PROPOSED ESTABLISHMENT OF A TRAFFIC TRAINING ACADEMY IN MKHUHLU, MPUMALANGA PROVINCE

Ecological and Biodiversity Specialist Report

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CONTENTS

EXECUTIVE SUMMARY

The Mpumalanga Provincial Government is proposing to develop a Traffic Training Academy along the Hazyview – Kruger Gate road R536 adjacent and pass the railway line in Mkhuhlu Township on the farm Calcutta 294-KU. The development in review is as a result of the prevailing challenge faced by the Province due to lack of training facility for traffic officers and ultimate shortage of higher standard skills in service delivery. The applicant, Department of Public Works, Roads and Transport (DPWRT) is the development agent on behalf of the Mpumalanga Department of Community Safety, Security and Liaison (DCSSL). DPWRT is assisting DCSSL in planning, designing and development of the Traffic Training Academy. The development area is located on the remainder of the Farm Calcutta No. 294-KU, Mkhuhlu in the Bushbuckridge Municipality of Mpumalanga Province

The envisaged development will cater for a higher standard facility which will accommodate both local and neighboring Provinces and elevate the standards required by trainees to promote service delivery.

The proposed development area was used for controlled grazing camps in the past and currently, the grazing is not formalized and randomly utilized. However, an Environmental Impact Assessment (EIA) for the proposed development is required in terms of the EIA Regulations of 2010 as amended under the National Environmental Management Act (NEMA) (Act No. 107 of 1998). As part of the EIA process, specialist report provides an assessment of the potential impacts of the proposed development on the flora and terrestrial faunal vertebrates and invertebrates of the site. The likely impacts on the ecological functioning of the site are assessed and appropriate mitigation strategies to minimize the ecological risks associated with the development are proposed for implementation.

The study area, (in the proximity of the World renowned Paul Kruger Gate of the Kruger National Park), which according to Mucina and Rutherford (2006), falls under the Pretoriuskop Sour Bushveld vegetation unit of the Lowveld Bioregion in the Savannah Biome.

A three day site visit and extensive desktop study were conducted and the results used to generate ecological analysis information of the area in review. Although the earmarked area has less or poor indication of ecologically sensitive habitats due to the nature of the terrain and history in utilization, characterized by the extent of bush encroachment and less ground cover, it remains important to have a closer look into other aspects related and required by the study. While the development will take place in a less sensitive area, there are floral species that are listed in the Red Data List (RDL) as protected by legislation especially kiaat (*Pterocarpus*). The whole area was in the past zoned for grazing where after rotational control was not monitored and resulting into an overgrazed area. Due to the biological cycle, the area is highly encroached with Sickle bush (*Dichrostachys*) however; there is a variety of floral species that also dominate the habitat and some occurrence of aliens like *Lantana*. There is a variety of floral species that are predominantly sandy soil inhabitants ranging from Silver clustered leaf (*Terminalia*), Bush willows (*Combretum*) and *Acacia*. Marula tree (*Sclerocarya birrea*) is also within the floral community within the study area.

Under the current layout, the development would be considered to have less or no significant negative impacts in the habitat although the occurrence of nationally listed species should not be ignored. The development therefore should be carried out with conservation of biodiversity at heart with special care not to directly impinge species of national significance.

Provided that the developer can accommodate the recommended mitigation and monitoring measures as will be outlined in the report, the impacts of the development would be reduced to a significantly low level. Under these circumstances, there is a high degree of confidence that development of the site will not 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 utilize the remaining landscape around the developed area.

After mitigation, the likely impact of the development on terrestrial ecology of the site is deemed to be of minor significance, and provided that the listed mitigation measures can be met there would be no compelling reasons from a terrestrial ecology standpoint to oppose the development.

1. INTRODUCTION

Background

The Mpumalanga Provincial Government proposes to develop a Traffic Training Academy in the Farm Calcutta No. 294-KU, Mkhuhlu, Bushbuckridge Local Municipality in the Mpumalanga Province. The Farm Calcutta is located along the road R536 leading to the Paul Kruger Gate of the Kruger National Park. The specific development site is located across the railway line towards Kruger National Park direction.

The proposed site is currently vacant with no other developments in it, with local cattle randomly feeding in the area.

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 report contributes towards meeting these requirements and details the likely impacts of the proposed development on the terrestrial ecology (fauna & flora) of the site. The likely impacts on soil and water have been dealt with through Geotechnical studies and reported separately.

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) was conducted in response to TORs 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 broad ecological characteristics of the site and its surrounds in terms of patchiness, patch size, relative isolation, connectivity, corridors, disturbance regimes, ecotones, buffering, viability, etc.

2. In terms of biodiversity pattern, the following will be identified and described where appropriate:
    a. Community and ecosystem level
        i. The main vegetation types, their aerial extent and interaction with neighbouring types, soils or landforms;
        ii. The types of plant communities that occur on and in the vicinity of the site.
        iii. Threatened or vulnerable ecosystems (with reference to Mucina and Rutherford (2006) and the NSBA (Driver et al. 2005).
    b. Species level
        i. Species of Conservation Concern (Red Data Book species), of both flora and fauna.
        ii. The viability and estimated population size of the RDB species that are present (including the degree of confidence in prediction based on availability of information and specialist knowledge
        iii. The likelihood of other RDB species, or species of conservation concern, occurring in the vicinity (including the degree of confidence).
    c. Other biodiversity pattern issues
        i. Any significant landscape features or rare or important vegetation/faunal associations such as seasonal wetlands, alluvium, seeps, quartz patches or salt marshes in the vicinity.
        ii. The extent of alien plant cover at the site, and whether the infestation is the result of prior soil disturbance such as ploughing or quarrying (alien cover resulting from disturbance is generally more difficult to restore than infestation of undisturbed sites).
        iii. The condition of the site in terms of current or previous land uses.

3. In terms of biodiversity process, the following will 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.

3. Over and above the foregoing, the assessment included 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 on the three different occasions by the authors. During the site visits, 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 plant species encountered were recorded and where necessary, photographed for verification purposes. The different habitats present were identified on site and delineated on orthophoto maps and aerial images. 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 an intensive 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 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 uplandlowland gradients, drainage areas, corridors etc

The ecological sensitivity of each unit identified, was rated according to the following scale:

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 provided 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 Limitations and Assumptions of the Study Approach

Oftentimes assessments such as this study are conducted under stringent time constraints which bring into play a number of potential shortcomings which should be made known to the reader:

- Thin temporal window:
  Preferably the site should be visited many times to ensure that the full complement of species present is captured. Unfortunately this is seldom possible with the consequence that the occurrence of many species is based on the literature, various spatial databases or reports by residents or landowners. This approach introduces some bias into the process, since many remote locations have been very poorly sampled for most groups of plants and animals and so the lists generated using these sources may under-represent certain groups of organisms and in particular rare species. In some cases where rare or endangered species are involved, a greater degree of certainty is desirable and follow-up surveys may therefore be required or recommended.
- Taxonomic scope:
  A comprehensive faunal field survey would examine all fauna, not only the terrestrial vertebrate fauna. There may be invertebrates or trophic interactions present that will be overlooked. Invertebrates are an integral component of the ecosystem, but have not been addressed. Pollination services in particular could be affected by the development and this potential impact is indirectly incorporated into the assessment through an assessment of the proportion of the flora at the site which requires specialist pollinations.
- Limited Resources:
  Idyllically, the site should be systematically sampled for the different groups of fauna using the appropriate trapping techniques. But since trap success in is not always optimal with the consequence that a large number of traps or trap days/nights are required in order to achieve an acceptable sample. In addition, many species are not easily trapped with the consequence that they may be overlooked or underrepresented.

2.4 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 the 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 systematic biodiversity plans adopted by the competent authority.

2.5 Relevant Aspects of the Development

Information provided to the consultant indicates that the development of the site as a Traffic Training Academy will involve the following activities and the construction of the following infrastructures:

- The Traffic Training Agency buildings
- Access Roads
- Additional Infrastructure
- Power, water and sewer reticulation
- A number of temporary activities will take place during construction of the academy. These will include:
  - A temporary laydown area of up to 80 m x 20 m (hard standing) may be constructed for the storage of construction vehicles and materials.
  - A temporary site compound will be created for the construction workforce.
  - It is possible that borrow pits will be developed within the site (for production of construction aggregate). These will be backfilled and rehabilitated as far as possible once construction is complete.

2.6 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 agency 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.

2.7 Description of the Affected Environment

Location

The project is located on the Hazyview – Kruger Gate road R536 just past the railway line in Mkhuhlu Township. The proposed development area is located on the remainder of the Farm Calcutta No. 294-KU, Mkhuhlu in the Bushbuckridge Municipality of Mpumalanga Province.

Conservation Status

The study area (in the proximity of the World renowned Paul Kruger Gate of the Kruger National Park), according to Mucina and Rutherford (2006), falls under the Pretoriuskop Sour Bushveld vegetation unit of the Lowveld Bioregion in the Savannah Biome. The area was used for controlled grazing camps in the past and currently, the grazing is not formalized and randomly utilized.

Table 2.2: Vegetation Unit SVl 10 Pretoriuskop Sour Bushveld (Mucina Rutherford 2006)

Name of vegetation type	*Pretoriuskop Sour Bushveld*
Code as used in the Book - contains space	*SVl10*
Conservation Target (percent of area) from NSBA	*19%*
Protected (percent of area) from NSBA	*39.5%*
Remaining (percent of area) from NSBA	*83.8%*
Description of conservation status from NSBA	*Least threatened*
Description of the Protection Status from NSBA	*Well protected*
Area (sqkm) of the full extent of the Vegetation Type	*942.91*
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*

The unit is considered to be least threatened. Conservattion target is 19% and some 40% of is statutorily conserved in the Kruger National Park. A very small area is also conserved in the private Mthethomusha Nature Reserve. About 16% transformed by cultivation and by development of settlements. Alien plants include Opuntia stricta, Lantana camara and Psidium guajava. Erosion is very low to moderate.

Typical views from the study area.

	
North western boundary of the site.	A Marula tree on the western boundary of the site.
	
Picture showing disturbed area on the site. Such patches should be fully exploited for situating buildings and parking bays.	The patch at far centre of the picture is a disturbed land (crop cultivation).

Physical characteristics

The climate of the area is characterized by summer rainfall and dry winters. The mean annual precipitation ranges between 550 and 800mm. frost is not frequent. The mean monthly maximum and mean monthly minimum temperatures are 37.3^0C and 5.2^0C for October and July respectively.

The area is underlain by granite and gneiss rock formations of the Nelspruit Suite. These have weathered down to form shallow, leached, red to yellow –brown sand to sandy loam of the Glenrosa, Hutton and Clovelly forms.

Vegetation

The natural setting of the area is mainly uplands with open tree savannah dominated by *Terminalia sericia* and *Dichrostachys cinerea* with relatively few low shrubs, grassy layer dense and dominated by sour grasses such as *Hyperthelia dissoluta, Elionurus muticus* and *Hyperrhenia hirta.* Grass composition changes somewhat on the midslopes and in the narrow bottomlands dominant species include: *Acacia nilotica, A. gerradii* and *A. tortilis, Digitaria eriantha, Eragrostis superb* and *Aristida congesta.* A checklist of plants likely to occur in the study area is available in Appendix 1.

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*).

Through a combination of biophysical features of available habitats and the results of field invetsigations the possibility of RDL species occurring on site was assessed (Table 2.3). No RDL species were identified on the affected area but a list of potential RDL species was compiled (Table 2.3)

Table 2.3 National RDL species potential for the study area.

Species	**National Status**	**Habitat preference**	**Recorded**
Acridocarpus natalitius	Near threatened	Forest, thickets, outcrops, Drainage lines.	
Adenia gumnifera	Declining	Bushveld habitats. Outcrops.	
Aloe kniphofioides	Near threatened	Grassland habitats.	
Aloe simii	Critically endangered	Tall, open grassland. Above altitude 900m	
Ansellia Africana	Declining	Bushveld, epiphyte	
Boophane disticha	Near threatened	Several habitat types. Prefers higher altitude grassland.	

Brachystelma chlorozonum	Vulnerable	Bushveld habitats.	
Crinum macowanii Baker	Declining	Riparian and moist areas	
Elaeodendron transvaalense	Near Threatened	Expected in natural bushveld;	
Encephalartos laevifolius	Critically endangered	Adaptable to several habitat types. Prefers higher altitude grassland.	
Eriosema naviculare	Endangered	Expected in natural bushveld;	
Hypoxis hemerocallidea	Declining	Prefers higher altitude grassland.	
Ilex mitis var. mitis	Declining	Forest, thicket and riparian areas	
Siphonochilus aethiopicus	Critically Endangered	Forests	

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
Acacia ataxacantha	CARA	Declared	Bush encroachment
Lantana camara	CARA	Declared	Category 1 weed/invader

Fauna

Mammals

A few species of small to medium sized mammals will use the natural habitats on the site (Appendix 2). The largest species expected to be present are common duiker, red duiker and bushbuck. Twelve mammals categorized as Red Data may be found in the study area. Another 16 species are listed as “Data Deficient” (DD), meaning there is inadequate information to make an

assessment of its risk of extinction based on its distribution and/or population status (Friedman & Daly 2004). The Red Data listed mammals are given in Table 2.5.

Table 2.5 Red Data listed mammals of the study area (Friedman & Daly, 2004); **NT**=Near threatened; **VU**=Vulnerable; **CR**=Critically endangered; DD=Data deficient

Scientific name	**Common name**	**SA Red Data Status**	**Permanent occurrence**	**Motivation**
Atelerix frontalis	SA Hedgehog	NT	Likely	Habitat inadequate
Crocidura cyanea	Reddish-grey musk shrew	DD	Possible	Habitat adequate
Cloeotis percivali	Short-eared trident bat	*CR*	Unlikely	Associated with caves
Crocidura flavescens	Greater Red musk shrew	DD	Possible	Habitat adequate
Crocidura fuscomurina	Tiny musk shrew	DD	Possible	Habitat adequate
Crocidura hirta	Lesser red musk shrew	DD	Unlikely	Not preferred habitat
Crocidura marquensis	Swamp musk shrew	DD	Unlikely	Habitat inadequate
Crocidura silacea	Lesser grey-brown musk shrew	DD		
Dasymys incomtus	Water rat	NT	Unlikely	Habitat inadequate
Elephantulus brachyrhynchus	Short snouted elephant shrew	DD	Unlikely	Habitat inadequate
Epomophorus gambianus *Crypturus*	Peter's (Gambian) fruit bat	DD	Possible	Habitat adequate
Graphiurus platyops	Rock dormouse	DD	Possible	Habitat adequate
Hippsideros caffer	Sundevall's leaf-nosed bat	DD	Unlikely	Associated with caves
Lemniscomys rosalia	Single striped mouse	DD	Unlikely	Habitat inadequate
Leptailurus serval	Serval	NT	Unlikely	Habitat inadequate
Lutra maculicollis	Spotted-necked otter	NT	Unlikely	Habitat absent
Manis temminckii	Pangolin	VU	Possible	Habitat adequate
Mellivora capensis	Honey badger	NT	Possible	Habitat adequate
Miniopteerus schreibersii	Schreiber's long fingered bat	NT	Unlikely	Associated with caves

Myotis tricolor	Temminck's bat	NT	Unlikely	Associated with caves
Paracynictis selousi	Selous' mongoose	DD	Unlikely	Habitat inadequate
Pipistrellus rusticus	Rusty bat	NT	Unlikely	Associated with rivers
Poecilogale albiucha	African weasel	DD	Unlikely	Prefers grassland
Rhinolophus blasii	Peak saddle horseshoe bat	VU	Unlikely	Associated with caves
Rhinolophus clivosus	Geoffroy's horseshoe bat	NT	Possible	Habitat adequate
Rhinolophus darlingii	Darling's horseshoe bat	NT	Unlikely	Associated with caves
Suncus infinitesimus	Least dwarf shrew	*DD*	*Unlikely*	Associated with termitaria
Suncus lixus	Lesser dwarf shrew	DD	Unlikely	Habitat inadequate
Tatera leucogaster	Bushveld gerbil	DD	Unlikely	Habitat inadequate

The mobility of most mammals will ensure that they can adapt or relocate if disturbed by the activities. Furthermore, it is not anticipated that these species will be negatively affected if given the necessary protection and habitat conservation.

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.

Thirty frog species' range of distribution includes the study area though none of them have Red Data status (Appendix 4). Only one species, the yellow-striped reed frog (*Hyperolius semidiscus*), is regarded as endemic. It is not anticipated that these species will be adversely affected if the mitigation measures outlined in this report are implemented.

Table 2.6 Important frogs of the study area

Taxon **Common name**	**Habitat Preference**	**P**	**Red Data Status**	**Occurrence** **Potential**
Hyperolius semidiscus Yellow-striped reed frog	Widespread and variety of habitats. Tolerant.		Least Concern Endemic Sthrn A	High

Reptiles.

The terrestrial and arboreal habitats present will provide habitat for a diverse group of reptiles (Appendix 3). According to Branch (1998), 98 species of reptiles can potentially occur in the area. Four RDL species are expected (Table 2.7). Three Endemic species are expected in the study area: Haacke's Flat Gecko *Afroedura (multiporis) haackei*, (provincial Endangered status), Barberton Girdled Lizard *Cordylus warreni barbertonensis* and Wilhelm's Flat Lizard *Platysaurus wilhelmi* (Table 2.7). All of these have a limited range of distribution roughly covering the area between Nelspruit, Barberton, Malelane and the southerly Kruger National Park.

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.

Table 2.7 Important reptiles of the study area.

Common name	*Scientific name*	**Occurrence Potential**	**SA Red Data status**	**Endemism**
Hewiit's Dwarf Burrowing Skink	*Scelotes breviceps*	Possible		Southern A
Water Monitor	*Varanus niloticus*	Unlikely		
Spotted House Snake	*Lamprophis guttatus*	Possible		S A
Giant Legless Skink	*Acontias plumbeus*	Possible		Southern A
Flap-neck Chamaeleon	*Chamaeleo dilepis*	Possible		
Barberton Girdled Lizard	*Cordylus (warreni) Barbertonensis*	Unlikely		Mpumalanga
Tropical Girdled Lizard	*Cordylus tropidosternum*	Possible		
Transvaal Girdled Lizard	*Cordylus vittifer*	Possible		Southern A
Southern Brown Eggeater	*Dasypeltis inornata*	Unlikely		Southern A
Leopard Tortoise	*Geochelone pardalis*	Possible		
Natal Hinged Tortoise	*Kinixys natalensis*	Unlikely	Rare	Southern A

Speke's Hinged Tortoise	*Kinixys spekii*	Unlikely		
Cape Thread Snake	*Leptotyphlops conjunctus* *Conjunctus*	Possible		Southern A
Distant's Thread Snake	*Leptotyphlops distant*	Possible		Southern A
Dusky-bellied Water Snake	*Lycodonomorphus* *Laevissimus*	Unlikely		SA
Variegated Wolf Snake	*Lycophidion variegatum*	Possible	Peripheral	Southern A
Spotted Dwarf Gecko	*Lygodactylus ocellatus*	Unlikely		Southern A
Transvaal Thick-toed Gecko	*Pachydactylus affinis*	Possible		Southern A
Van Son's Thick-toed Gecko	*Pachydactylus vansoni*	Possible		Southern A
Wilhelm's Flat Lizard	*Platysaurus (intermedius)* *Wilhelmi*	Possible		Mpumalanga
Sundevall's shovel snoute	*Prosymna sundevalli*	Unlikely		Southern A
Southern African Python	*Python natalensis*	Possible	Vulnerable	
Bibron's Blind Snake	*Typhlops bibronii*	Unlikely		Southern A
Rock Monitor	*Varanus albigularis*	Possible		
Haacke's Flat Gecko	*Afroedura (multiporis) haackei*	Unlikely		Mpumalanga
Nile Crocodile	*Crocodylus niloticus*	Possible	Vulnerable	

Avifauna

The following literature, data bases and other methods were 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 300 species' range of distribution falls within the study area and are supported by the available habitats. 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.

The diverse bird assemblage of the study area is an indication of the ecological gradient presented by the study area, ranging from low altitude foot slopes to the high mountain summit of the Northern Escarpment. Several species are endemic to the grasslands of and several are forest species, others are found more widespread. A total of 17 endemic (including 5 Red Data species); 11 near-endemic (including 2 Red Data species); 42 Red Data – species are included (Table 2.8). These include 17 endemic/near -endemic species that are not in any threatened category and are commonly found.

Table 2.8 Red Data and Endemic birds that may be present and affected by the development in the study area. National Red Data listed birds according to Barnes (2000) and Lincoln et al (2001). A full checklist is attached in Appendix 5.

Scientific name **Common name**	**Habitat requirements**	**National Red data Status** **(Endemism)**	**Occurrence** **Potential**
Aegypius occipitalis Whiteheaded vulture	Dry woodland, arid savannah, often associated with Baobab trees.	VU	Occasional visitor
Aegypius tracheliotos Lappetfaced vulture	Open woodland in arid and semi-arid regions. *Acacia, Boscia, Terminalia.*	VU	Occasional visitor
Anastomus lamelligerus Openbilled stork	Wetlands – floodplains, pans, marshes, ponds, steams, rivers, dams, lakes.	VU	Low
Anthropoides paradisea Blue Crane	Karoo and grassland biome. Croplands.	VU	High
Bucorcvus leadbeateri Southern ground hornbill	Grassland, savanna, woodland. From higher than 2000m in grassland with patches of forests and gorges to lowland *Mopane* woodland.	VU	High

Buteo trizonatus Forest Buzzard	Afromontane forests and plantations. Occurrence potential may be encouraged by establishment of plantations.	(SA)	High
Ciconia nigra Black stork	Shallow water: streams, rivers, marshes, floodplains, coastal estuaries, large and small dams; dry land. Cliffs for breeding.	NT	High
Ephippiorhynchus senegalensis Saddlebilled stork	Large rivers in open savanna, marshes, lake shores and flood plains.	EN	Low
Eupodotis barrowii Whitebellied korhaan	Tall, fairly dense grassland: Open and lightly wooded areas.	VU (Sthrn A)	High
Eupodotis melanogaster Blackbellied Korhaan	Tall, fairly dense grassland in grassy savanna – hilly and flat areas with rainfall>600mm.	NT (SA)	High
Falco biarmicus Lanner Falcon	Open grassland and cleared woodland habitats. Cliff-nester, also in old nests in trees.	NT	High
Falco naumanni Lesser Kestrel	Semi-arid grassland. Avoid wooded areas; forage in agricultural fields. Grassy Karoo, Sweet and Mixed grassland, Central Kalahari vegetation types.	VU	Medium
Falco peregrines Peregrine Falcon	Restricted to mountainous, riparian or coastal areas where high cliffs are available for nesting and roosting.	NT	High
Geronticus calvus Southern Bald Ibis	High rainfall, sour and alpine grasslands – absence of trees, short dense grass sward. Montane grassland of Eastern Transvaal escarpment. Cliffs for breeding.	VU (SA)	High
Gorsachius leuconotus White-backed night heron	Clear and slow flowing rivers and streams with overhanging vegetation. Forested and woodland regions.	VU	High
Gyps africanus Whitebacked vulture	Drier woodlands, mopane, arid Kalahari; tall trees for roosting and nesting.	VU	Occasional visitor
Gyps coprotheres Cape Vulture	Both open country (grasslands) and woodland. Reliant on tall cliffs for breeding and roosting. Wanders widely.	VU	High

Hirundo atrocaerulea Blue Swallow	High rainfall montane grassland with streams forming shallow valleys, potholes and dongas, edges of marshes. Potholes, dongas, mine shafts and old excavations for nest sites.	CR	High
Leptoptilos crumeniferus Marabou stork	Terrestrial and aquatic habitats, excluding desert and forests.	NT	Occasional visitor
Mycteria ibis Yellowbilled stork	Dams, large marshes, swamps, estuaries, margins of lakes and rivers, seasonal wetlands.	NT	Low
Necrosyrtes monachus Hooded vulture	Mesic savanna. Well developed woodlands with tall trees, e.g. Mopane, Jackal berry and Nyala tree.	VU	Occasional visitor
Neotis denhami Stanley's Bustard	Breeding: High rainfall sour grassveld, fairly high altitudes. Also cultivated pastures. Non-breeding: Lower-lying regions, grassland and woodland.	VU (SA)	High
Nettapus auritus Pygmy Goose	Inland wetlands, mainly in savanna, clear water and drifting vegetation especially water lillys.	NT	Low
Pododica senegalensis African finfoot	Forest and woodland areas: Streams and rivers lined with reeds, overhanging trees and shrubs. Avoids stagnant and fast flowing water. Perennial watercourses, clear water.	VU	High
Polemaetus bellicosus Martial Eagle	Open grassland and scrub. Large trees for nests. Wide range of vegetation types: deserts, densely wooded and forested areas.	VU	High
Sagittarius serpentarius Secretary bird	Open country: Savanna, open woodland, grassland and dwarf shrubland.	NT	High
Stephanoaetus coronatus Crowned eagle	Forests and plantations, dense woodland. Forested gorges in grassland.	NT	High
Tyto capensis African Grass owl	Rank grass and marshes are the preferred habitat. Usually in open habitat at fairly high altitudes.	VU	High
Vanellus melanopterus Black-winged plover	Short and burnt grassland; higher altitudes.	NT (SA)	High

Abbreviations as follows: CR=critically endangered; EN=endangered; VU=vulnerable; T=threatened; NT=near threatened; LC=least concern; DD=data deficient. Endemic status (SA = South Africa; Sthrn A = Southern Africa):

2.8 Identification of Risks and Potential Impacts

Potential impacts on the terrestrial ecology of the site resulting from the development of the Mkhuhlu Traffic Training Agency 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 Traffic Training Agency, specific risks stem from the following activities

- The clearing and leveling of land for the foundations of buildings, driveways, parking bays etc.
- The excavation of borrow pits
- 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

The ecological sensitivity map of the site is depicted in Figure 5 below. Croplands and residential sites, which are classified as low sensitivity constitute a significant proportion of the site and predominate on the edges of the development area. The area itself is considered to be of Less Concern according to Ferrar and Lotter (2007) – The Mpumalanga Biodiversity Conservation Plan. The area is however fairly degraded and mostly infested/encroached with Sickle bush and *Lantana camara* as a result of its historic use as grazing camps. This however, does not signify the absence of other natural vegetation species. Silver clustered leaf (Terminalia) is also dominant as they are the custodians of sandy soils. 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 the cabling, 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 Mkhuhlu Traffic Training Academy site on the local vegetation. Mitigation refers to the development proceeding under this specific layout which should avoid sensitive areas

CRITERIA	IMPACT			
			OPERATION	
Magnitude:	**Without**	**With**	**Without**	**With**
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

The survey conducted did not record any encounter with any mammal species, save for some livestock (cattle). Although locals confirmed the occurrence of some rabbits and duiker, the species could not be scientifically confirmed. The occurrence of mice and rats can not be ruled out as crop farming within the proximity of the site is active. Although the site has a uniform type of a habitat and although in the proximity of the Kruger National Park, migration of mammal species is likely possible due to habitat fragmentation stemming from agricultural activities such as stock and crop farming. There are a lot of human activities around the study area as local people collect firewood and herd cattle in and within. The site also occurs within a matrix consisting of a high proportion of croplands, consequently, many of the larger mammals which require relatively large extents of intact vegetation are not likely to occur at the site. Medium-sized carnivores such as Jackal and Caracal are likely to occur at the site as they are less affected by fragmentation and their adaptable nature allows them to persist within fairly fragmented landscapes and human activities provided that prey species remain available.

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 grazing camps and surrounded with croplands. Provided that the development proceeds in a sensitive manner and that the buildings and associated infrastructure are restricted to transformed areas, the risk to the mammal fauna is low. 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. The construction of some overhead transmission lines could increase the risk of predation to some small mammals as the poles and lines create perches which attract raptors. However, according to indicative layouts provided, overhead transmission lines will be limited in extent and confined to the buildings. Thus, beyond the impact that is already present in the proximity of the site due to the existing powerline for the rail line and domestic supply, there is likely too little additional impact as a result of the envisaged overhead lines.

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 and semi industrial sites, impacts will not be restricted to the site, but will nevertheless remain local in extent. An overall assessment of the likely impact of the development on mammals is provided in Table 2.

Table 3.2. Assessment of the impact of the development of the Mkhuhlu Traffic Training Academy site on mammals.

CRITERIA	IMPACT			
			OPERATION	
Magnitude:	**Without**	**With**	**Without**	**With**
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 the 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. The loss of some natural vegetation, although undesirable, is not likely to have a large negative impact due to the fact that the vegetation type is well conserved and hence categorised as Least Concern.

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 Table 4. 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 herbivory 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 to 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 & Academy 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

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. Within the croplands this is not a significant issue as these areas are already dominated by alien species and their biodiversity potential is low. However, 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 revegetation 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 revegetate 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 croplands grazing 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).
- Revegetation 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. Under the alternative recommended layout, the majority of these are not likely to be impacted. However, Pelargonium crassipes may occur within the natural vegetation in areas that may be lost to the development. The following recommendations are made regarding the potential impact on this 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 Kiaat 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.

5. RECOMMENDATIONS FOR MONITORING

Potential impacts and the associated recommendations for monitoring are listed in Table 4. In general, during the construction phase, monitoring should be used to ensure that the development takes place within the guidelines provided by this document and to ensure that construction does not impact adjacent natural vegetation, fauna and ecosystems. During the operational phase, monitoring should be focused on ensuring that that there are no residual impacts such as soil erosion and alien plant invasion resulting from the construction phase and on reducing the day to day impact of the Academy. The following specific recommendations are made regarding monitoring under the same risk factor headings described in the mitigation section:

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

Erosion

As erosion has been identified as one of the major risks associated with most developments, there should be strong focus on monitoring the development, presence and persistence of erosion at the site. Specific recommendations include:

An erosion monitoring system is set in place to record the location and extent of all erosion sites in the vicinity of the roads and the Academy facilities. The results should be recorded and stored in manner that they can be used in a GIS. The erosion monitoring system should record the measures taken to address existing erosion problems, their success and the occurrence of new erosion sites.

Sweeps specifically for erosion problems should be made after large storms or heavy rainfall events as these are likely to be the trigger events for erosion and control will be more easilyaffected while the problem is still of a small extent and low severity. Sweeps should be more frequent in the first year of construction as this is when the majority of problems are likely to manifest as the soil will still be loose and unvegetated. Particular attention should be paid to roads and other disturbed areas on slopes and vulnerable soil types.

In terms of frequency, erosion should be checked at least quarterly, more often in the rainy season.

Alien Plant Invasion

The large amount of disturbance at the site is likely to render it highly vulnerable to alien plant invasion, particularly in the first few years post-construction. The roads and disturbed areas around the turbines are likely to be the major invasion foci. Monitoring for aliens should include the following:

- In a similar manner to erosion, an alien monitoring system should be set up which allows for the occurrence, persistence and treatment of alien plants to be monitored in a manner which allows the data to be interrogated in a GIS.
- Monitoring for alien plants could be done simultaneously with erosion monitoring and at a similar interval.
- The system should record the species present, their location, the control measures used and their success rate.

Loss of Habitat & Habitat Fragmentation

Habitat loss and fragmentation is primarily a concern during the construction phase since this is when the majority of disturbance will take place. Monitoring should thus focus on ensuring that construction takes place within the guidelines stated in this document and other the relevant mitigation guidelines contained within the other specialist reports. Specific areas that should be monitored include:

- Any deviations from the final construction plan, including the location, extent and nature of vegetation impact and transformation.
- The location and extent of temporary lay-down areas, these should be included in the sweeps for alien species.
- Any inadvertent or otherwise unintended destruction of natural vegetation and the remediation steps taken to encourage the recovery of the impacted areas.
- Monitoring of borrow pit sites to ensure that the minimum required area is disturbed and that the appropriate remediation and rehabilitation steps are taken once the pit is no longer required.
- Monitoring frequency would need to be high, at least weekly during the construction phase. During the operational phase monitoring could coincide with maintenance activities that may impact natural vegetation such as servicing of the facilities.

Impacts on Sensitive Environments

Although the site is regarded as less sensitive, it should be treated similarly with one as the little biodiversity available in the area has an ecological niche. This area will be particularly vulnerable to negative impact during the construction phase while the major infrastructure associated with the development is laid down. During the construction phase, monitoring should largely be directed towards enforcement to ensure that this area is not negatively impacted. As such monitoring of these aspects should be on a continuous basis. During the operational phase there are not likely to be many activities which pose a direct risk to the area. Recommendations include:

- Where roads traverse rivers and drainage lines, the sites should be monitored to ensure that the presence of the road is not resulting in changes to the stream morphology such as bank erosion or the deposition of large amounts of silt. This may be a particular problem during the construction phase when large amounts of heavy traffic leave these areas vulnerable to erosion. However, the outlay in review has minor drainage areas and shows no evidence of water feature characteristics even if they have to be monitored against growth. Monthly monitoring during the construction phase would be adequate, while during the operational phase, this could form part of the erosion monitoring.

Impacts on Rare or Endangered Plant Species

The primary concern in terms of endangered plant species at the site, is the potential impact on kiaat. The following monitoring actions are recommended:

- Prior to construction the development of the Academy site within the natural vegetation should be searched for kiaat and any other plant species of conservation concern that may occur in the area. Individuals of listed species should be marked so that they can be relocated to a nearby similar environment. Monitoring for such species should occur during the late winter and spring, when the geophytes at the site are in flower and can be identified.

- If any listed species are located, they should be relocated in the winter or spring. The relocated individuals should be marked and monitored for at least a year after transplanting to establish the success rate of the relocation exercise.

Direct faunal Impacts

Particularly during the construction phase but also during the operational phase, direct faunal impacts are a particular concern of the development given the number of listed reptile species at the site which are vulnerable to human interference. Monitoring during the construction phase should be used to ensure that human-animal interactions are kept to a minimum and during the operational phase to assess the extent to which animal populations are vulnerable to or recover from the negative effects of the development. Specific recommendations include:

- The traffic on the access and service roads poses a significant risk to many animals, particularly during the construction phase when traffic volumes on the roads are likely to be heavy. Any fauna accidentally killed during construction or maintenance activities should be reported and a log of such mortalities maintained. Where possible the species killed should be identified and recorded as well. Monitoring should be on an ad-hoc basis, as incidents occur.

- The activities of construction staff should be monitored to ensure that undesirable activities such as hunting, illegal collecting of plants, seeds or any other biological material does not occur, and that fires outside of the designated and demarcated areas do not occur. Any incidents or transgressions relating to these aspects should be logged, as well as the remedial steps taken to rectify the situation.

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
Degraded woodland	Fragmentation of habitat. Loss of important flora species.	Medium	• Minimize loss and disturbance of natural habitat by using already disturbed areas (cultivated and 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
Amphibians	Low	No significant impacts are anticipated.	Minimize loss of natural habitat by using already disturbed areas.	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
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

With adequate mitigation, the anticipated impacts on biodiversity can be controlled and reduced to a satisfactory level to ensure a minimal effect on biodiversity. Monitoring should seek to ensure that the following preventative and mitigating measures are incorporated with the planning, construction and operational phases of the Academy and that they are implemented.

Planning Phase

- The proponent must be committed to a conservation approach during the planning phase;
- Sensitive habitats must be avoided or least sensitive crossings must be used as mitigation.
- The significance of potential impacts on biodiversity can be mitigated by aligning the alternatives alongside existing power lines and roads and by considering easy access.
- Riparian vegetation at river crossings must be avoided altogether. If this is not achieveable such habitats must only be disturbed where absolutely necessary and prominent trees must be avoided;
- The necessary plant destruction permits must be obtained from the regulating authorities prior to construction;
- A specialist must assist the surveyor to ensure that the above recommendations are followed;

Construction Phase

- The proponent must be committed to a conservation approach of practice and the actual footprint of construction/disturbance must be kept to a minimum;
- As much of the natural environment must be conserved (minimal construction of access roads and bush clearing);
- Relocation of important species, identification and demarcation of specimens and sub-habitats not to be disturbed will have to be done beforehand by a specialist;
- Important species (fauna as well as flora) that will be threatened by the development must be relocated to safer habitats by suitable specialists;
- Preventative erosion control measures to be put in place;

Operational Phase

- Maintenance crews must be educated with regards of the importance of biodiversity;
- Maintenance of the Academy must be done in such a manner to conserve vegetation and create as least disturbance as possible and servitudes must be cleared of invasive vegetation;
- The operational phase must be monitored by the proponent's environmental officials to ensure that adequate mitigation measures are in place and to take reactive measures in places where impacts pose problematic.

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