PROPOSED

ESTABLISHMENT OF A CEMETERY

ON PORTION A (PORTION OF PORTION 148) OF THE FARM KAAP BLOCK SECTION F,

IN MBOMBELA LOCAL MUNICIPALITY, MPUMALANGA PROVINCE

DEDET REF: 17/2/3/E-200

Terrestrial Ecology Specialist Report

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June 2013

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1. INTRODUCTION

Background

The applicant, Mbombela Local Municipality, is planning to establish a new cemetery at Nkambeni to cater for the communities of Nkambeni, Shabalala, Numbi and Mahushu areas. The project will be located on portion A (portion of portion 148) of the farm Kaap Block Section F, in Mbombela Local Municipality, Mpumalanga Province.

An Environmental Impact Assessment (EIA) is required for the proposed development in terms of the EIA Regulations of 2010 as amended under the National Environmental Management Act (NEMA) (Act No. 107 of 1998). This ecological report contributes towards meeting these requirements and highlights the likely impacts of the proposed development on the terrestrial ecology of the site.

Scope

The broad terms of reference required include the following aspects:

Vegetation assessment:

- Conduct vegetation survey
- Identify and map vegetation habitats
- Indicate presence of any seasonal wetlands, rivers, streams and dams
- Provide photos illustrating any conservation action or plant species that might need special attention
- Produce a vegetation sensitivity information that will be used to inform the layout of project infrastructure

Terrestrial faunal assessment off the site

- An assessment of the potential impacts (positive, negative or cumulative if relevant) on fauna during construction and operation of the proposed development
- A description of the occurrence and distribution of fauna (mammals, reptiles, amphibians)
- The identification of specific mitigating measures, for enhancing benefits and avoiding or mitigating negative impacts and risks, which should be implemented during the construction and operation of the proposed development

2. METHODOLOGICAL APPROACH

2.1 Approach and Assessment Philosophy

The assessment (vegetation and terrestrial ecology) is being conducted in response to terms of reference (TOR) as suggested, and following the guidelines and principles for biodiversity assessment provided by De Villiers *et al*. (2005). These include the following:

1. A description of the ecological characteristics of the site and its surrounds in terms of patchiness, patch size, relative isolation, connectivity, corridors, disturbance regimes, eco-tones, buffering, viability, etc.

2. In terms of biodiversity pattern, the following will be identified and described where appropriate:
    a. Community and ecosystem level
    b. Species level
    c. Other biodiversity pattern issues

3. In terms of biodiversity process, the following should be identified or described:
    - The key ecological "drivers" of ecosystems on the site and in the vicinity, such as fire and grazing.
    - Environmental gradients (e.g. upland-lowland), biome boundaries, soil interfaces or sand movement corridors on the site or in its vicinity.
    - Any possible changes in key processes, e.g. increased fire frequency or drainage/artificial recharge of aquatic systems.
    - The condition and functioning of rivers and wetlands (if present) in terms of: possible changes to the channel, flow regime and naturally-occurring riparian vegetation.

4. Over and above the foregoing, the assessment to include the following:
    - A description of the environment that may be affected by the activity and the manner in which the environment may be affected by the proposed facility.
    - A description and evaluation of the environmental issues and potential impacts (including direct, indirect and cumulative impacts) that have been identified.
    - The nature and the extent of the impact.
    - A statement regarding the potential significance of the identified issues based on the evaluation of the issues/impacts.
    - "Red Flag" any sensitive or no-go areas within the broader study area which could influence the siting of the infrastructure.
    - Should potential conflicts arise, alternatives will be identified as far as the ToR allow.
    - Ecological opportunities and constraints will be identified, which may include mitigation measures and offsets to reduce the ecological impact of the development.
    - Recommendations for future management actions and monitoring.

2.2 Field Assessment Methodology

2.2.1 General

The site was visited and surveyed by the author. During the site visit, the area earmarked for development was investigated and the surrounding broader area surveyed for any potential conflicts between the proposed development of the site and ecological processes and terrestrial biodiversity pattern and processes.

2.2.2 Vegetation

The area was walked and important plant species encountered were recorded and where necessary, photographed and or specimens obtained for verification purposes. The different habitats present were identified on site. The consultants looked out for potentially sensitive habitats or areas that appeared to be species-rich or host different or unique species, such as drainage areas, wetlands and rocky ridges. Literature references used to support findings and to assist in arriving at conclusions are listed. The vegetation units of Mucina & Rutherford (2006) were used as reference. The combination of the available literature with the survey results made stratification of vegetation communities possible.

The site was also intensively searched for important species and the potential for Red Data Book (RDB) and other important species. The objective of this exercise was to identify distinct vegetation types and to establish their integrity and representation in the study area.

2.2.3 Terrestrial Fauna

The faunal investigation was based on desktop study verified by cross reference with available habitats of the study area, so as to establish the faunal potential of site. All reptiles, amphibians, mammals and birds observed during field trips and floral surveys were to be recorded. Also recorded was any characteristic evidence of presence or activity such as droppings, spoors, diggings, burrows etc. Within certain habitats such as rocky outcrops, the area was actively searched for reptile species characteristic of these areas or species of conservation concern which were identified beforehand as potentially occurring at the site. By method of elimination (based on available habitats and the taxon's biology and known distribution), lists of faunal representation for the study area was assembled. Literature references used to support findings and to assist in arriving at conclusions are listed.

2.2.4 Ecological importance and sensitivity rating of habitats

The information from the surveys indicated above was then synthesized into a sensitivity map of the area which ranked the ecological sensitivity of each unit identified according to:

- The conservation status of the untransformed vegetation in terms of the currently conserved and target amount as listed by Rouget et al. (2006) as well as the Draft National List of Threatened Ecosystems (Notice 1477 of 2009, Government Gazette No 32689, 6 November 2009).
- The likely presence and number of Red Data and other species of conservation significance within the habitat.
- The species richness and uniqueness of the habitat as observed in the field or reported in the literature.
- The topography of the unit in terms of the slope, presence of koppies or other significant landscape features.
- The nature and significance of ecological processes operating on the site, such as upland lowland gradients, drainage areas, corridors etc

The ecological sensitivity of each unit identified, is rated according to the scale in Table 2.1.

Table 2.1: Ecological Importance and Sensitivity Rating

Ecological Importance of **Terrestrial and Riparian Communities**	**Sensitivity Rating**
Critical and unique habitats that serve as habitat for rare/endangered species or perform critical ecological roles.	*Very High*
Areas of natural or transformed land where a high impact is anticipated due to the high biodiversity value, sensitivity or important ecological role of the area.	*High*
Areas of natural or previously transformed land where the impacts are likely to be largely local and the risk of secondary impact such as erosion low.	*Medium*
Units with a low sensitivity where there is likely to be a negligible impact on ecological processes and terrestrial biodiversity. This category is reserved specifically for areas where the natural vegetation has already been transformed, usually for agricultural purposes.	*Low*

Following the identification of the different ecological features of the site, lists of mammals, reptiles, amphibians and birds observed or likely to be associated with the different habitats present were compiled. These lists were compiled based on the observations made during the site visit as well as available literature sources (Friendmann & Daly 2004) and spatial databases (SANBI's SIBIS and BGIS databases). The lists are based on species which are known to occur in the broad geographical area as well as an assessment of the availability and quality of suitable habitat at the site. For each species, the likelihood that it occurs at the site was rated according to the following scale:

- Low: The available habitat does not appear to be suitable for the species and it is unlikely that the species occurs at the site.
- Medium: The habitat is broadly suitable or marginal and the species may occur at the site.
- High: There is an abundance of suitable habitat at the site and it is highly probable that the species occurs there.
- Definite: Species that were directly or indirectly (spoor, droppings, characteristic diggings, burrows etc) observed at the site.

The conservation status of each species is also listed, based on the IUCN Red List Categories and Criteria version 3.1 (2010) and where species have not been assessed under these criteria, the CITES status is reported where possible. These lists are adequate for mammals, amphibians and birds, the majority of which have been assessed, however the majority of reptiles have not been assessed and therefore, it is not adequate to assess the potential impact of the development on reptiles, based on those with a listed conservation status alone. In order to address this shortcoming the distribution of reptiles was also taken into account such that any narrow endemics or species with highly specialized habitat requirements occurring at the site were noted.

2.3 Policies, Legislation, Standards and Guidelines

The National Environmental Management Act (NEMA) (Act No 107, 1998) requires that measures are taken that 'prevent pollution and ecological degradation; promote conservation; and secure ecologically sustainable development and use of

natural resources while promoting justifiable economic and social development.' In addition it states that environmental management should:

- Avoid, minimise or remedy disturbance of ecosystems and loss of biodiversity
- Avoid degradation of the environment.
- Avoid jeopardizing the integrity of ecosystems.
- Pursue the best practicable environmental option by means of integrated environmental management.
- Protect the environment as the people's common heritage.
- Control and minimise environmental damage.
- Pay specific attention to sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems, especially where they are subject to significant human resource usage and development pressure.
- That a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions

The National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA) provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The Draft National List of Threatened Ecosystems (Notice 1477 of 2009, Government Gazette No 32689, 6 November 2009) has been gazetted for public comment. The list of threatened terrestrial ecosystems supersedes the information regarding terrestrial ecosystem status in the NSBA 2004. In terms of the EIA regulations, a basic assessment report is required for the transformation or removal of indigenous vegetation in a critically endangered or endangered ecosystem. It is important to note that a basic assessment report in terms of the EIA regulations is only triggered in remaining natural habitat within each ecosystem and not in portions of the ecosystem where natural habitat has already been irreversibly lost. Details of the Criteria used to identify the threat status of different vegetation types are provided in the Act and will not be repeated here.

NEMBA also deals with endangered, threatened and otherwise controlled species. The Act provides for listing of species as threatened or protected, under one of the following categories:

- Critically Endangered: any indigenous species facing an extremely high risk of extinction in the wild in the immediate future.
- Endangered: any indigenous species facing a high risk of extinction in the wild in the near future, although it is not a critically endangered species.
- Vulnerable: any indigenous species facing an extremely high risk of extinction in the wild in the medium-term future; although it is not a critically endangered species or an endangered species.
- Protected species: any species which is of such high conservation value or national importance that it requires national protection. Species listed in this category include, among others, species listed in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Certain activities, known as Restricted Activities, are regulated on listed species by a set of permit regulations published under the Act. While most of the activities center around the hunting, catching, import, export or movement of listed species, the following is relevant to the current development:

- Picking parts of, or cutting, chopping off, uprooting, damaging or destroying, any specimen of a listed threatened or protected species;
- Any other prescribed activity which involves a specimen of a listed threatened or protected species;

Under the recently published Listing Notice 3: List of activities and competent authorities identified in terms of sections 24(2) and 24D (R:546, 18 June 2010) of NEMA, various activities which require authorization are listed. Of particular relevance to the current study are the activities related to bioregional plans and Critical Biodiversity Areas (CBAs). The notice lists the following thresholds with regards to the clearing of natural vegetation:

- 300m^2 within critical biodiversity areas identified in bioregional plans
- 1ha within critical biodiversity areas and ecological support areas as identified in the systematic biodiversity plans adopted by the competent authority.

2.4 Relevant Aspects of the Development

The proposed project will involve the transformation of approximately 41 ha of vacant land into a public cemetery comprising the following:

- Grave sites for both adults and young.
- Palisade fencing and gate.
- A parking area.
- Ablution facilities.
- Security Offices
- Two access road (Existing road to be utilized).

The cemetery will also be divided in to three sections: first sections for Indians; second sections for cultural and last section for municipal. It is estimated that the grave yard will last for a life span of about 30-50 years.

2.5 Scenarios Considered in the Impact Assessment

A single scenario, based on an indicative layout as provided by Wandima Environmental Services has been considered. An alternative site is not currently being considered. Although, alternative layouts of the Cemetery buildings, drive ways and parking bays do not directly form part of this assessment, it is however intended and anticipated that the results of this assessment will inform the final layout of the site that will accompany the application.

2.6 Description of the Affected Environment

Location

The proposed cemetery establishment is to be situated on Portion A (Portion of Portion 148) of the farm Kaap Block Section F, colloquially known as Sand River, Numbi in Mbombela Local Municipality, Mpumalanga province.

Conservation Status

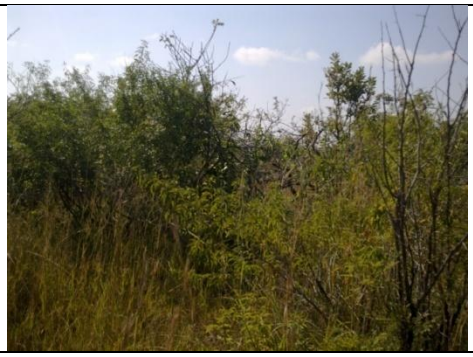
The study area according to Mucina and Rutherford (2006), falls under the Legogote Sour Bushveld vegetation unit of the Lowveld Bioregion in the Savannah Biome.

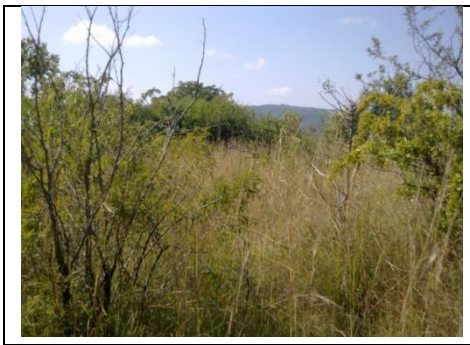
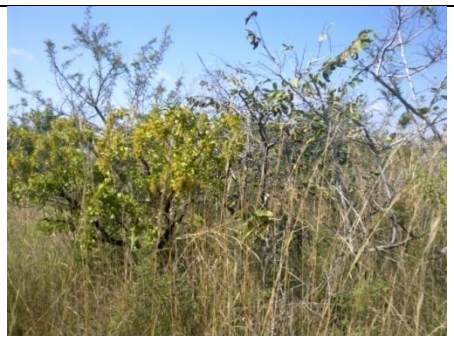
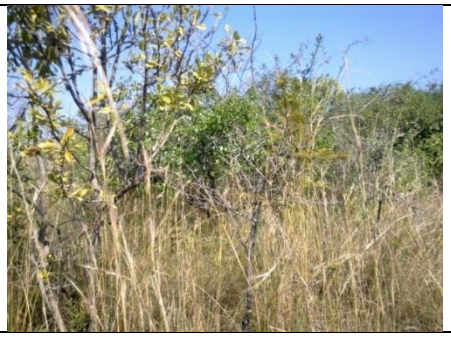
The vegetation unit is considered endangered. The conservation target is 19%. About 2% is statutorily conserved mainly in the Bosbokrand and Barberton Nature Reserves; at least a further 2% is conserved in private reserves including the Mbesan and Kaapsehoop Reserves and Mondi Cycad Reserve. This vegetation unit (Legogote Sour Bushveld) has been greatly transformed (50%), mainly by plantations and also by cultivated areas and urban development. Scattered alien plants include *Lantana camara*, *Psidium guajava, Agave sisalana* and *Solanum mauritianum*. Erosion is very low to moderate.

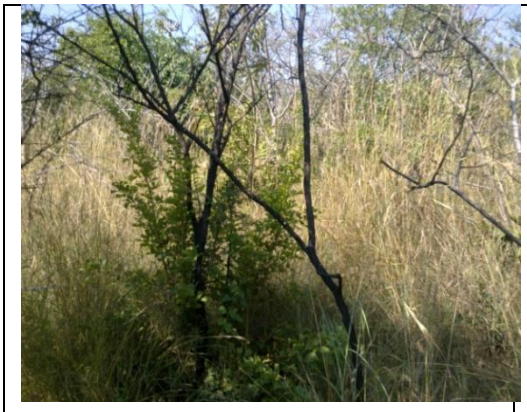
Table 2.2: Vegetation Unit SVl 9 Legogote Sour Bushveld (Mucina Rutherford 2006)

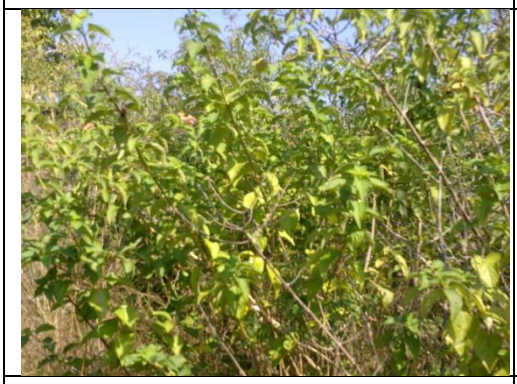
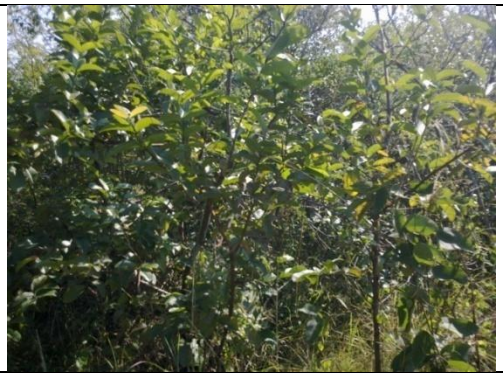
Name of vegetation type	Legogote Sour Bushveld
Code as used in the Book - contains space	SVl9
Conservation Target (percent of area) from NSBA	19%
Protected (percent of area) from NSBA	1.6% (+2.3%)
Remaining (percent of area) from NSBA	50.4%
Description of conservation status from NSBA	Endangered
Description of the Protection Status from NSBA	Poorly protected
Area (sqkm) of the full extent of the Vegetation Type	3538.14
Name of the Biome	Savanna Biome
Name of Group (only differs from Bioregion in Fynbos)	Lowveld Bioregion
Name of Bioregion (only differs from Group in Fynbos)	Lowveld Bioregion

Typical views from the study area.

	
North view. Pictures taken from the highest point at the site.	North east view

	
East view	South east view
	
South view	South west view
	
West view	North west view

	
Signs showing area experiences fire.	Sickle bush (*Dichrostachys cinerea*) common in the area

	
Access routes	Alien plants: *Agave sisalana*
	
Alien plants: *Lantana camara*	Alien plants: *Psidium Guava*

Physical characteristics

The climate of the bushveld component of the savannah lowveld is characterized by summer rainfall and dry winters with mean annual precipitation ranges between 700 and 1150mm. Frost is infrequent to occasional. The mean monthly maximum and mean monthly minimum temperatures are 35.7^{0}C and 1.6^{0}C for October and July respectively. Site specific conditions include hot summers and dry cold winters. Average daily temperatures range above 29^{0}C in summer and are lower than 23^{0}C in winter. Annual rainfall ranges between 550 mm and 767 mm.

The Legogote sour bushveld is generally underlain by gneiss and migmatite rock formations of the Nelspruit Suite and dominated by soils of Mispah, Glenrosa and Hutton forms that are mainly shallow to deep, sandy or gravelly and well drained. The site itself is underlain by granite bedrock that is below a mantle of thin transported soils and residua. The granite is grey to white in colour, coarse-grained and biotite-rich, and belongs to the Nelspruit Suite of Basement Granitic Rocks (Zn).

Vegetation

The site's natural setting is mainly gently to moderately sloping upper pediment slopes with dense woodland including many medium to large shrubs often dominated by *Bauhinia galpini* and *Parinar curatellifolia* with *Panicum maximum* and *Hyperthelia dissoluta* in the undergrowth. Short thicket dominated by *Acacia Ataxantha* occurs on less rocky sites. Exposed granite outcrops have low vegetation cover, typically with *Englerophytum magalismontaumnum*, *Aloe petricola*, and *Myrothamnus flabellifolia*. *Breonadia salina* and *Syzygium cordatum* dominate the riverine habitat.

Protected tree species whose range include the development site include: Cheesewood (*Pittosporum viridiflorum*), Red stinkwood (*Prunus Africana*), Wild teak (*Pterocarpus angolensis*), Pepper bark tree (*Warburgia salutaris*), Yellowwood (*Podocarpus falcatus*), Stinkwood (*Ocatea bullata*), Marula (*Sclerocarya birrea*), Yellowwwood (*Podocarpus latifolius*), Protea (*Protea comptonii*), Apple leaf (*Philenoptera violecea*), Camel thorn Acacia (*Acacia orioloba*), Pod Mahogany (*Afzelia quanzensis*), Torchwood (*Balanites mughnamii*), Shephard's tree (*Boscia albitrunca*), Bushmen's tree (*Catha edulis*), Breonadia (*Breonadia salina*), Asegai (*Curtisia dentate*), Leadwood (*Combretum imberbe*), Bushveld saffron (*Elaodendron transvalensis*).

The occurrence of alien invasive species and weeds is another important factor in this assessment. Alien invasive and weed species are listed in the Conservation of Agricultural Resources Act of 1983 (CARA) and the Mpumalanga Conservation Act (1998). The control by landowners of the presence and spreading of such species is regulated by these Acts. Several important exotic / invader species were recorded on the study area (Table 2.4).

Table 2.4 Aliens, weeds and exotics, CARA categories are indicated where applicable

Name	Legislation	Status	Comments / GPS reference
Dichrostachys cinerea	CARA	Declared	Bush encroachment
Psidium guajava	CARA	Declared	Bush encroachment
Lantana camara	CARA	Declared	Category 1 weed/invader

Fauna

A few species of small to medium sized mammals are expected to use the natural habitats on the site. The largest species expected to be present are common duiker, red duiker and bushbuck. The mobility of most mammals will ensure that they can adapt or relocate if disturbed by the activities.

Amphibians.

Frogs will utilize the aquatic and terrestrial habitats on the site for various reasons, such as breeding purposes. Frogs are rather sensitive to pollution and ecological imbalances, which is why the presence of frogs in an area indicates that the habitat is healthy and of good ecological integrity. It is not anticipated that frog species will be adversely affected if the mitigation measures outlined in this report are implemented.

Reptiles.

The reptile survey indicates that especially the rocky habitats are of high importance to reptiles, however all natural habitats will be utilized by reptiles on this property. Several important lizard species, is present on the rocky areas. However, it is not anticipated that these species will be adversely affected if given the necessary protection and habitat conservation.

Avifauna

The following literature, data bases and other methods will be used in order to cover as many as possible aspects for the avifauna assessment:

- Robert's Birds of Southern Africa. 1985. (Maclean G L)
- The Important Bird Areas of Southern Africa (IBA) data (Barnes, 1998) to determine if any IBA sites/regions are affected;
- Important Bird Areas in Africa and Associated Islands (Lincoln et al 2001).
- Mpumalanga Biodiversity Conservation Plan (MBCP) was consulted to determine the environmental sensitivity of the study area (Lötter, 2007);
- Mpumalanga Parks & Tourism Agency Biobase Data for birds (Emery *et al*., 2000) to determine the general sensitivity of the area regarding birds;
- The vegetation types and habitats important to birds were determined by literature studies as described elsewhere in this report and actual site investigations were conducted to determine the on-site conditions and integrity of habitats as well as important-bird surveys;
- By method of deduction (using all the above mentioned data) the study area and alternative routes were assessed to determine the magnitude of possible impacts on birds.

The literature review indicates that a diverse group of birds may utilize the area. More than 200 species' range of distribution falls within and around the study area. Due to the topography and habitat types present in the study area, the expected birds will vary from commonly found savannah and bushveld to forest and grassland specific species.

2.7 Identification of Risks and Potential Impacts

Potential impacts on the terrestrial ecology of the site resulting from the development of the Nkambeni Cemetery include negative impacts on the following

- Biodiversity – where biodiversity is taken to mean
    i. the number of different species and individuals in a habitat or geographical area;
    ii. the variety of different habitats within an area;
    iii. the variety of interactions that occur between different species in a habitat; and
    iv. the range of genetic variation among individuals within a species.
- Sensitive Habitats – impacts to ecologically sensitive habitats such as riparian areas or edaphically unique areas such as quartz patches, or areas which are the habitat of rare or endangered species.
- Ecosystem Function - Impacts on ecosystem function such as the regulation of water flow and quality resulting from changes to the abiotic environment. Changes to disturbance regimes such as fire frequency may also result.
- Connectivity – Habitat fragmentation or a reduction in the ability of fauna to move about the landscape, this may impact ecosystem function as well as gene flow and other aspects of biodiversity.
- Ecosystem Resilience - Intact ecosystems are better able to recover from perturbations and resist invasion by alien plants.
- Secondary/Cumulative Impacts – When considered in isolation, the development of a single site may not be significant, however, when considered in light of similar actual or potential developments in the area, a greater concern for broader ecological processes may arise.

In terms of the activities involved in the construction of the Nkambeni Cemetery, specific risks stem from the following activities

- The clearing and leveling of land for the foundations of buildings, driveways, parking bays etc.
- Increased risk of chemical contamination by construction vehicles
- Disturbance of natural ecosystems, making them vulnerable to invasion by alien organisms
- Hunting, collecting or otherwise damaging plants and animals by construction workers or other individuals who have gained access to the site as a result of the construction activities.

3 IMPACT ASSESSMENT

Croplands and residential sites (low sensitivity) predominate on the edges of the development area. The area itself forms part of an Endangered vegetation unit according to Ferrar and Lotter (2007) – The Mpumalanga Biodiversity Conservation Plan. The area is however fairly degraded and mostly infested/encroached with Sickle bush, guava and lantana. This however, does not signify the absence of other natural vegetation species. Should the layout require the transformation of intact vegetation, then it would be preferable for this to occur within the degraded areas as this would minimize biodiversity loss.

Again, it is important to ensure that roads and service areas are located in a manner which does not result in the loss or degradation of these fragments.

3.1 Vegetation

The loss and modification of important habitats can only be minimized by firstly avoiding sensitive habitats by making use of existing access roads and disturbed areas, and secondly by positioning of the structures (buildings & other facilities) on pre-selected sites of low floral importance. The loss of individual plants of importance can also be minimized by the above measures and site selection must be done prior to construction with the aid of a specialist.

Table 3.1 Assessment of the impact of the development of the Nkambeni Cemetery site on the local vegetation. Mitigation refers to the development proceeding under this specific layout which should avoid sensitive areas.

CRITERIA	**IMPACT**			
	CONSTRUCTION		**OPERATION**	
Magnitude:	***Without***	***With mitigation***	***Without***	***With mitigation***
Extent	Local	Local	Local	Local
Duration	Long-Term	Long-Term	Long-term	Long-term
Intensity	High	Medium	Medium	Low
Likelihood:	High	Low	Low	Minor
Significance	Major	Moderate	Moderate	Minor
Status	Negative	Negative	Negative	Negative

3.2 Mammals

Although the occurrence of some rabbits and duiker is highly likely, the species could not be scientifically confirmed. The occurrence of mice and rats cannot be ruled out as crop farming in proximity of the site is active. The major risk factors for mammals associated with the development are likely to be related to the increased levels of noise and human activity at the site. Direct habitat loss is not likely to be a significant factor due to the fact that the major development is within previously disturbed areas and surrounded with croplands and settlement. The noise, physical disturbance and high levels of human activity associated with the construction phase are likely to cause significant disruption to some smaller mammals which are likely to move away from the site. However, such disturbance will be transient and during the operational phase it is likely that such animals will quickly become habituated to the presence of human and will resume their normal activities.

The impact on mammals is thus likely to be of low to medium intensity during the construction phase declining to a low intensity thereafter.

Many small mammals, such as hares and mice, rely on acute hearing to avoid predators. The background noise resulting from the construction site could potentially impair the ability of such animals to hear approaching predators. Most predators (except snakes) on the other hand, rely primarily on vision to catch their prey and as a result are not likely to be similarly affected. Consequently, some small mammals could experience higher levels of predation which could have long-term consequences for their breeding potential and persistence at the site. The extent and severity of this effect has however not been documented and is regarded as an unknown.

Due to the proximity of the development to the adjacent villages, impacts will not be restricted to the site, but will nevertheless remain local in extent.

Table 3.2. Assessment of the impact of the development of the Nkambeni Cemetery site on mammals.

CRITERIA	**IMPACT**			
	CONSTRUCTION		**OPERATION**	
Magnitude:	**Without mitigation**	**With**	**Without mitigation**	**With mitigation**
Extent	Local	Local	Local	Local
Duration	Short-Term	Short-Term	Long-term	Long-term
Intensity	Medium-High	Medium	Medium	Low
Likelihood:	Medium-High	Low	Medium	Low
Significance	Moderate	Moderate	Moderate	Minor
Status	Negative	Negative	Negative	Negative

3.3 Reptiles and Amphibians

The possibility exists that several of the important reptiles and amphibians discussed earlier, may occur in the site. However, due to the mobility of most such fauna, it is not anticipated that any of the taxa will be directly threatened by the activities. The animals can move away when disturbed an can return to the general area after the completion of construction. The major impact on such fauna is expected to result from fragmentation of habitat. Impact on reptiles and amphibians and important species can be minimized by making use of existing access roads and disturbed areas and avoiding sensitive habitats (e.g. rocky outcrops and wetlands), and secondly by placing of the structures on pre-selected sites of low faunal importance.

3.4 Integrated Assessment

Ideally all structures should be situated within previously transformed areas. If this is not achievable due to design constraints then the positioning of structures has to be done in conjunction with a biodiversity specialist to avoid unnecessary destruction of protected species and important habitats.

With the appropriate mitigation, as described in mitigation measures, the impact of the operating infrastructure on all components of the terrestrial ecology of the site could be reduced to a low level. There are, however, also some potential impacts that are associated with the construction phase; these are listed along with appropriate mitigation measures in Table 4.1 & Table 4.2. Not all impacts associated with the construction phase can be mitigated. Little can practically be done to reduce the noise and the disturbance associated with the construction phase. However, this phase of the development should be fairly short-lived and the impacts transient.

The greatest uncertainty regarding the development, perhaps, is the potential for trophic ripple effects. Predators such as raptors and large carnivores such as jackal and caracal may avoid the area, which may affect the abundance of prey species which in turn may impact vegetation dynamics and herbivoury patterns as well as the abundance of other small vertebrates. However, the extent and manner to which this is likely to occur is not well known and requires further investigation and research to clarify these aspects. Apart from keeping disturbance levels and human activity at the site to a minimum, there is little that can be done to reduce the possibility of this impact, as in the long-term, it is most likely to be related to the presence of the people & vehicles themselves. Although further research might clarify the matter, this effect is difficult to quantify since the density of top predators is naturally low. Furthermore, research at a single site is unlikely to yield useful information and an integrated research effort involving several developments would probably be the most fruitful approach.

Given the appropriate mitigation, the development of the site is therefore not predicted to disrupt local or regional ecological processes, reduce the connectivity of the landscape to a significant degree or impact the ability of the terrestrial biota to utilise and move about the landscape. Overall, provided that the listed mitigation measures can be met then the likely impact of the development on the terrestrial ecology of the site can be seen as a low to minor negative impact. Under the appropriate mitigation, there are no compelling reasons from a terrestrial ecology standpoint to oppose the development.

4 MITIGATION

The objective of mitigation is to minimise impacts on vegetation and animal habitats and to maximise re-vegetation and rehabilitation of disturbed areas. Mitigation should be focussed on ameliorating the major risk factors associated with the development, which in the current development can be summarized under the following areas:

- Erosion
- Alien Plant Invasion
- Loss of Habitat & Habitat Fragmentation
- Impacts to Sensitive Environments
- Impacts to Rare or Endangered Plant Species
- Direct Faunal Impacts

These risk factors are in turn caused by or related to the following activities:

- Vegetation Clearing
- Road & Cemetery facilities Construction Activities
- Vehicle Activity
- Human Activity

Mitigation measures associated with each of the risk factors listed above are described under the same headings below:

Erosion

According to the geotech studies, the proposed cemetery site has the following flaws: permeable soils coupled with a shallow, non-perennial perched, groundwater table, the site's proximity to the adjacent drainage lines and the potential for grave instability near surface. To counteract the above flaws it is critical that the following mitigating measures are implemented:

- A buffer at least 100m wide must be included around the perimeter of the site – extending up-slope from the centre of the adjacent streams; deep-rooted, indigenous, hydrophilic vegetation/trees should be planted in this buffer to reduce the amount of percolating groundwater entering the adjacent streams.
- The non- or slightly cohesive surficial regolith is susceptible to erosion. As such, it is recommended that a phased approach be undertaken to clearing and grubbing the site for use, i.e., areas up to 1-hectare only, should be cleared and grubbed for use as necessary.

The large amounts of soil disturbance that are likely to accompany the development imply that soil erosion is a high risk factor. Semi-arid areas are particularly vulnerable to erosion due to the low plant cover, susceptible soils and occasional intense rainfall events. Soil erosion is a serious ecological issue as it has the potential to cause ecosystem-wide impacts, particularly on sensitive ecosystems such as riparian areas and wetlands. Soil disturbance is the primary driver of erosion risk and consequently, soil disturbances of all kinds should be kept to an absolute minimum. The following mitigation measures are suggested as key factors in reducing the erosion risk associated with the development.

- Roads should avoid steep slopes as far as possible as it becomes increasingly difficult to regulate the flow of water with increasing slope and the risk of erosion increases rapidly. Should some of the steeper roads at the site prove vulnerable to erosion problems, then these areas should be surfaced with concrete or tar.
- Roads should not be built wider than necessary and only essential roads should be built
- It is important that where flow is diverted from the road surface that it is done in a manner which does not result in erosion problem in the adjacent vegetation. Serious attention should be given to flow attenuation and dispersion methods.

Lay-down areas for the buildings and storm water drainage should be cleared to the minimum necessary. It is preferable to retain low vegetation as far as possible and to permit vehicles to traverse demarcated areas of natural vegetation rather than clear them completely. A site development plan that clearly indicates and demarcates the extent of vegetation clearance and development activities in different portions of the site should be compiled prior to construction and enforced by an Environmental Control Officer. If vegetation needs to be cleared for temporary construction activities or laydown areas, it is preferable that only the vegetation is cleared (e.g. With a brush-cutter) and that the topsoil is left intact.

Where soil must be temporarily disturbed or moved such as at borrow pit sites, the topsoil should be set aside and replaced as soon as possible once the activity is completed. Disturbed sites in semi-arid regions usually recover very slowly and replacing topsoil at a site greatly increases the rate and extent of vegetation recovery. Topsoil that is stored for an extensive period of time becomes sterile and no longer acts to encourage natural re-vegetation. Where possible, existing roads should preferably be upgraded rather than constructing new roads. Alternatively if upgrading is not feasible, then the existing roads should be rehabilitated if they are no longer going to be used as they are likely to initiate erosion problems if not maintained.

Erosion control measures should be initiated as soon as signs of erosion problems become apparent. Problem areas may need to be fenced off and managed intensively. Should any erosion develop which cannot be remedied by simple erosion control measures, then the services of a rehabilitation and erosion control consultant with experience in semi-arid zones should be brought in to provide guidance in this regard.

Alien Plant Invasion

Due to the increased levels of human activity at the site and the large amount of disturbance and bare soil associated with the development, ideal conditions for the invasion of alien plants will be created. As there is already evidence level of alien plant invasion at the site e.g. Lantana, it could prove difficult to keep alien plants out of the disturbed areas. Where intact vegetation is disturbed, measures should be taken to reduce the invasion of alien species into these areas. Unfortunately, the woody species at the site are not suitable candidates for transplanting, so moving these species to disturbed areas as a re-vegetation technique is not likely to be successful. Mitigation of alien plant invasion risk will to some extent be achieved by similar practices to those which limit the erosion risk at the site. The following mitigation measures are suggested in order to minimize the risk of alien plants invading the site.

- Vegetation clearing and soil disturbance should be minimized.
- Natural re-vegetation of disturbed areas such as road verges should be encouraged. Seed of indigenous species collected on site could be used to re-vegetate cleared areas.
- No foreign plant material should be brought onto the site; this specifically includes such items as hay bales.
- All alien plants observed at the site should be removed on a regular basis. This will however not be possible

for the alien annual grasses, which need to be managed at the ecosystem level. Sweeps for alien plants and alien clearing activities should be conducted at least on a quarterly basis.

- Alien species should be controlled in the appropriate manner as incorrect control measures can exacerbate invasion problems. There are various publicly available sources which list the most appropriate control method for the different alien species likely to be encountered from South African National Biodiversity Institute.
- Clearing methods should themselves aim to keep disturbance to a minimum.

Loss of Habitat & Habitat Fragmentation

The site is already quite fragmented due to the high proportion of settlements and croplands in the area, leaving it vulnerable to further fragmentation and loss of habitat. The following mitigation measures are aimed at reducing these impacts:

- No structures should be built outside the area demarcated for the development. There is a tendency of hawkers putting up structures for selling food items to contractors which should be planned and controlled regardless of the need.
- Although it is unavoidable that some roads will need to traverse areas of potential Sensitivity, the existing road infrastructure should be upgraded in such cases so as to avoid further impact to these areas. In addition, where roads are to be widened, the adjacent vegetation that is to be lost should be assessed by a qualified botanist before construction to ensure that rare, protected or endangered species are not being impacted by the road and if necessary alternative routes identified or the plants relocated to a similar nearby environment.
- Vegetation clearing should be kept to a minimum, and as already described, this should only occur where it is absolutely necessary and the use of a brush-cutter is highly preferable to the use of earth-moving equipment.
- Access roads should not be wider than the minimum requirement for the development (at least 4m wide).
- Re-vegetation of road verges should be encouraged, while the natural revegetation of facilities service areas and road surfaces should be tolerated as far practically feasible.
- All temporary construction lay-down areas should be sited on open areas, preferably flat areas. No natural vegetation should be transformed for temporary activities.
- Borrow pits should be located within previously transformed areas and the area disturbed should not be larger than necessary.

Impacts to Rare or Endangered Plant Species

There are several listed plant species which may occur at the site. The following recommendations are made regarding the potential impact on these species:

Prior to construction and preferably during the winter or early spring,

- The areas of natural vegetation that may be lost to the development should be searched for this species.
- Any individuals of important species located, should be relocated to an adjacent area and into a similar microsite from where they were taken.
- The success of the translocation should be monitored for at least a year after transplant to ascertain the success rate of the intervention.

Direct Fauna/ Impacts

High levels of human activity will be associated with the development, these activities pose several different risks to the fauna of the site, including collisions with vehicles, fires, collecting and disturbance. These risks will be very high during the construction phase and decrease during the operational phase. Mitigation and control measure that should be instituted include the following:

- Vehicles must adhere to a speed limit, 30-40 km/h is recommended for light vehicles and a lower speed for heavy vehicles.
- All construction and maintenance vehicles must stick to properly demarcated and prepared roads. Off-road driving should be strictly prohibited.
- Fauna must have 'right of way' on the roads. Slow moving animals such as tortoises which may be in the way, should be placed at the side of the road in the direction the animal was seen traveling.
- No fires should be allowed at the site anywhere other than within demarcated areas within the compound.
- No dogs or other pets should be allowed at the site. All staff at the site should remain within the compound at night.
- No harvesting or collecting of plants, seeds, animals or their parts should be allowed. Poaching or hunting should be strictly forbidden.
- Littering should be strictly forbidden and waste generated by staff or at the compound should be disposed of in an appropriate manner, preferably off-site.
- The compound and other temporary lay-down areas should be fenced-off to reduce human-wildlife interactions.
- All chemical, fuel and oil spills should be cleaned up in the appropriate manner. As part of the EMP for the site, it should be mandatory for staff of both the developer as well as contractors to attend an environmental briefing and training session with respect to the guidelines outlined in this document and the EMP.

Table 4.1 Assessment of impacts on natural vegetation and habitats, including proposed mitigation measures.

Affected Habitat	**Impact Description**	**Impact Significance before Mitigation**	**Recommendations and Mitigation**	**Impact Significance after mitigation**
Woodland	Fragmentation of habitat. Loss of important flora species.	Medium	• Minimize loss and disturbance of natural habitat by using already disturbed areas (cleared lands) • Make use of existing access roads. • Align access roads with existing linear infrastructure (e.g. roads, power lines) • Make every effort to save protected trees.	Low

Table 4.2 Assessment of impacts on fauna, including proposed mitigation measures.

Taxa	**Impact Significance before mitigation**	**Impacts Description**	**Recommendations and mitigation**	**Impact Significance after mitigation**
Mammals	Medium	Loss of habitat and creation of breaks in continuity of biodiversity corridors	Minimize loss of natural habitat by using already disturbed areas. Make use of existing access roads.	Low
Avifauna	Low	No significant impacts are anticipated	Minimize loss of natural habitat by using already disturbed areas. Make use of existing access roads.	Low
Reptiles	Medium	Loss of habitat. Disturbance as well as killing of serpentines by uneducated crews.	Crews must be educated to the value of biodiversity and not to disturb or kill wild animals.	Low

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