Threatened
Rhinolophus	*darlingi*	Darling's Horseshoe Bat	Near Threatened
Atelerixs	*frontalis*	South African Hedgehog	Near Threatened
Crocidura	*mariquensis*	Swamp Musk Shrew	Data deficient
Crocidura	*cyanea*	Reddish-grey Musk Shrew	Data deficient
Crocidura	*flavescens*	Greater Musk Shrew	Data deficient
Crocidura	*fuscomurina*	Tiny Musk Shrew	Data deficient

Crocidura	*hirta*	Lesser Red Musk Shrew	Data deficient
Suncus	*infinitesimus*	Least Dwarf Shrew	Data deficient
Suncus	*lixus*	Greater Dwarf Shrew	Data deficient
Suncus	*varilla*	Lesser Dwarf Shrew	Data deficient
Graphiurus	*platyops*	Rock Doormouse	Data deficient
Lemniscomys	*rosalia*	Single-striped Mouse	Data deficient
Tatera	*leucogaster*	Bushveld Gerbil	Data deficient
Elephantulus	*brachyrhynchus*	Short snouted Elephant shrew	Data deficient
Manis	*temminckii*	Pangolin	Vulnerable

8.2.2 Birds

8.2.2.1 Birds observed and recorded in the area

A total of 30 bird species were identified during the wet season survey (Table 8-6). Most of these birds were observed in the vicinity of less disturbed areas, tall trees such as Red River Gum (*Eucalyptus camaldulensis)* and Weeping Willow *(Salix babylonic)a* occur. Many were also identified close to the dam on the southern corner of the project area, with birds regularly seen feeding on dried mielie kernels on the edges of mielie fields.

Table 8-6. Bird species recorded during the wet season survey

Scientific	**English Name**	**Residency**	**Rareness**	**SA Red Data Status**	**IUCN Status**
Phalacrocorax lucidus	Whitebreasted Cormorant	Resident	Common	Not threatened	
Anhinga rufa	Darter	Resident	Common	Not threatened	Least Concern
Chlidonias hybrida	Whiskered Tern	Resident	Locally common	Not threatened	Least Concern
Egretta alba	Great White Egret	Resident	Common	Not threatened	
Egretta garzetta	Little Egret	Resident	Common	Not threatened	Least Concern
Bubulcus ibis	Cattle Egret	Resident	Common	Not threatened	Least Concern
Ardea melanocephala	Blackheaded Heron	Resident	Common	Not threatened	Least Concern
Ardea cinerea	Grey Heron	Resident	Common	Not threatened	Least Concern
Scopus umbretta	Hamerkop	Resident	Common	Not threatened	Least Concern
Bostrychia hagedash	Hadeda Ibis	Resident	Common	Not threatened	Least Concern

Dendrocygna viduata	Whitefaced Duck	Resident	Common	Not threatened	Least Concern
Thalassornis leuconotus	Whitebacked Duck	Resident	Uncommon	Not threatened	Least Concern
Anas undulata	Yellowbilled Duck	Resident	Common	Not threatened	Least Concern
Fulica cristata	Redknobbed Coot	Resident	Common	Not threatened	Least Concern
Gallinula chloropus	Commen Moorhen	Resident	Common	Not threatened	Least Concern
Vanellus armatus	Blacksmith Plover	Resident	Very Common	Not threatened	Least Concern
Burhinus capensis	Spotted Dikkop	Resident	Common	Not threatened	Least Concern
Coturnix coturnix	Common Quail	Resident//Non-breeding migrant/Breeding migrant	Common	Not threatened	Least Concern
Pternistis swainsonii	Swainson's Francolin	Near Endemic	Common	Not threatened	
Numida meleagris	Helmeted Guineafowl	Resident	Very Common	Not threatened	Least Concern
Elanus caeruleus	Blackshouldered Kite	Resident	Common	Not threatened	Least Concern
Buteo vulpinus	Steppe Buzzard	Non-breeding migrant	Common	Not threatened	
Streptopelia senegalensis	Laughing Dove	Resident	Very Common	Not threatened	Least Concern
Streptopelia capicola	Cape Turtle Dove	Resident	Very Common	Not threatened	Least Concern
Urocolius indicus	Redfaced Mousebird	Resident	Common	Not threatened	Least Concern
Passer melanurus	Cape Sparrow	Near Endemic	Very Common	Not threatened	Least Concern
Ploceus velatus	Masked Weaver	Resident	Common	Not threatened	Least Concern
Euplectes orix	Red Bishop	Resident	Common	Not threatened	Least Concern
Euplectes afer	Golden Bishop	Resident	Locally common	Not threatened	Least Concern
Euplectes ardens	Redcollared Widow	Resident	Locally common	Not threatened	Least Concern

8.2.2.2 Red Data birds

No rare or endangered species were observed during the wet and dry season's survey. This does not mean that none occur here ,but merely that none were recorded during this survey.

8.2.3 Reptiles

No reptile species was observed during the wet season or dry season surveys.

8.2.4 Amphibians

During the wet season studies the following amphibian species were encountered in the study area, these species were found in the vicinity of permanent water bodies (Table 8-7).

Table 8-7: Amphibian species encountered

Family	Genus	species	Common name	IUCN Status	Habitat	Breeding sites
Ranidae	*Strongylopus*	*fasciatus*	Striped Stream Frog	Least Concern	Savanna Grassland Fynbos	Streams Pans Dams Seepage areas Grassy margined waters
Bufonidae (Toads)	*Bufo*	*gutturalis*	Guttural toad	Least Concern	Savanna Grassland	Semi-permanent water Open pools Dams Streams Pans
Bufonidae (Toads)	*Bufo*	*rangeri*	Raucous Toad	Least Concern	Fynbos Grassland Woodland	Semi-permanent water Permanent water Rivers Streams Ponds
Pipidae	*Xenopus*	*laevis*	Common Platanna	Least Concern	Savanna Grassland Fynbos Semi-desert Desert	Permanent water

8.2.5 Terrestrial Invertebrates

With the good representation in the area of interest being mielie fields and valley bottom grasslands containing wetland areas, a high volume of green foliage is available as food for insects, therefore one can expect a fair representation of terrestrial invertebrates.

The Reduviidae family had the highest species richness followed by the Meloidae family, during the wet season sampling. In Table 8-8 the insects collected from grasslands and their abundances is shown.

Table 8-8. Total number of families found at Kangala during the wet season

	Families	**Total Abundance**
1	Acanthosomatidae	1
2	Acrididae	25
3	Alydidae	8
4	Asilidae	6
5	Carabidae	1
6	Ceratopogonidae	1
7	Chironomidae	12
8	Chrysomelidae	26
9	Chrysopidae	4
10	Cicadellidae	1
11	Coccinellidae	29
12	Coenagrionidae	1
13	Coreidae	5
14	Curculionidae	1
15	Drosophiliidae	4
16	Eumenidae	16
17	Formicidae	4
18	Mantidae	2
19	Meloidae	36
20	Muscidae	12
21	Noctuidae	1
22	Pentatomidae	10
23	Phycitidae	4
24	Reduviidae	76
25	Scutelleridae	2
26	Sepsidae	1
27	Sphecidae	7
28	Syrphidae	3
29	Tenebrionidae	18
30	Tingidae	2
31	Tipulidae	1

9 DISCUSSION

9.1 Vegetation

Grass plays an essential role as a food source and shelter in most habitats. The main reason for this is that grass occurs widely over the sub-continent and is almost always edible. Grass usually forms the basis of food chains with animals at the bottom of the food chain being directly dependent on it and therefore predators indirectly dependent on it. In the area of interest it was found that only areas located in the valley bottoms harboured natural grassland and certain wetland species. These areas are associated with seasonal wetness and as such is not utilised by farmers for agriculture. Furthermore, the farmers in the areas bordering the natural low lying grassland, burn the dry stumps of mielie plants to prepare for the planting season and this practice sets alight the grasslands, and it appears to be happening every season. Even though grasslands have evolved under a regime of seasonal mosaic burning, complete regular burning such as what is taking place in the project areas is detrimental to the species composition of the specific area (Tainton 1999).

9.2 Mammals

Common/Grey duiker was observed during both the dry and wet seasons surveys. These species can survive and flourish in a wide range of habitats (Kingdon 1997) and the fact that it could be identified in both seasons proves that point. Large and medium sized herbivores are actively hunted and if not, excluded from properties by farm owners, as a result very few wild animals were expected to occur on the farms of interest. The very low numbers of actual wild animal sightings confirmed this. The pans provide watering points for the existing wildlife. The presence of Serval (*Leptailurus serval)* indicates that these species might not be actively prosecuted and this could be because natural prey exists in the study area. With the abundance of mielie fields and the subsequent availability of food one can assume the presence of rodents. This and the presence of preferred habitat (reed beds and marshes) could indicate the reason for a small population of these animals is surviving.

9.3 Birds

During the wet and dry season field excursions 30 bird species were observed, most of which were observed at the dam and wetland in the south west of the property, at sampling points S1

and S7. Furthermore, most of the birds were either water birds (Egrets, Cormorants and Ducks) or seed eating birds (Quail, Franklin and Guineafowl), which is to be expected as the dominant land use in the area is mielie farms which is a great source of food for seed eaters.

9.4 Insects

Invertebrate collection took place during the wet season only as burnt dry season conditions did not allow sampling during this time. Insects are normally found in abundance after big rains and they stay dormant during the winter season (Elzinga 2000). Of the 320 species found during the wet season, 76 (23%) fall under the Reduviidae family better known as the assassin bug family The nymph of this family feeds on green leaves abundant in mielie fields, which could explain their abundance during the wet season. Second most abundant insect species found was the Meloidae or blister beetles with 11.0%, followed by Coccinellidae, with 9 %.

9.5 Reptiles

The fact that no reptile species were encountered during the field surveys could be attributed to positioning of the study area in the landscape. The preferred habitat for reptiles is rocky areas and these were not present in the area surveyed.

9.6 Amphibians

The presence of amphibian species was investigated during the wet season only, with four species encountered, all of which can be expected to occur in the Mpumalanga grasslands. Because amphibians are ectothermic they are most active when their surrounding temperature stabilises between 20˚C and 30˚C, which is why they hibernate in burrows or damp retreats during winter times when temperatures regularly fall below 20˚C (Du Preez and Caruthers 2009).

In summer rainfall areas breeding usually takes place after the first thunder storms. It therefore stands to reason that amphibian field surveys are most successful during the rain season. With the available habitat present on the area of interest, it was expected to encounter amphibian species. However, after the dry season field visit it was evident that the threats present in the study area was having a serious effect on the population of amphibians. The biggest threat observed was uncontrolled burning by local farmers, this practice not only destroys the habitat (plants for shelter and food) but also directly kills the amphibians that cannot avoid the flames.

10 CUMULATIVE IMPACTS

According to the Mpumalanga Biodiversity conservation plan handbook the Mpumalanga province is categorised in six biodiversity conservation categories for terrestrial ecosystems using systematic biodiversity planning methods. In Table 10-1 one can see the six categories and the relevant percentages of each one in the province. In Appendix 1 a visual representation of the six categories show that the study area consists of two terrestrial categories, these are Least concern and No habitat remaining, these categories make up the majority of the province. Furthermore, three tributaries consisting of wetland vegetation (Ferrar and Lotter 2007), also exist on the area of interest.

The main threat to natural areas/biodiversity is the reduction of viable habitat, which can be contributed to the following, human settlement and urban development, mining, industry and manufacturing, energy, transport, agricultural activities and tourism and recreation (Ekurhuleni SoER 2003). All of the above with the possible exception of tourism and recreation are currently exerting pressure on the study area (area in general) by reducing the viable natural land. If the cumulative impacts of all the above mentioned seven threats are taken into account, the outcome is the percentages displayed in Table 10-1. The No natural habitat remaining is the category in which most threats can be categorised, and the transformation of the natural habitat from Protected areas to No natural Habitat remaining is driven by the seven threats.

Table 10-1: Terrestrial biodiversity conservation categories (Ferrar and Lotter 2007)

Category	**Percentage**
Protected areas	14.8% (10.4% KNP)
Irreplaceable	2.4%
Highly Significant	12.3%
Important and necessary	9.5%
Least concern	25.5%
No natural habitat remaining	35.8%

The reduction in natural habitat has taken place because of the current and continuing land use within the study area, which is agricultural, the change in land use from agricultural to mining will not have such a negative effect as changing land use from pastures to mining, for example. The main reason for this is the presence of natural habitat in pastures that could support fauna species.

Therefore the immediate and direct negative effect of this project on the natural environment is not seen as significant. However as illustrated previously the cumulative effects of threats in the general area and province is of serious concern and needs urgent attention. As this document only discusses the current project, mitigation measures suggested in this document is only relevant for this project.

It is imperative that the mitigation measures set forth in this document is strictly adhered to as to reduce the contribution this project could have to the Least concern and No natural habitat remaining categories.

11 CONCLUSION

The land capability of any area should be well studied and seen as very important when a change in land use is proposed. An area might have high agricultural potential or/and high potential to sustain natural habitats, if these land uses are not already taking place. During the planning phase and the changing of land use, land capability must be kept in mind as this could bring about considerable cost saving later on in a project, most notably during closure and rehabilitation phase.

By protecting designated areas within a mining concession area from the negative effects of mining, the land capability of these areas could be used to facilitate rehabilitation. These designated areas could hold great potential from a natural fauna and flora perspective by creating refuge for plant and animal species thereby creating a source within an area that is seen as a sink. With adequate conservation planning and implementation, these protected natural areas could be linked to form corridors of natural habitat whereby sources and sinks will be linked to form a larger area of conservation. With the creation of these corridors the ecological functioning of areas previously disturbed could be restored, once such an area is linked to a suitable source

population. Natural corridors exist throughout the Kangala project area, these are the lowlying wetland and hill slope areas that are unsuitable for agricultural purposes.

During the field investigations it was found that these valley bottom and hill slope areas were not managed to exploit their full potential. These areas were also the only areas where natural vegetation was found, suitable to sustain small fauna species.

The destruction of the remnant grassland has resulted in habitat destruction impacting negatively on fauna and this is the case on the site in question and the surrounding areas. During the survey it was found that small scale fragmentation has already occurred within the site and in the surrounding area, mainly due to human intervention either in the form of livestock grazing or agricultural activities.

The fauna and flora survey suggests that parts the area has been misused in the past, and this is reflected in the vegetation found on site. The overall impact of the proposed development will be negative however the mitigation measures suggested will minimise these impacts.

12 DESCRIPTION OF POTENTIAL IMPACTS

The following section describes the potential impacts that the proposed mining activities could have on the local fauna and flora. For more information on the proposed mine plan, please refer to the EIA. Acitivity numbers correspond with the listed activities in the EIA.

11.1 Construction phase

Activity 2: Traffic on site

This activity will be associated with all heavy duty transport of materials and general operating of vehicles. It is likely that the increase in vehicle use will cause further damage (deterioration) to the informal roads which will result in further exposure of non-vegetated areas increasing the potential for erosion and sedimentation during rainfall periods. The increase in vehicle numbers will also increase the potential of spillages and leaks from operating vehicles which will have a negative impact on vegetation growth and even rehabilitation. Dust created during activity could have a detrimental effect on plant evapotranspiration. This activity is considered to be ongoing through the life of mine and long term in duration and also site specific with regards to extent of impacts. The severity of the impact was determined to be minor.

Activity 3: Storage of fuel, lubricant and explosives

The storage of fuel, lubricant and explosives will be required for the life of mine. Incorrect, inadequate or negligent storage of these materials may result in the potential pollution of surface water and top soil resources due to pollutant and toxicant spillages and leaks which may impact negatively on the water (drinking) and soil quality (plant growth) availability to plants and subsequently animals. Such spills will also negatively affect the ecological functioning of the systems . This activity is considered to be medium in duration as it will be required for the life of mine. The impact will be local in extent. The severity of the impact was determined to have moderate effects.

Activity 4: Site clearing and topsoil removal

The existing vegetation within the proposed area of development will be impacted on as the existing vegetation will be removed to facilitate the construction of mining related infrastructure. This will include the continuous and complete removal of vegetation and soil as the opencast pit is excavated. This activity is considered to be medium term during life of mine as it will be required for the construction and operating phases of the mine. The impact will be site specific in extent with impacts likely to occur on site. The severity of the impact was determined to be medium.

The partial degradation of natural vegetation and habitat for animal life has already taken place within the surrounding environment due to current land use practices. The destruction of the areas with undisturbed natural grassland will result in the permanent reduction of natural habitat of reptiles, birds, frogs, insects and mammals present within the areas. The grassland and surrounding vegetation offers habitat to certain birds, reptiles, frogs, insects and mammals that could be present. The impact will be site specific in extent with impacts likely to occur on site. The severity of the impact was determined to be moderate.

Activity 5: Construction of surface infrastructure

The construction of discard dumps, pollution control dams, offices, sewage treatment facility and other infrastructure will increase the favourable habitat for alien invasive plant species to establish themselves, primarily due to open/cleared ground being available to the very efficient establishment strategies of alien invasive plant species. The area designated for surface infrastructure will no longer allow for seepage of surface water into underground aquifers due to

the hardening of surfaces. The infiltration will increase the surface water run off, which in turn will increase erosion that will lead to loss of topsoil, which is detrimental to plant species. This activity is considered to be short term in duration as well as local in extent. The severity of the impact was determined to be minor.

Activity 6: Establishment of initial boxcut and access ramps

The establishment of the mining area by means of an initial boxcut will remove soil and vegetation. There will be a reduction in availability of soil for plant establishment, which will bring about a net loss of vegetation. This activity is considered to be long term in duration as it will be required for the life of mine. The impact will be site specific in extent with impacts likely to occur on site. The severity of the impact was determined to be medium.

11.2 Operational phase

Activity 10: Topsoil and overburden removal and stockpiling

The removal of topsoil and overburden will result in stockpiling of the material which will increase the potential of the stockpiles becoming eroded as a result of winds and rain moving across the areas. As the only vegetation present on the actual footprint is mielie fields, the removal of these plants will negatively affect soil binding, and surface runoff. This activity is considered to be medium in duration as it will be required for the construction and operational phases. The impact will be site specific in extent with impacts likely to on site. The severity of the impact was determined to be low.

Activity 13: Vehicular activity on haul roads

The vehicular activity will result in the creation of soil based as well as coal dust which will increase the deposits these materials on plant leaves, blocking stomata and inhibiting evapotranspiration. Natural dust will be created from use of the haul road and coal dust will be created during transport by haul trucks. This will impact on the vegetation health and availability as food items as well as inhibit the ability of the plants units to provide ecological services. This activity is considered to be medium in duration as it will be required for the operational phase. The impact will be site specific in extent with impacts likely to occur on site. The severity of the impact was determined to be minor.

Activity 19: Concurrent replacement of overburden and topsoil and re-vegetation

This may be considered to be a positive impact if implemented properly. The replacement of overburden and topsoil throughout the operational phase may result in the reduction of available space for alien invasive species, soil erosion and soil compaction, associated with top soil storage areas. This activity will create favourable habitat for indigenous plant species, and promote rehabilitation efforts. This activity is considered to be medium in duration as it will be required for the operational phase as well as the decommissioning phase. The extent will be site specific with effects being on site. The severity of the impact was determined to be moderate.

11.3 Decommissioning phase

Activity 21: Demolition of infrastructure no longer required

The demolition and removal of infrastructure may result in impacts to vegetation, as large machinery is needed for removal of infrastructure. Of concern here is the destruction of vegetation, creation of favourable habitat for fast growing invasives and ground compaction. Also of concern are the possible spillages from infrastructure holding hazardous material. These spillages and leaks may be considered for infrastructure such as sewerage and waste facilities, toxicant, pollutant and fuel storage infrastructure and general vehicle use. In the event that this infrastructure is not demolished properly and with caution, resulting spillages and leaks would impact on vegetation and soil quality. The demolition of infrastructure may require vehicles making use of non-designated areas, special care must be taken not to destroy rehabilitated areas. This activity is considered to be short in duration as well as site specific in extent with impacts being on site. The severity of the impact was determined to be minor.

Activity 22: Final replacement of overburden and topsoil and revegetation

This may be considered to be a positive impact if implemented properly. The replacement of overburden and topsoil throughout the life of mine as well as the final replacement during the decommissioning phase may result in the restoration of the natural vegetation. This activity is considered to be medium in duration as it will be required for the decommissioning phase. The extent will be site specific with effects being on site. The severity of the impact was determined to be moderate.

13 DESCRIBED MITIGATION MEASURES

The objectives described for the recommended mitigation and/or management measures for each identified impact associated with each activity are presented below in Table 13-1. This table lists the relevant activities for each phase of the mining operation and provides information pertaining to the legal requirements, recommended actions plans, timing, responsible person and significance after mitigation.

Table 13-1: Recommended mitigation measures for the identified impacts associated with each activity.

Activity	Objectives	Mitigation/Management measure	Frequency of mitigation	Legal Requirements	Recommended Action Plans	Timing of implementation	Responsible Person	Significance after Mitigation
CONSTRUCTION PHASE								
Traffic on site	Limit the footprint of the disturbed areas	Make use of existing roads and/or areas and roads designated for the mining operation	Weekly	National Environmental Act (NEMA), 1998 (Act no. 107 0f 1998)	Rehabilitation and Closure Plan	Construction, operational and Decommissioning phases.	Environmental Co-ordinator	Minor
	Avoid impacts to vegetation and soil through spillages and leaks	Proper maintenance of operating vehicles and regular vehicle inspections.	Weekly	National Environmental Act (NEMA), 1998 (Act no. 107 0f 1998)	Monitoring Plans	Construction, operational and Decommissioning phases.	Environmental Co-ordinator	Minor
	Limit the negative effects of excessive dust	Remove lose earth from the road sides. Periodic spraying of roads with water.	Daily	National Environmental Act (NEMA), 1998 (Act no. 107 0f 1998)	Rehabilitation	Construction, operational and Decommissioning phases.	Environmental Co-ordinator	Minor
Storage of fuel,	Avoid impacts to	The storage of materials and	Weekly	National	Possible removal and	Construction,	Environmental	Minor

lubricant and explosives	vegetation and soil by means of leaks and spillages.	substances will be housed in suitable facilities. Management of these facilities will be ongoing and this will include regular inspections to detect faults/issues.		Environmental Act (NEMA), 1998 (Act no. 107 0f 1998)	replacement of facilities, or repair of existing facilities.	operational and Decommissioning phases.	Co-ordinator	
Site clearing and topsoil removal	Limit degradation and destruction of natural environment to designated project areas	Keep the footprint of the disturbed area to the minimum and designated areas only. Vegetate and wet stockpiles to limit erosion. Berms created below the piles to trap particles and runoff from the stockpile	Daily	National Environmental Act (NEMA), 1998 (Act no. 107 0f 1998)	Removal of lose sediment and rehabilitation of exposed areas	Construction and operational phases	Environmental Co-ordinator	Moderate alteration
	Restrict alien invasive plant recruitment	Removal of vegetation during stripping and dump operation will be minimised to reduce the risk of open areas occurring.	Daily	Conservation of Agricultural resources Act (CARA), 1983 (Act no. 43 0f 1983)	Rehabilitation	Construction and operational phases	Environmental Co-ordinator	Moderate alteration
Construction of surface infrastructure	Limit areas suitable for alien invasive recruitment	Removal of vegetation during construction of infrastructure will be minimised to reduce the risk of open areas occurring.	Weekly	Conservation of Agricultural resources Act (CARA), 1983 (Act no. 43 0f 1983)	Rehabilitation	Construction and operational phases	Environmental Co-ordinator	Minor
	Limit the erosion potential of the site	Make use of permeable materials for pavements and walk-ways. Introduce a storm water management programme and create flower beds below the street level.	Monthly	National Environmental Act (NEMA), 1998 (Act no. 107 0f 1998)	Removal of lose sediment and rehabilitation of exposed areas	Construction and operational phases	Environmental Co-ordinator	Minor

Establishment of initial boxcut and access ramps	Removal of vegetation during boxcut construction will reduce available areas for plant recruitment.	The establishment of the boxcut air unavoidable, no mitigation is possible.	Daily	National Environmental Act (NEMA), 1998 (Act no. 107 0f 1998)	Rehabilitation	Construction phase	Environmental Co-ordinator	Very significant
Temporary waste and sewerage handling and treatment	Avoid impacts to water quality and wetland functioning through spillages and leakages.	A waste water management system will be introduced on site to ensure that potential pollution of the water resource will be minimised	Weekly	National Environmental Act (NEMA), 1998 (Act no. 107 0f 1998)	Possible removal and replacement of facilities, or repair of existing facilities.	Construction, operational and Decommissioning phases.	Environmental Co-ordinator	Minor
OPERATIONAL PHASE								
Topsoil and overburden removal and stockpiling	Limit erosion of exposed areas and stockpiles.	Keep the footprint of the disturbed area to the minimum and designated areas only. Vegetate and wet stockpiles to limit erosion. Berms created below the piles to trap particles and runoff from the stockpile	Daily	National Environmental Act (NEMA), 1998 (Act no. 107 0f 1998)	Removal of lose sediment and rehabilitation of exposed areas	Construction and Operational phases	Environmental Co-ordinator	Moderate alteration
Vehicular activity on haul roads	Prevent excess dust creation, that could inhibit plant growth	Wetting of the haul road to suppress dust creation as well as cover haul trucks to prevent dust emissions during transport.	Weekly	National Environmental Act (NEMA), 1998 (Act no. 107 0f 1998)	Continuous wetting of operating areas	Operational phase	Environmental Co-ordinator	Minor
Concurrent replacement of overburden and	Reduce areas available for alien infestation	The footprint of the area disturbed by the mining operation will have natural vegetation restored.	Daily	Conservation of Agricultural resources Act (CARA), 1983	Soils to be stockpiled and managed properly for	Operational phase	Environmental Co-ordinator	Serious (Positive)

				(Act no. 43 0f 1983)	rehabilitation			
topsoil and revegetation	Limit the erosion potential of exposed areas.	Exposed areas will be re-vegetated	Weekly	National Environmental Act (NEMA), 1998 (Act no. 107 0f 1998)	Removal of excess sediment and low gradient rehabilitation where possible.	Operational phase	Environmental Co-ordinator	Serious (Positive)
	Restore water infiltration, and reduce surface water runoff	Re-vegetated areas will form seepage areas which will help aid infiltration.	Weekly	National Environmental Act (NEMA), 1998 (Act no. 107 0f 1998)	Restore of wetland areas and low gradient rehabilitation to create seepage units.	Operational phase	Environmental Co-ordinator	Serious (Positive)
DECOMMISSIONING PHASE								
Demolition of infrastructure no longer required	Avoid spillage of hazardous materials, thereby protecting vegetation and soil.	The correct and careful handling of the infrastructure housing pollutants and toxicants to prevent spillages and leaks	Daily	National Environmental Act (NEMA), 1998 (Act no. 107 0f 1998)	Continuous inspection and management of the removal process to detect issues.	Decommissioning phase	Environmental Co-ordinator	Minor
	Avoid destruction of vegetation, the creation of favourable habitat for fast growing invasive plants and ground compaction.	Vehicles to make use of existing roads and designated areas. Avoid rehabilitated and natural habitat areas as far as possible.	Daily	National Environmental Act (NEMA), 1998 (Act no. 107 0f 1998)	Rehabilitation of impacted wetland areas	Decommissioning phase	Environmental Co-ordinator	Minor
Final replacement of overburden and	Restore natural vegetation	The footprint of the area disturbed by the mining operation will have	Daily	National Environmental Act	Rehabilitation to represent original	Decommissioning phase	Environmental	Serious (Positive)

		topsoil and overburden replaced to restore the vegetation cover.		(NEMA), 1998 (Act no. 107 0f 1998)	contours and topography		Co-ordinator	
topsoil and revegetation	Limit the erosion potential of exposed areas.	Exposed areas will be re-vegetated	Weekly	National Environmental Act (NEMA), 1998 (Act no. 107 0f 1998)	Removal of excess sediment and low gradient rehabilitation where possible.	Decommissioning phase	Environmental Co-ordinator	Serious (Positive)

14 COMMENTS RECEIVED

No comments at present from authorities were received for this project.

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Appendix 1. Map indicating the Sensitivity areas within the study area.

Appendix 2. Specialist declerarion of independence

SPECIALIST DECLARATION OF INDEPENDENCE

I, Rudolph Greffrath , declare that I –

- Act as the independent specialist for the undertaking of a specialist section for the proposed biodiversity assessment;
- Do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2006;
- Do no have nor will have a vested interest in the proposed activity proceeding;
- Have no, and will not engage in, conflicting interests in the undertaking of the activity;
- Undertake to disclose, to the competent authority, any information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the Environmental Impact Assessment Regulations, 2006;

____ _Rudolph Greffrath_____

Name of the specialist

Signature of the specialist

DIGBY WELLS & ASSOCIATES

Name of company

Date

Appendix 3: Sampling points in the study areas.

Appendix 4: Plant species recorded during wet and dry season survey in Kangala

Wet Season

Scientific Name	Common Name	Ecological Status	Form
Amaranthus hybridus	Pigweed	Alien Invasive	Herb
Andropogon appendiculatus	Vlei Bluestem	Decreaser - Climax	Grass
Andropogon eucomus	Snowflake grass	Increaser 2 - Subclimax	Grass
Anemone caffra	Anemone	Medicinal	Herb
Anthephora pubescens	Wool grass	Climax Decreaser	Grass
Aponogeton junceus	-	Medicinal	Aquatic herb
Argyrolobium tuberosum	Little Rusett pea	-	Herb
Becium obovatum	Cat's Whiskers	Medicinal	Herb
Berardia species	-	-	Herb
Berkheya maritima	-	-	Herb
Berkheya setifera	Buffalo-tongue Berkheya	Medicinal	Herb
Berkheya speciosa	-	Medicinal	Herb
Berkheya umbellata	-	Traditional	Herb
Bewsia biflora	False Love Grass	Climax Grass	Grass
Bidens pilosa	Common Black-jack	Alien Invasive	Herb
Bothriochloa radicans	Stinking grass	Subclimax Increaser 2	Grass
Brachiaria brizantha	Common signal grass	Climax Increaser 1	Grass
Cenchrus ciliaris	Foxtail Buffalo grass	Subclimax climax Decreaser	Grass
Chaetacanthus burchellii	Fairy stars	-	Shrublet
Chamaecrista comosa	Trailing dwarf cassia	-	Herb
Chloris virgata	Feather top chloris	Pioneer increaser 2	Grass
Cirsium vulgare	Scotch Thistle	Alien Invasive 1	Herb
Clutia cordata	Grassland clutia	-	Shrublet
Conyza albida	Tall fleabane	Alien Invasive	Shrub
Flax-leaf fleabane	Flax-leaf fleabane	Alien Invasive	Herb
Cortaderia selloana	-	Alien invasive 1	Grass
Cosmos bipinnatus	Cosmos	Alien Invasive	Shrub
Crotalaria natalitia	-	-	Shrub
Crotalaria obscura	Rattle pod	-	Herb
Cymbopogon excavatus	Broad-leaved Turpentine Grass	Increaser 1 - Climax	Grass
Cymbopogon plurinodis	Narrow-leaved Turpentine Grass	Increaser 3 - Climax	Grass
Cymbopogon validus	Giant turpentine grass	Increaser 1 - Climax	Grass
Cynodon dactylon	Couch Grass	Increaser 2 - Pioneer	Grass
Cyperus compressus	Sedge	-	Sedge
Cyperus denudatus	Winged Sedge	-	Sedge
Cyperus esculentus	Yellow Nut Sedge	Medicinal/Edible/Alien Invasive	Sedge
Digitaria eriantha	Common Finger Grass	Decreaser - Climax	Grass
Eragrostis cilianensis	Stink love grass	Pioneer increaser 2	Grass
Eragrostis curvula	Weepong Love Grass	Increaser 2 - Subclimax to climax	Grass
Eragrostis racemosa	Narrow Heart Love Grass	Increaser 2 - Subclimax	Grass
Eucalyptus camaldulensis	Red River Gum	Alien Invasive 2	Tree
Eustachys paspaloides	Brown roads grass	Decreaser - Climax	Grass

Geigeria burkei	-	-	Herb
Gladiolus crassifolius	Thick-leaved Gladiolus	MPB Protected	Shrub
Gladiolus dalenii	Natal lilly	MPB Protected	Shrub
Gomphocarpus fruticosus	Milkweed	Alien Invasive	Herb
Haplocarpha scaposa	False Gerbera	Medicinal	Herb
Helichrysum aureonitens	Golden everlasting	Medicinal	Herb
Helichrysum cephaloideum	-	-	Herb
Helichrysum inornatum	-	-	Herb
Hemarthria altissima	Swamp couch	Decreaser - Climax	Grass
Hibiscus trionum	Bladder Hibiscus	Medicinal	Herb
Hyparrhenia hirta	Common Thatching Grass	Increaser 1 - Subclimax to climax	Grass
Hypoxis hemerocallidea	Star-flower	Medicinal	Herb
Imperata cylindrica	Cotton Wool Grass	Increaser 1, Alien invasive	Grass
Jamesbrittenia aurantiaca	Cape safron	-	Herb
Kniphofia brachystachya	Poker	MPB Protected	Shrub
Leersia hexandra	Wild Rice Grass	-	Grass
Mariscus solidus	-	-	Sedge
Melinis nerviglumis	Bristle leaved red top	Climax Increaser 1	Grass
Moraea albicuspa	-	-	Herb
Nidorella anomala	-	-	Herb
Oxalis latifolia	Pink Garden Sorrel	Alien	Herb
Oxalis obliquifolia	Oblique sorrel	-	Herb
Panicum coloratum	Small buffalo grass	Climax Decreaser	Grass
Paspalum urvillei	Vasey Grass	Exotic	Grass
Pennisetum sphacelatum	Bull Grass	Climax Decreaser	Grass
Persicaria lapathifolia	Spotted Knotweed	Alien Invasive	Herb
Persicaria serrulata	Knotweed/Snake Root	Alien Medicinal	Herb
Phragmites australis	Common Reed	Decreaser	Grass
Polygala virgata	Purple broom	Medicinal	Shrub
Pycreus macranthus	-	Medicinal	Sedge
Salix babylonica	Weeping Willow	Exotic**	Tree
Scabiosa columbaria	Wild scabiosa	Medicinal	Herb
Scirpus ficinioides	-	-	Sedge
Senecio inornatus	-	Medicinal	Herb
Setaria sphacelata v. sphacelata	Bristle Grass	Decreaser - Climax	Grass
Setaria sphacelata v. torta	Creeping Bristle Grass	Decreaser - Climax	Grass
Solanum panduriforme	Yellow Bitter-apple	Medicinal Weed	Shrub
Sorghum bicolor	Common wild Sorghum	Pioneer Subclimax	Grass
Sporobolus africanus	Ratstail dropseed	Subclimax increaser 3	Grass
Tephrosia purpurea	Silver Tephrosia	Medicinal	Herb
Themeda triandra	Red Grass	Decreaser - Climax	Grass
Tristachya leucothrix	Hairy Trident Grass	Increaser 1 - Climax	Grass
Typha capensis	Bulrush	Alien Medicinal	Reed
Verbena bonariensis	Tall Verbena	Alien invasive	Shrub
Vernonia fastigiata	-	-	Herb
Wahlenbergia grandiflora	Giant bell flower	-	Herb

Dry Season

Scientific Name	Common Name	Ecological Status	Form
Paspalum dilatatum	Dallis Grass	Exotic	Grass
Sporobolus pyramidalis	Catstail dropseed	Subclimax increaser 2	Grass
Urochloa mosambicensis	Bushveld Signal Grass	Increaser 2 - Pioneer to subclimax	Grass
Tragus berteronianus	Carrot-seed Grass	Increaser 2 - Pioneer	Grass
Eragrostis curvula	Weepong Love Grass	Increaser 2 - Subclimax to climax	Grass
Eragrostis gummiflua	Gum Grass	Increaser 2 - Subclimax	Grass
Erythrina zeyheri	Ploughbreaker	Medicinal	Shrub
Modiola caroliniana	-	Alien invasive	Herb
Leonotis leonurus	-	-	Herb
Setaria sphacelata	Bristle Grass	Decreaser - Climax	Grass
Aristida adscensionis	Annual three awn	Pioneer Increaser 2	Grass

Appendix 5: Plant community structure

Group	Genus	Species
A	*Berkheya*	*setifera*
	Conyza	*bonariensis*
	Cymbopogon	*excavatus*
	Eragrostis	*racemosa*
	Eucalyptus	*camaldulensis*
	Salix	*babylonica*
	Wahlenbergia	*grandiflora*
B	*Bewsia*	*biflora*
	Crotalaria	*obscura*
	Nidorella	*anomala*
	Tephrosia	*purpurea*
	Tristachya	*leucothrix*
C	*Hypoxis*	*hemerocallidea*
	Helichrysum	*aureonitens*
	Helichrysum	*inornatum*
	Polygala	*virgata*
D	*Imperata*	*cylindrica*
E	*Phragmites*	*australis*
	Anemone	*caffra*
	Geigeria	*burkei*
	Andropogon	*eucomus*
	Cortaderia	*selloana*
	Melinis	*nerviglumis*
F	*Berkheya*	*umbellata*
	Chloris	*virgata*
G	*Crotalaria*	*natalitia*
	Eustachys	*paspaloides*
	Jamesbrittenia	*aurantiaca*
	Digitaria	*eriantha*
H	*Amaranthus*	*hybridus*
	Becium	*obovatum*
	Haplocarpha	*scaposa*
	Scirpus	*ficinioides*
	Berardia	*species*
	Eragrostis	*cilianensis*
	Oxalis	*obliquifolia*
	Setaria	*sphacelata*
	Gladiolus	*paludosus*
	Cymbopogon	*plurinodis*
	Solanum	*panduriforme*
I	*Berkheya*	*maritima*
J	*Anthephora*	*pubescens*
	Bidens	*pilosa*
	Hibiscus	*trionum*
	Sporobolus	*africanus*

	Cymbopogon	*validus*
	Aponogeton	*junceus*
	Gladiolus	*dalenii*
	Gladiolus	*crassifolius*
	Pennisetum	*sphacelatum*
	Cyperus	*esculentus*
	Paspalum	*urvillei*
	Hemarthria	*altissima*
	Eragrostis	*curvula*
	Setaria	*sphacelata*
	Hyparrhenia	*hirta*
	Berkheya	*speciosa*
K	*Andropogon*	*appendiculatus*
	Helichrysum	*cephaloideum*
	Sorghum	*bicolor*
	Kniphofia	*brachystachya*
L	*Gomphocarpus*	*fruticosus*
	Moraea	*albicuspa*
	Clutia	*cordata*
	Oxalis	*latifolia*
	Conyza	*albida*
M	*Brachiaria*	*brizantha*
	Chaetacanthus	*burchellii*
	Cyperus	*denudatus*
	Leersia	*hexandra*
	Mariscus	*solidus*
	Nicolasia	*felicioides*
	Panicum	*coloratum*
	Persicaria	*lapathifolia*
	Pycreus	*macranthus*
	Vernonia	*fastigiata*
N	*Cenchrus*	*ciliaris*
	Persicaria	*serrulata*
	Cyperus	*compressus*
O	*Cynodon*	*dactylon*
	Typha	*capensis*
P	*Cirsium*	*vulgare*
Q	*Bothriochloa*	*radicans*
	Chamaecrista	*comosa*
	Verbena	*bonariensis*
	Setaria	*sphacelata*
	Cosmos	*bipinnatus*
	Senecio	*inornatus*
	Themeda	*triandra*

Plan 1

Universal Coal Kangala Coal Mine

Sensitive Areas

Legend

- Project Area
- Arterial / National Route
- Main Road
- Non-Perennial Stream
- Perennial Stream
- Dam Wall
- Contour (20m)
- Dam / Lake
- Non-Perennial Pan
- Perennial Pan
- Wetland

Terrestrial Biodiversity Assessment

- Highly Significant
- Important & Necessary
- Irreplaceable
- Least Concern
- No Natural Habitat Remaining
- Protected Areas

(Source: Mpumalanga C Plan 2008)

Universal Coal Development 1 (Pty) Ltd

DWA

Tel: +27 11 789 9495

Projection: Transverse Mercator
Datum: Hartebeesthoek 1994
Central Meridian: 29°E

Ref #: glo.UNI605.200909.032
Revision Number: 2
Date: 08/10/2009

N

0 0.5 1 2 3

Kilometres

1:50,000

Plan 2

Universal Coal
Kangala Coal Mine
Fauna & Flora
Sampling Points

Legend

Fauna & Flora Sampling Points

- Amphibians
- Mammals
- Red Data Plants
- Project Area
- Farm House
- Arterial / National Route
- Main Road
- Minor Road
- Track
- Non-Perennial Stream
- Perennial Stream
- Dam Wall
- Dam / Lake
- Non-Perennial Pan
- Perennial Pan
- Wetland
- Agricultural Fields

Universal Coal Development 1 (Pty) Ltd

DWA

Tel: +27 11 789 9495

Projection: Transverse Mercator
Datum: Hartebeesthoek 1994
Central Meridian: 29°E

Ref #: glo.UNI605.200909.044
Revision Number: 3
Date: 26/10/2009

N

0 0.25 0.5 1

Kilometres

1:25,000